

**“Encouraging
young agricultural
entrepreneurs to
make sustainable
decisions”**

Dear Future,

Colofon

Master thesis

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Preface

Dear reader,

I am José Dijkshoorn, and this is my master thesis—something my younger self would never have thought achievable. But I made it! This project finalises my Master's course in Design for Interaction.

When I started studying at the TU Delft, I knew I wanted to dedicate one of my projects to the agricultural sector. I grew up on a farm and have seen this sector develop over time, making me interested. So when the graduation project approached, I decided to apply to agricultural companies and organisations. Luckily, I found LTO Noord, who was interested in my view and approach. I was thrilled that I could do field research on farms!

During the research, one thing struck my eye: the passion farmers have for their work. This insight ensured that my passion for this project also grew. This passion helped me during the process to stay motivated and want to create something valuable.

I want to thank my TU Delft supervisors, Dr. ir. Gert Pasman and ir. Sander Mulder, for their guidance and support during the process. I learned a lot during this project from your feedback and tips. I also want to thank Lisa Ligtermoet, Henriët Dijk and Marieke van Leeuwen of LTO Noord. Thank you for allowing me to research a sector that is dear to me and learn more about this industry. Thank you for your enthusiasm and feedback during our meetings and talks. I want to thank Tina Lenz for giving me insights into the world of design anthropology.

Next, I am grateful to all who participated in this project through interviews, observations, creative sessions, and the like. Through your contributions, this project turned out the way it did.

I would like to thank the many friends I have met throughout my years here in Delft for their friendship, support, and encouraging words. Thanks to all the friends that wanted to proofread

this report and helped me translate the difficult agricultural terminology. I also want to thank them for keeping me alive: ensuring I would eat, drink, sleep and exercise during this stressful period. Special thanks to my friends from the photo and video committee of the rowing association D.S.R. Proteus-Eretes, Wessel and Cas. Thank you for helping me realise the video for this project.

Finally, I want to thank my family for being there when I needed it.

And, of course, I would also like to thank you, my reader: I hope you enjoy your reading.

José Dijkshoorn
Delft, June 8th, 2023

Executive Summary

The objective of this project is to design a product or product-service combination to encourage agricultural entrepreneurs to make sustainable decisions based on their decision-making process. This assignment was set up in collaboration with LTO Noord and the DAW to find what is withholding farmers from implementing sustainable agricultural practices to improve their support for agricultural entrepreneurs.

To accomplish this objective, first, literature on farmers' decision-making, entrepreneurship and design anthropology is reviewed. Next, qualitative research was conducted, where a focus group, probes, participatory observation and a semi-structured interview were used to examine the decision-making of young farmers. Results of the qualitative research, note the characteristics of the young agricultural entrepreneurs, their stance towards choices, their decision-making process of a conscious decision, and the experiences of being a young farmer in a partnership. The most striking results were found considering the experiences of a young farmer in a partnership with older generations. The young and older generations have to run the farm together, having different

beliefs and standards. This difference is especially experienced when the younger generation proposes a change; they feel they need practical proof to convince the older generation about this change. The results were used to set criteria for the design and develop a design brief: The to-be-designed product or product-service combination should support young farmers to convince the older generation in the partnership to make a step towards implementing a sustainable practice.

Within this design brief, three concepts were generated. The research-based criteria were used to select one concept: a simulation of the farm. During the conceptualisation, a preliminary design is realised: SoilMate. SoilMate is a tool whereby farmers can experiment with new (sustainable) measures on their (digital) farm. SoilMate embodies itself as an interactive screen in the canteen or kitchen. It simulates the farmer's farm and the possible results of changes. The concept gives access to a planning tool (the Graslandkalender), a 3D visual representation of the farm and its soil, the current and possible future data of values, and the possibility to experiment with and apply changes on the farm.

The planning tool functions as the starting point of the use. Since filling in the planning will be done regularly, the farmer regularly gets in contact with the tool. The tool predicts the future values of the farm or parcel. When they are dropping low, the farmers can decide to experiment with changes. When trying different changes, the farmers can discuss possible futures and have the predicted values as support.

In summary, the conducted research has uncovered the experiences of a young farmer in a partnership with older generations. Most striking, the younger generation feels they need (practical) proof to convince the older generation about new measures. SoilMate is the presented concept to support the young farmer in this feeling. It generates the data and thus evidence the young generation needs to convince the older farmers.

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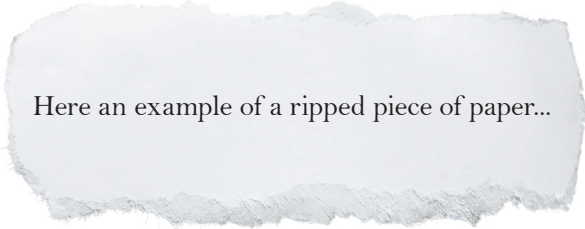
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Reading Guide

Report Structure

This report describes the project mainly in chronological order. The project's process and, thus, the report can be divided into seven sections: The beginning, Literature Review, Research, Scope, Create, Design, and Concluding. Furthermore, the document is split into chapters; each chapter covers a specific topic or an aspect of the process.

Next to the structural build-up of this document, some visual cues are used to help the reader identify the nature of what they are reading. Most notable are the ripped papers throughout this report. On these pieces of paper, reflective stories are written. Since the researcher is familiar with the research context, and the research methodology is mainly based on the researcher's interpretation, there was decided to write auto-ethnographic or reflective parts alongside the research. This is to make the reader aware of the researcher's view.



Here an example of a ripped piece of paper...

List of abbreviations

Throughout the report, different abbreviations are used. These abbreviations and their meaning are listed below:

LTO – Land- en Tuinbouworganisatie
(The Netherlands Agricultural and Horticultural Association)

DAW – Deltaplan Agrarisch Waterbeheer
(Task force Agricultural Water Management)

NAJK – Nederlands Agrarisch Jongeren Kontakt
(Dutch Agricultural Youth Association)

Glossary

This thesis contains many terms and concepts that only occur in the Dutch language and governmental system. I have therefore decided to give the closest translation and definitions for these terms and instances below, to improve the thesis's readability.

Waterschap – Union of Water Boards (Dutch regional water authorities)

A 'waterschap' is a government organisation, such as municipalities. The water board is responsible for water management in a specific area of the Netherlands. For example, it ensures that you have enough clean water.

Maatschap – Partnership

A 'maatschap' is a legal form often chosen for agricultural enterprises. A partnership allows for the profession to be carried out together with partners under a common name.

Erfbetreders – Farm visitors

An 'erfbetreder' is a third party who visits the farmer's yard for their work. Examples are veterinarians or nutrition consultants.

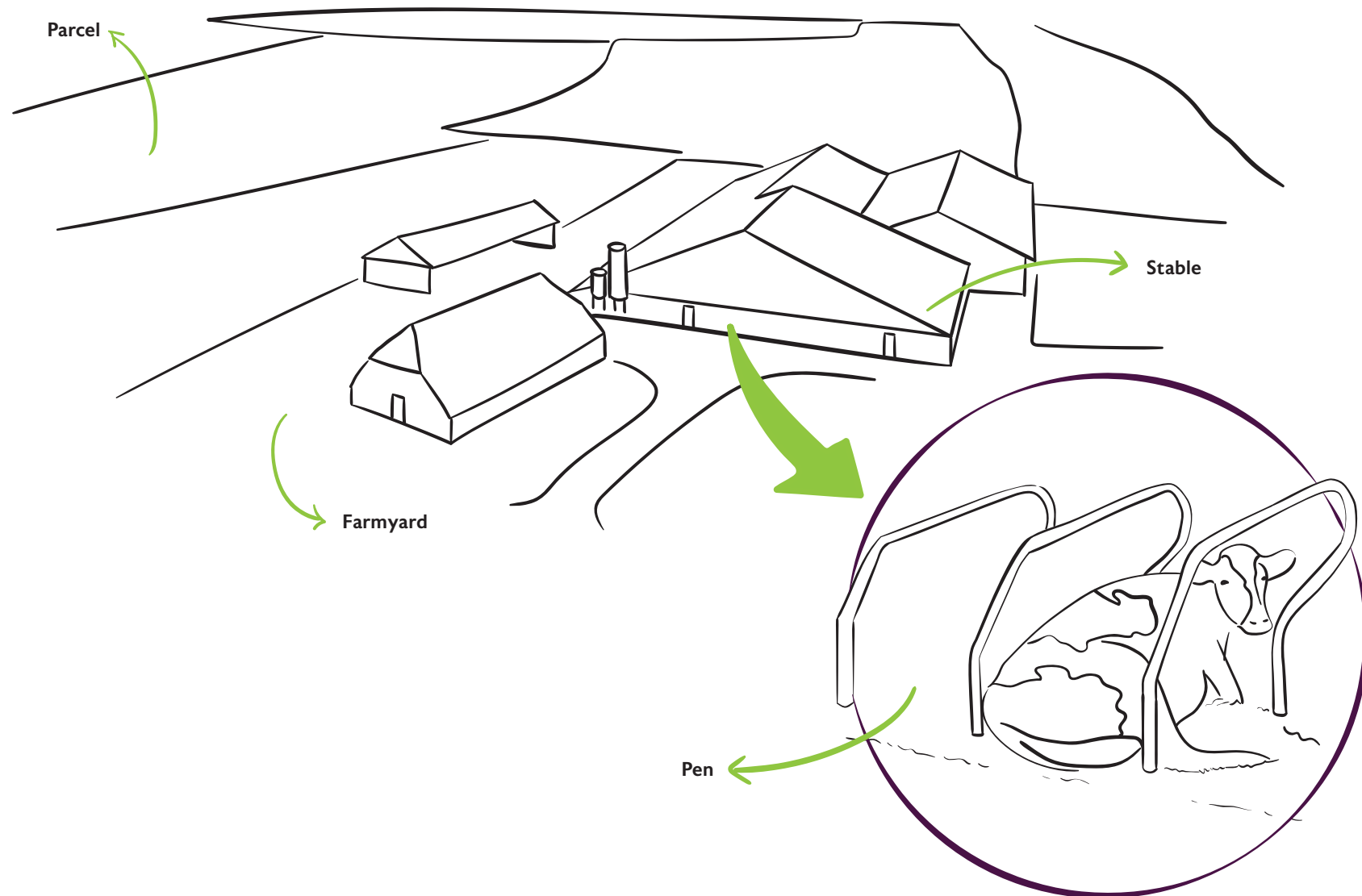


Figure 01; Some farm terminology

The beginning

1. Introduction

Agriculture is the practice of farming to provide primarily food but also other products. This is done by cultivating the soil for the growing of crops and the rearing of animals. The Netherlands is after the United States, the world's largest agricultural producer (Ministerie van Economische Zaken, 2011). Being one of the largest producers as a small country is possible by using the world's most efficient agricultural technologies (Viviano, 2021). But it's not all sunshine and rainbows, of course.

In recent months, Dutch farmers reached worldwide news coverage due to their protests. The slow-moving tractors as well as the flaming hay bales and manure on the motorway caused delays for motorists all across the Netherlands. The farmers are under immense pressure to cut harmful emissions by making radical farm changes. Which for some farmers can lead to no longer being allowed or able to farm. The Dutch government estimates that around 11,200 farms will have to be shut down (Holligan, 2022). The farmer protests and political upheaval led to a significant shift in the Senate during the elections on the 15th of March 2023; the Farmer-Citizen Movement

(BBB) is in the majority. The required reduction in emissions by the agricultural sector in the Netherlands is not the only topic to be concerned about. Because of climate change, the soil quality, water quality and quantity, will become a problem for the farmers. This upcoming problem was the starting point for LTO Noord to draft a project, which is executed in this thesis.

1.1 The company

This project was carried out in collaboration with Land- en Tuinbouworganisatie (LTO) Nederland. LTO Nederland serves the interests of agricultural entrepreneurs and, as an employers' association, makes a strong case for their economic and social position. LTO Nederland is a collaboration of three organisations: LTO Noord, ZLTO and LLTB.

LTO Noord represents the following provinces of the Netherlands: Friesland, Groningen, Drenthe, Overijssel, Flevoland, Gelderland, Utrecht, North Holland and South Holland. In total around 22,000 farmers, horticulturalists and entrepreneurs in the agricultural chain are represented. Alongside these agricultural entrepreneurs, LTO Noord takes the

lead in the development of the sector to ensure that agricultural enterprises are futureproof.

One of the LTO Nederland initiatives is ‘Deltaplan Agrarisch Waterbeheer’ (DAW). This program focuses on the collaboration between agricultural entrepreneurs and the regional water authorities regarding cleaner and sufficient water and better soil conditions. This program started in 2013 and is facilitated by the Kadaster and LTO Nederland. DAW was introduced to ensure better quality and quantity of water, as it is crucial for agriculture. Climate change emphasises the importance of a clean and sufficient water supply for crops and farm animals. With the right approach, the biodiversity in and around the farms will also improve, which is closely connected to soil quality.

DAW provides projects for the agricultural chain to deal with the current problems arising from climate change. These projects are set up in collaboration with experts from the Union of Water Boards (Dutch regional water authorities), the provinces (Dutch regional public bodies), the government, land management organisations, agricultural nature associations, research institutes

and drinking water companies. The DAW projects focus on voluntary measures suggested by the government to reduce emissions. DAW believes voluntary measures would motivate farmers to undertake actual steps more. The facilitation of consultations, conversations and activities regarding the measures for the agricultural entrepreneurs who participate in DAW is done by LTO Noord.

1.2 Assignment

The current support of the DAW towards agricultural entrepreneurs mainly focuses on knowledge transfer towards agricultural entrepreneurs. For some farmers, implementing this DAW-provided knowledge can be deemed a step too far: it is LTO Noord’s wish to obtain a greater insight into the decision-making process of the agricultural entrepreneurs. With these insights, LTO Noord would like to continue improving the support given to agricultural entrepreneurs and help them implement more sustainable decisions within their farms.

This project aims to find what is withholding the

farmers from implementing sustainable alternatives and design an intervention to encourage them to implement sustainable measures nevertheless.

“I will research agricultural entrepreneurs’ decision-making process when implementing farming changes. With these insights, I will design and evaluate a product or product-service combinations to encourage agricultural entrepreneurs to make sustainable decisions. This concept can also help LTO Noord to improve their support for agricultural entrepreneurs.”

1.3 Research question

The following research question is set up for this thesis based on the given assignment above:

“How can young agricultural entrepreneurs be encouraged to make sustainable choices based on their decision-making process?”

To gain insights into the decision-making process of young agricultural entrepreneurs, the following sub-questions were formulated:

- How does an agricultural entrepreneur make decisions and do business?
- When, where, and on what do the agricultural entrepreneurs base their choices?
- What are the motives for an agricultural entrepreneur to make changes at their farm?
- What are the incentives for an agricultural entrepreneur to start considering a change?
- Who and what does influence the decision-making process of a farmer?

1.4 The research group

Farmers are diverse; they differ in the type of agriculture they pursue, geographic location, soil type, age, education, and more. The previously mentioned aspects were researched to see which could lead to a narrowed research group.

For the research group, it has been decided to focus on young agricultural entrepreneurs. From the age they enter the farm partnership up to 35 years. For each situation, the age that a person enters the partnership is different, but mostly it is around the age of 20 years.

This decision was made based on the following: LTO Noord employees noticed and noted differences in farmers' educations. The academically educated farmers are more aware of the new and sustainable ways of farming. However, it is hard to categorise farmers based on education, especially when it has been long since they attended school. Therefore the first factor that led to choice for the younger generation: they are still in school or have just graduated. Next, the young generation is the future since they will be the next farm leaders. They will shape the agricultural sector of the future, and therefore, it is

interesting for LTO Noord to focus on them. It was decided not to narrow down the research group further based on the type of agriculture they pursue or geographic location to make participant recruitment practically feasible. Throughout the sampling, it was decided to specify the research on dairy farmers since seven of the eight participants that were able to participate were dairy farmers.

During the research, it was discovered that young farmers are not alone in owning the farm. They are part of a partnership, of which the composition differs per situation with whom: brothers, sisters, fathers, mothers, lovers, uncles, etcetera. This will become interesting later in the research.

This thesis will first examine literature related to the farmers' decision-making process (Chapter 3), which includes existing frameworks, influences on and how to influence this process. Since farmers are seen as agricultural entrepreneurs, writings about decision-making within entrepreneurship will also be assessed (Chapter 4), in particular effectuation. Lastly, the research approach design anthropology is revised (Chapter 5). To better understand the basic principles and workings of the industry and its people, a field trip, a walk along with a farmer and a conversation with a soil advisor were conducted as initial field research (Chapter 6) before performing the main research. A research was set up to research young farmers' decision-making (Chapter 7). A cultural probe, participatory observation and a semi-structured interview were performed with eight participants. The interesting outcomes of the research were used to set up a design brief (Chapter 8), followed by design parameters (Chapter 9). These parameters functioned as starting point for ideation (Chapter 10), after which three concept directions, which all support young farmers to convince the older generation in the partnership, were created (Chapter 11) and validated (Chapter

12). A final concept was extracted (Chapter 13) and proposed (Chapter 14). This thesis is wrapped up with a discussion (Chapter 15) and a conclusion (Chapter 16).

2. Background

As introduced, the context of this thesis is Dutch agriculture and the problems concerning water and soil. This chapter introduces the Netherlands' agriculture, the definition of good agricultural water and soil, its issues, and how the DAW relates to this.

2.1 Agriculture in the Netherlands

As forefronted in the introduction, this project's context is the Dutch agriculture. This sub-chapter explores this theme: the different types of agriculture and how they are distributed across the Netherlands, the importance and history of the agricultural industry in the Netherlands, the farmers and the transitions towards a more sustainable agriculture.

2.1.1 Agriculture types and distribution

Dutch agriculture can be divided into four types: arable (open and covered cultivation), livestock, (greenhouse) horticulture, and contracting companies (Agrarische Sector, n.d.). The special distribution of farm types depends on the local soil type, the historical and economic reasons (Land- en tuinbouw: ruimtelijke spreiding, grondgebruik en aantal bedrijven, 1980-2021, 2022).

Arable farming

Arable farming is a process of crop production. There are two different methods used for arable farming, open and covered cultivation. Open cultivation, involves growing crops directly in the open air on large fields. Typical crops for open cultivation are potatoes, carrots, and onions, which withstand the Dutch climate and grow well in the country's fertile soils. Covered cultivation involves growing crops in protected environments, such as greenhouses, polytunnels, or other covered structures. This method is used for crops that require another environment than the Dutch climate, like tomatoes, cucumbers and peppers.

Horticulture

Horticulture is the cultivation of plants for both commercial and non-commercial purposes, including fruits, vegetables, flowers, and ornamental plants. It concerns various methods of plant cultivation, including open-field farming, greenhouse cultivation, etcetera. Horticulture typically involves more intensive and specialised techniques than traditional field agriculture, as it requires greater attention to soil quality, plant nutrition, and pest management.

Livestock farming

Livestock farming involves the raising and managing of animals for food, fibre, labour, or other purposes. The most common types of livestock are cattle, pigs, poultry, sheep, and goats. Livestock farming practices can vary widely depending on the type of animal, the region, and the desired output. (Ministerie van Economische Zaken en Klimaat, 2022)

Dairy farming

Dairy farming is a livestock farming class for long-term milk production. In the Netherlands, dairy farming is diverse and the farms are mainly family businesses. The average number of dairy cows per dairy farm is 113 (Wageningen University & Research, 2022). The operational structure of dairy farming can, like Dutch agriculture, be divided into intensive and extensive. Intensive agriculture is an agricultural production system that is designed for efficiency and optimum yield. Extensive agriculture aims to produce food on more hectares of land with less input from outside, like fertilisers. The animals are fed with feed grown on the farm's land for extensive dairy farming. For cows, this often concerns grass. Examples of extensive agriculture

are nature-inclusive agriculture and organic agriculture (Intensieve En Extensieve Landbouw: Wat Is Het Verschil?, n.d.).

Special distribution

The agricultural sector is particularly strongly represented in the (dark) blue regions showed in figure 02). In these regions, a large part of the working population works in the agricultural sector. Not every region has the same type of agriculture: In the north of the Netherlands, the emphasis is on dairy farming. In the northwest, the emphasis is on open cultivation of flower bulb and the wholesale of them. In the Midwest, greenhouse horticulture and open cultivation of trees are mainly represented. Poultry farming and open cultivation of fruit are dominant in the east. Pig farms and mushroom cultivation mainly occur in the southeast of the Netherlands. And finally, in the southwest open cultivation in agriculture and horticulture, but also fruit cultivation are significant (UWV, 2019).

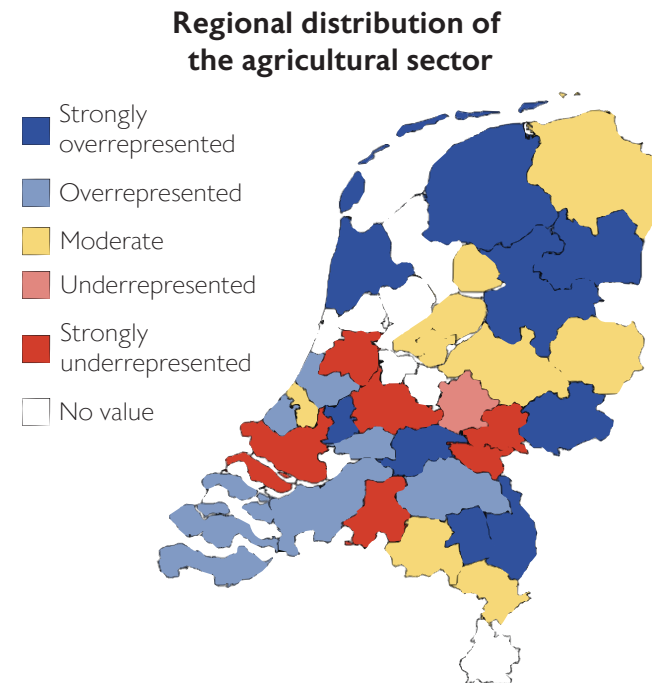


Figure 02; Regional distribution of the agricultural sector (UWV, 2019)

2.1.2 The agriculture industry

The Netherlands is one of the world's largest agricultural producers (Ministerie van Economische Zaken, 2011). The fertile soil and the moderate climate create good farming conditions. Two-thirds of the land in the Netherlands is used for agriculture and horticulture. There are 51.042 agricultural companies in the Netherlands (Aantal Land- En Tuinbouwbedrijven, n.d.), with large differences in company size: 9% of the companies generate almost 60% of the production (Bedrijfsgrootte Land- En Tuinbouwbedrijven, n.d.). The history of the agricultural sector mainly causes these differences.

The agricultural sector changed enormously in the last 70 years: from small-scale, local production and short chain to a long, complex food system aimed at mass production and consumption. After the Second World War, the agricultural sector build up an income gap. The small farm that was profitable until 1950 could suddenly no longer exist. Therefore the agricultural sector intensified, mechanised, rationalised, specialised and scaled up. The smaller companies were bought out by land consolidation, and the vacant land

was made available to the remaining companies. Especially intensive livestock farming grew, mainly due to the European countries' agreement in 1958. It was decided that each European country would specialise in producing the food the country is most suited for. Since the Netherlands had a relatively large amount of grassland, the Netherlands specialised in dairy farming. Also, specialisation in pig and poultry farms took place because the food industry's residual flows functioned as feed (Agrarische Sector, n.d.). The intensification of the agricultural sector continued (Ontwikkelingen in De Landbouw, 1900-2008 I Compendium Voor De Leefomgeving, n.d.): the average number of dairy cows per dairy farm has increased from 57 to over 113 between 2000 and 2022 (Wageningen University & Research, 2022). The growth of the agricultural sector brought many opportunities but also problems: surpluses and a decrease in production quality due to livestock epidemics. The agricultural sector is often associated with environmental problems.

1.1.3 The farmer

Being and becoming a farmer in the Netherlands is a unique profession.

In the Netherlands, you can only become a farmer if you have access to a farm, take over from a family member, or in-law. It is important to note that there is no required training to become a farmer in the Netherlands. Noting this, there are different paths you can take to become a farmer. It is possible to join the family business after high school immediately. Or you can get educated at a primary, secondary, or higher agricultural school or even an agricultural university. The courses mainly specialise in one of the types of agriculture. Higher agricultural schools and universities also offer entrepreneurship and farm management courses. In the Netherlands, 64% of the farmers have attended an agricultural education or course for two years or more (Coenen & Coenen, 2019). Whereas 14% have attended a higher agricultural school or university, making the Dutch farmers the most educated in the European Union (Van Rooijen, 2022).

'Taking over' a farm also has different routes. As a successor, you usually join the partnership first, and later the other owners leave the partnership. How and when you enter the partnership differs per

company. Some successors join the partnership when still in school, whereas others may first explore different aspects of the agricultural sector. Since taking over a farm is a big investment, particularly relatives can become a successor of a farm. Farms are passed down from generation to generation and have a long history. If the next generation is not interested in taking over the farm, and thus the farmer does not have a successor, they will most likely put the farm to an end. In 2020 only 40% of the farms with a farmer aged 51 or older stated that they have a successor (Opvolgingspercentage Land- En Tuinbouw, n.d.).

Lifestyle types

Research by Geleen Consultancy and SAMR for Boerderij (2019) has shown that farmers can be divided into four types based on the BSR model, each with their lifestyle (see figure 03). These lifestyles are associated with specific values, needs, motives and drives. These four types of farmers can be found in all agricultural sectors. (Schmitz, 2019)

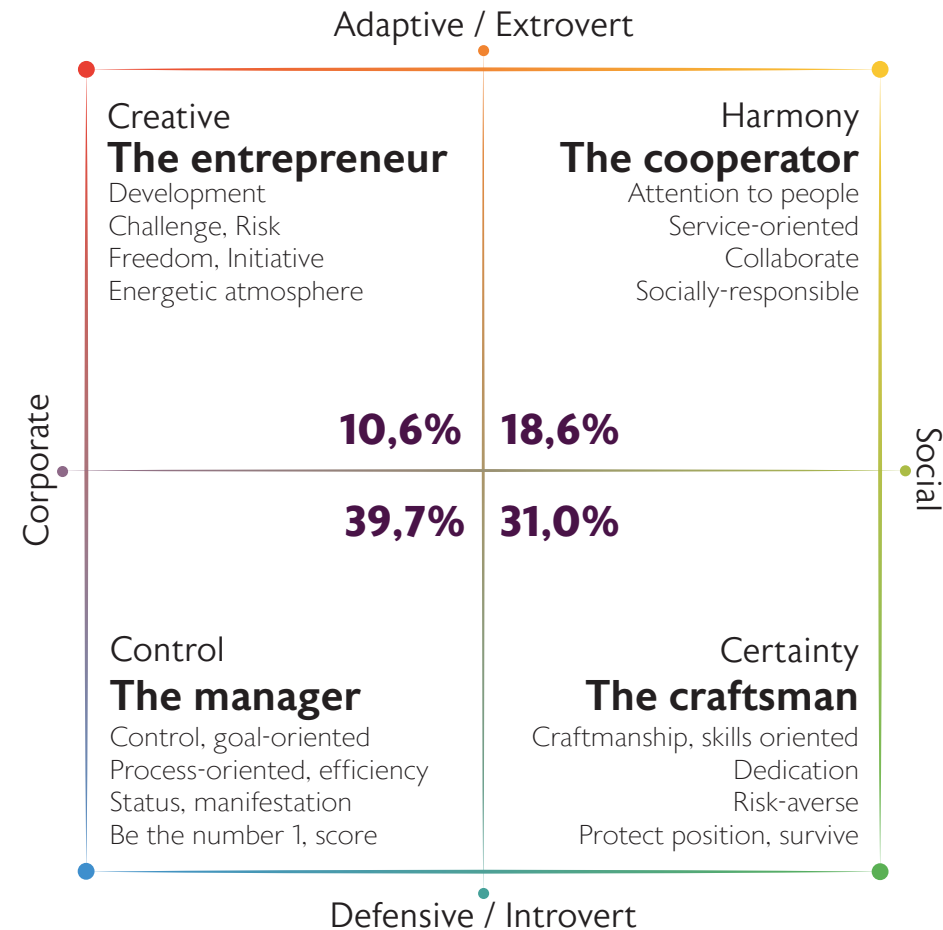


Figure 03: BSR model of farmers (Schmitz, 2019)

2.1.4 Sustainability of the agricultural sector

At this time, a transition needs to occur in the agricultural sector, which must be done quickly. Under the leadership of former Minister of Agriculture Carola Schouten, this transition meant for farmers that they must transition to circular agriculture in 2030. (Ministerie van Landbouw, 2022). This implies the change to a system with minimal unnecessary losses. Agriculture will become part of a circular food system. In such a system, arable farming, livestock farming and horticulture primarily use raw materials from each other's chains and residual flows from the food industry and food chains. These circular chains can be organised differently: within a company, a region, the Netherlands or across borders. The motto is: "Local if possible, regional or international if necessary" (Ministerie van Landbouw, Natuur en Voedselkwaliteit, 2018). Residues from the agricultural sector, and the food chain are reused or processed into new products. This circular or sustainable agriculture will ensure less harmful emissions to the soil, air and water and more biodiversity and animal welfare (Duurzame Landbouw, n.d.). To become more sustainable

as a farmer, there are various ways, like organic, nature-inclusive, and regenerative agriculture. Sustainable farming focuses on extensive farming and therefore requires major farm system changes for some farmers.

However, under the leadership of the current minister of agriculture, Piet Adema, there is doubt about whether circular agriculture is the solution to have more sustainable agriculture. The policy for the agricultural sector is still under construction, ensuring sustainable agriculture. Because there is no policy, the farmer has no perspective to work towards. This causes a lot of confusion and unrest among farmers.

Whatever transition agricultural entrepreneurs need to be made, there will be much commotion. Bouwmeester et al. (2022) stated that farmers want to become more sustainable but cannot make the change by themselves. Farmers are part of a chain, which makes them dependent on the needs and requirements of the others in the chain. For example, if a farmer wants to change to an organic farming model but has no customers for organically produced food, the farmer has

no income. So not only can the farmer be held accountable for its responsibility for sustainability (de Wolf & Vellinga, 2020).

Cultural standards towards sustainable farming

The cultural standards of farmers can play a significant role in the transition towards nature-inclusive agriculture. Westerink (2020) acknowledge that the view of farmers on a 'good farmer' and what agricultural land should look like is vital to consider when pursuing the transition. Farmers judge their self-identity and professional pride based on the cultural norms within the industry about what constitutes a 'good farmer'. Previous literature describes a 'good farmer' as a farmer who takes good care of their land, livestock and soil and can be recognised by a neat landscape: free of weeds and well-maintained. Westerink's research (2020) adds aspects to this: "A good farmer takes responsibility for the environment, biodiversity and society, is social, does not work too hard and is happy". This statement has many similarities with what is seen as sustainable agriculture; however, it is not embraced by every farmer.

2.2 Water & soil in the Dutch agriculture

This sub-chapter provides more information about water quantity, quality and soil quality. The importance of the quantity and quality is introduced alongside the problems farmers will face. Furthermore, the approach of the DAW to help agricultural entrepreneurs transition to sustainable agriculture related to water and soil measures will be explained.

2.2.1 Water

Good water quality is vital for people, animals and plants. The quality of the national waters in the Netherlands is under pressure because of several factors: the construction of dikes and dams, the disruption of the natural flow, the discharge of wastewater, more intensive use by shipping, agriculture and recreation, and of course climate change (Ministerie van Infrastructuur en Waterstaat, 2023a).

Water is needed for agricultural production, but agriculture has substantial consequences for the water quality and balance. These consequences and subsequent problems that farmers face concerning the water quality and quantity are listed below.

Drought

Most areas in the south and east of the Netherlands and in Zeeland are Elevated Sandy Soils, and these soils depend entirely on rainwater. As a result of climate change, the weather in the Netherlands will be characterised by periods of more severe drought and flooding. The increased drought makes the importance of retaining and saving water more apparent, resulting in Water Boards imposing an irrigation ban for farmers. (Ministerie van Infrastructuur en Waterstaat, 2023b)

Salinisation

Salinisation is the increase of the salt concentration in the soil, groundwater and surface water. In the coastal region of the Netherlands, brackish groundwater comes to the surface and enters the groundwater and surface water through the soil. That leads to reduced fertility. Due to climate change, the sea level will rise, which will increase the pressure from the sea on the groundwater. As a result, salinisation in the coastal regions will continue to grow. (DAW En Verzilting, 2022)

Leaching and run-off of nutrients

Leaching and run-off of nutrients to groundwater and surface water causes eutrophication of this water. Substances that are leaching now will eventually reach the groundwater layer that is used for drinking water later. For example, nitrate, sulphate and nickel can reach water extraction, just like some plant protection products. Farmers are required to fertilise or spray with more precision. Less harmful plant protection products and ensuring that plants covert nutrients better also help improve the water quality. (Hoeve, 2021) (De Invloed Van Landbouw Op Waterkwaliteit, n.d.)

2.2.2 Soil

Agricultural land is the foundation of food production and fulfils several vital functions simultaneously, such as water buffering, carbon sequestration and biodiversity enhancement. Compared to elsewhere in the world, the Netherlands' agricultural soil is excellent. Because of the high soil fertility, good water management and land level, there are hardly any unproductive lands in the Netherlands. From the production side, it is difficult to conclude that the agricultural land in the Netherlands is in a bad state: the crop

yields are high. But on the ecological side it is.

The quality of agricultural soils results from the interplay of natural factors, like soil variety and the depth of the groundwater, as well as human interventions, such as fertilisation, ploughing and liming*. Due to harvesting crops, nutrients disappear. Next, a natural process acidifies the soil by breaking down the present carbon. Soils need to be managed to restore and maintain balance and thus a good quality.

Poor soil quality may include soil compaction, soil-borne pests and diseases, and low pH levels. As a result, crop yields decrease and possible problems with crop quality, and the condition of the local environment is also negatively affected. These negative impacts include ground and surface water eutrophication, declining water retention in the soil, and higher greenhouse gas emissions.

There are different problems farmers face with their soils (De Bodem, Daar Is Toch Iets Mee?, 2022):

* "Liming is the application of calcium- and magnesium-rich materials to soil. In acid soils these materials react as a base and neutralise soil acidity."

Soil structure and soil compaction

Soil compaction is caused by heavy machinery operating on the land in wet conditions. Due to soil compaction, crops quickly suffer in dry conditions because root growth and water absorption through capillary actions is impeded. At the same time, the soil also struggles to absorb water properly, and this causes damage to the crops during heavy rainfall.

Drought

Agricultural soils are drained to allow crops to take root. Maintaining a relatively low water level during the growing season also makes it more difficult for crops to access water during drought. Climate change increases the frequency of summer droughts, and water shortages lead to irrigation bans.

Soil-borne diseases

Soil is home to many organisms, and many of these organisms perform useful functions. However, some organisms can be harmful to crops. If a susceptible crop is grown on a plot where such a harmful organism occurs in the soil, that organism will rapidly multiply.

Soil fertility in arable farming and horticulture

Particularly in arable agriculture, the land is used intensively, and it is become challenging to supply organic matter within the parameters of current regulations sufficiently. Intensive tillage for harvest crops leads to organic matter being decomposed at high levels. At the same time, these crops tend to leave little crop residues, and current legislation limits the supply of organic fertiliser.

Soil fertility in dairy farming

Soil fertility is often a problem on dairy farms with plots where maize is grown year after year, with little organic fertiliser being used. But dairy farmers are concerned about their grasslands, where phosphate levels are declining. The grasslands are used to produce roughage for the cows, and lower phosphate levels in roughage is a point of interest for the health of highly productive animals. In addition, phosphate levels in manure are also declining, leading to a decrease in phosphate fertilisation of the land.

A good last note on soil: The desired soil quality depends strongly on the purpose of use: nature objectives require different soil than agricultural objectives.

2.2.3 DAW

The DAW targets the water challenges of farmers. The DAW focuses on promoting water quality, improving soil quality and reducing desiccation, flooding/waterlogging and soil subsidence. They support farmers by, for example, sharing knowledge and practical experience of other farmers, encouraging and facilitating initiatives, and setting up area-based processes. For DAW to be more effective, it is important to strengthen and enhance the participation of farmers. The DAW tries to reach many farmers and gardeners by operating through area planning processes and transferring knowledge. DAW actively approach farmers through awareness-raising projects next to facilitating the funding or implementation of projects. The projects of DAW correspond to the following themes: Fertilisation, Soil, Crop protection, Desiccation and waterlogging, Management, and Groundwater protection. Each theme offers projects and information for different measures farmers can take.

Next to projects and information, the DAW offers different activities and services that farmers can use: field trips to the 'farm of the future' or

to farms of farmers participating in one of the projects, getting advice from a soil advisor, and excursions with an expert. All this is to ensure improvement of the water and soil quality with farmers in the agricultural sector to stimulate the transition towards sustainable agriculture with healthy soils, clean and sufficient water and a robust revenue model. Figure 04 shows some ways to live up towards the change.

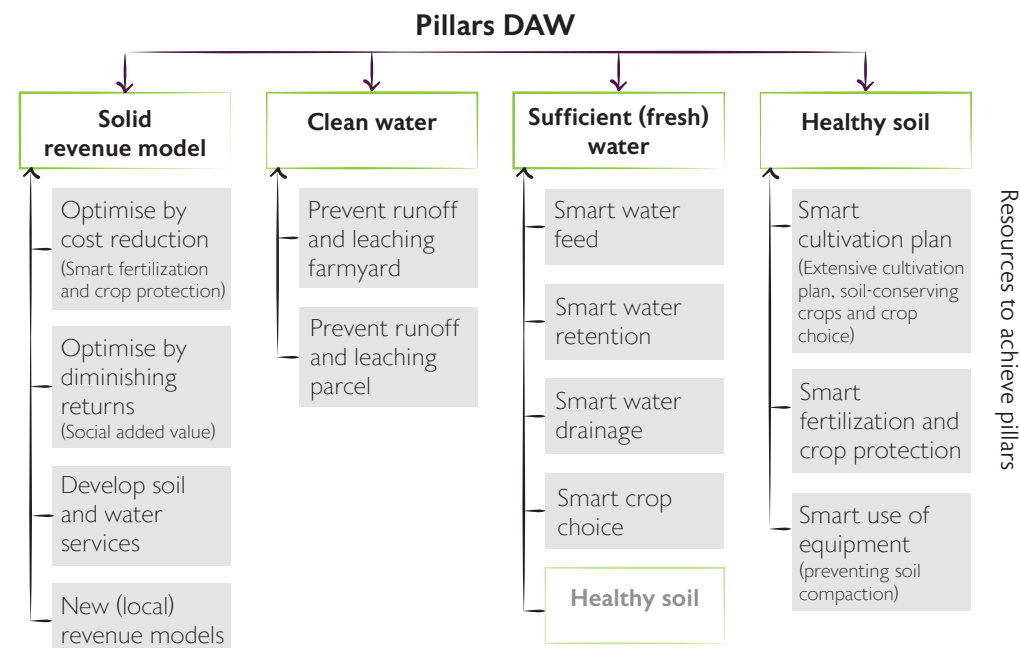


Figure 04: Pillars of the DAW.

Literature Review

The research question queried a literature review on several topics. First, writings on farmers' decision-making is reviewed to gain insight into different models, as well as what aspects affect the decision-making process. Next, literature about entrepreneurship is assessed to gain insights into entrepreneurial decision-making. Lastly, the research approach design anthropology is revised.

3. Farmers' decision-making

To encourage farmers to make sustainable choices, some of their behaviour needs to change: the decision-making behaviour. Therefore there is looked into literature about the decision-making process of farmers and how to influence it. This chapter describes the farmers' decision-making process. Papers about farmers' decision-making, triggers and influences are reviewed to gain insights. Frameworks of the farmer decision-making process, influences on farmer decision-making behaviour and recommendations that aims to change farmer behaviour are introduced.

3.1 Frameworks of the farmer decision-making process

In this sub-chapter, two frameworks are discussed on the topic of farmers' decision-making processes. Both these frameworks solidify the established principles on the conscious decision-making, where each model lays focus on different phases in the

continuous process in full. Their inner workings are explained and discussed to enable for results validation and further referencing within the scope of this project.

3.1.1 The evolution of farmer decision-making (Sutherland et al., 2012)

Sutherland et al. (2012) propose a five-stage framework called 'the 'triggering change' cycle' to predict the evolution of farmer decision-making: 1) Path dependency, 2) Trigger event, 3) Active assessment, 4) Implementation, and 5) Consolidation. See figure 05.

Path dependency is the phenomenon whereby history matters; what has occurred in the past persists because of the resistance to change. This explains the continued use of a product or practice based on historical preference or use. As a result of path dependency, it could be argued that major changes in farming practices occur in response

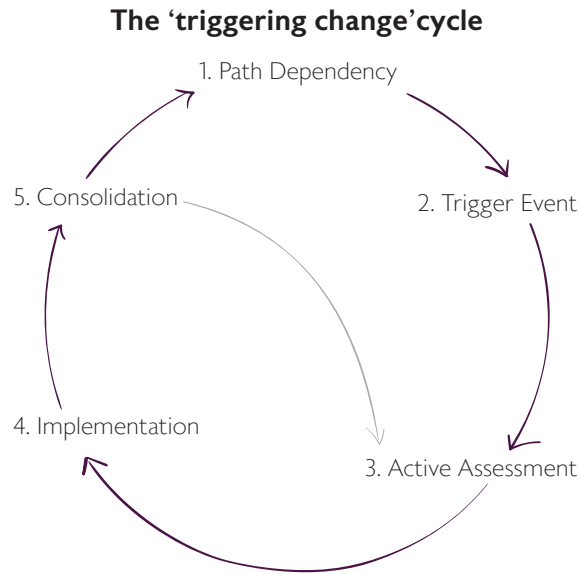


Figure 05: The 'trigger change' cycle (Sutherland et al., 2012)

to trigger events (Sutherland et al., 2012). When a particular event occurs, like new technologies or an injury, farmers can consider whether to do something new. If they think about something new, they use a variety of information sources to assess a range of options. Then the farmer decides to implement a new practice and start monitoring the implementation (Consolidation). When the implementation is successful, the farmer will return to stage one. If it is unsuccessful, the farmer will

start again on the assessment.

So Sutherland et al. (2012) state that farmers maintain a steady course on farm operation until an event or opportunity occurs, which leads to a decision to consider change: they trigger change. These triggers are often unpredictable and thus may occur at any stage in the change process.

3.1.2 The concept of lenses: Creation of practical opportunities (Farmer-Bowers & Lane, 2009)

Farmer-Bowers & Lane (2009) state that making decisions on a farm is done by the partnership, which mainly consists of family members. So the decision-making is not done by the individual farmer but by the farming family. This given fact makes the decision process very complex. Since it covers, next to the human and natural environments around them, all personal family issues, the differences between decision-makers in the family, and whole lifetimes.

This complex process is captured by Farmer-Bowers & Lane (2009) in five concepts to explain different possible decision-making processes. The

last concept is the concept of lenses, whereby the four other concepts are combined and summarised, see figure 06. The concepts include family aspirations, creating opportunities, the hierarchy of decision-making, and the individual perspective.

The last concept is called 'Lenses' since it reflects how farmers view options when creating opportunities. So, this framework focuses on the process of identifying options towards a practical opportunity they can execute. Some steps in this process (lenses) are explained below.

Family aspirations (Lens 2)

First, Farmer-Bowers & Lane (2009) discuss 'a hierarchy of motivation stories'. Whereby creating opportunities to satisfy your motivations over your life stands central. Farmers actively create opportunities and see business decisions as the 'means' to satisfy their family motivations. Farming families make decisions about various things, which can be divided into different decision systems. They first decide if the opportunity fits the family aspirations, and then the operational decision is made in the relevant other systems.

These systems are ordered in a hierarchical order, whereby the 'family decision system' is the most important one.

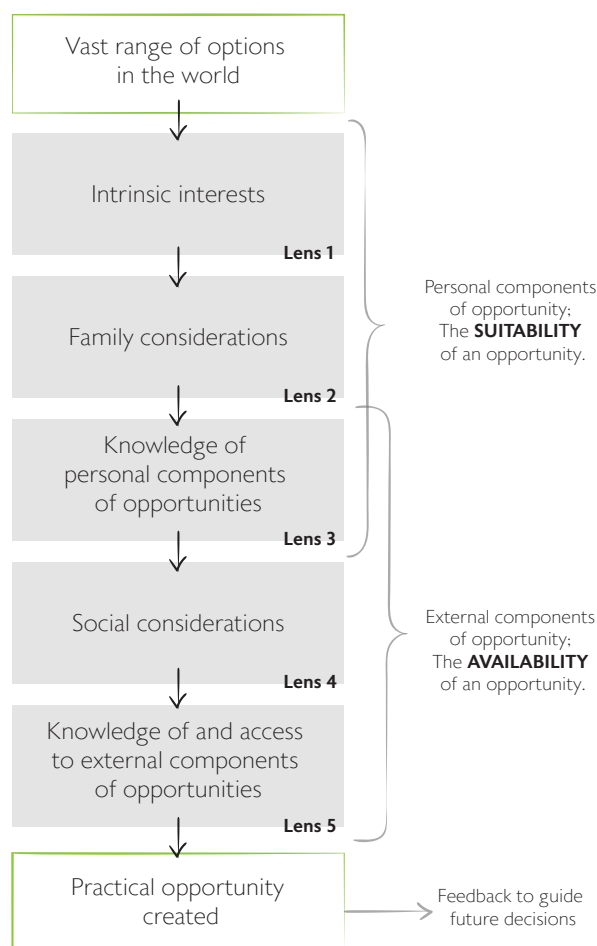


Figure 06; The concept of lenses. (Farmer-Bowers & Lane, 2009)

Personal and external components (Lens 3 and 5)

Following Farmer-Bowers & Lane (2009), farmers see opportunities as something they create from personal and external components and are influenced by random components. To create opportunities, suitability and availability are critical factors for farmers. Suitable in the way that the opportunity must satisfy one or more motivations. Available in the way that the opportunity must only require the possessed personal components and immediately accessible external components.

Personal components are unique to the farmer, such as their current skills, knowledge, financing, the land they own, and contact with other people they can use. On the other hand, external components include transport, markets, infrastructure, finance, etcetera and are not unique to the farmer. Random components are not unique to individual farmers and influence regions. Random components are events such as diseases, droughts, market fluctuations, etcetera.

Individual perspective (Lens 1)

Although the given knowledge mainly accentuates the prominence of family in the farmers' decision-making, there is also an individual perspective. Farmers also create opportunities to satisfy their individual motivations, not always to take a family view of opportunities: their 'personal career path'. Creating these individual opportunities results that some farm partners having an 'off-farm' career. Farmers try to satisfy their personal motivations as part of meeting their family's motivations. However, the family's stage in life influences the differentiation between decisions for family or personal reasons.

These two frameworks contradict each other in the sense of the starting point to make a decision. The 'triggering change cycle' states that a trigger is needed before a farmer starts looking and even assessing different options to implement. Whereas 'the concept of lenses' argues that farmers actively seek and create opportunities by constantly evaluating options based on their family aspirations.

3.2 Influences on farmer decision-making behaviour

A range of factors influences farmers' decision-making. In this chapter factors proposed by Rose et al (2018) and Edwards-Jones (2006) which affect the farmers' decision-making are summarised. Rose et al. (2018) present several factors that influence farmer behaviour. Edwards-Jones (2006) lists (non-financial) factors that influence farmers' adoption of new products, policies, and technologies within the agricultural context.

3.2.1 The farmer and farm household

Personal factors

Both Rose et al. (2018) and Edward-Jones (2006) state that personal factors or characteristics are determinants of behaviour. Such as the farmers age, gender, education, experience, attitudes, beliefs and personality. Edward-Jones (2006) also adds the importance of the characteristics of the farm household. This includes the family cycle and the work patterns of the spouse.

Feeling in control

When a farmer feels more confident about implementing new products, policies, and technologies, it is more likely that the farmer will

carry out that new thing. Rather than being told what to do, a farmer wants to be in control or needs to feel they have the skills, knowledge, or practical conditions. This is closely related to the level of education; a higher level of education tent to let a farmer feel more confident about implementing something new. (Rose et al., 2018)

Information provision education

Rose et al. (2018) note that clear communication and good information provision towards farmers are key factors influencing behaviour. These factors are related to the education level of the farmer.

3.2.2 The farm

The farm type and size influence the decision behaviour of farmers. Other farm-related factors influencing decision-making are the cashflow, succession plans, staff numbers and debt-to-asset ratio.

3.2.3 The social milieu

Rose et al. (2018) noticed that it is difficult to change individual behaviour without including trusted people, the wider social and organisational change. The opinions of the social circle, like

family, peer and trusted advisor networks, are highly influential. Next to this, Rose et al. (2018) noticed that the willingness to change of farmers is affected by social norms and societal pressure.

Edward-Jones (2006) identifies variables in the structure of the social environment of farmers that influence decisions. It was noted that the information flow, the local culture, the level of information, the attitude of friends, and the impact of institutions play a viable role.

3.2.4 The implementation

The farmers' participation in new implementations is influenced by the characteristics of the to be implemented innovation. Edward-Jones (2006) mentioned the voluntary nature of the implementation, payments, the duration, the information provided about the implementation and the follow-up, and the severity of change in farm management as factors.

Relative advantage

Farmers associate cost with change; therefore, direct financial motives are sometimes needed for farmers to adopt certain behaviours (Rose et al.,

2018). But also profitability and other benefits to the farms can influence the behaviour change. It was found that financial benefits are more valuable than environmental benefits for farmers.

3.2.5 Summarising: Want, Can, Must and May (Westerink et al., 2018)

The above-mentioned factors can also be found in the framework proposed by Westerink et al. (2018). This framework shows four conditions farmers experience for choices, see figure 07. It contrasts the personal factor affecting the farmers against the external factors. The personal factors are described as 'want' and 'can'. 'Want' is about the farmer's intrinsic motivation and their identity, what they see as a 'good farmer'. 'Can' considers the business factors (like company style), suitability of the practice and the farmer's knowledge. Next, are the external factors: 'Must' and 'May': 'Must' is not necessarily an obligation but an appeal from society (chain, government, etcetera) and colleagues, 'May' is about the potential farmers have or experience in the social and cultural norms.

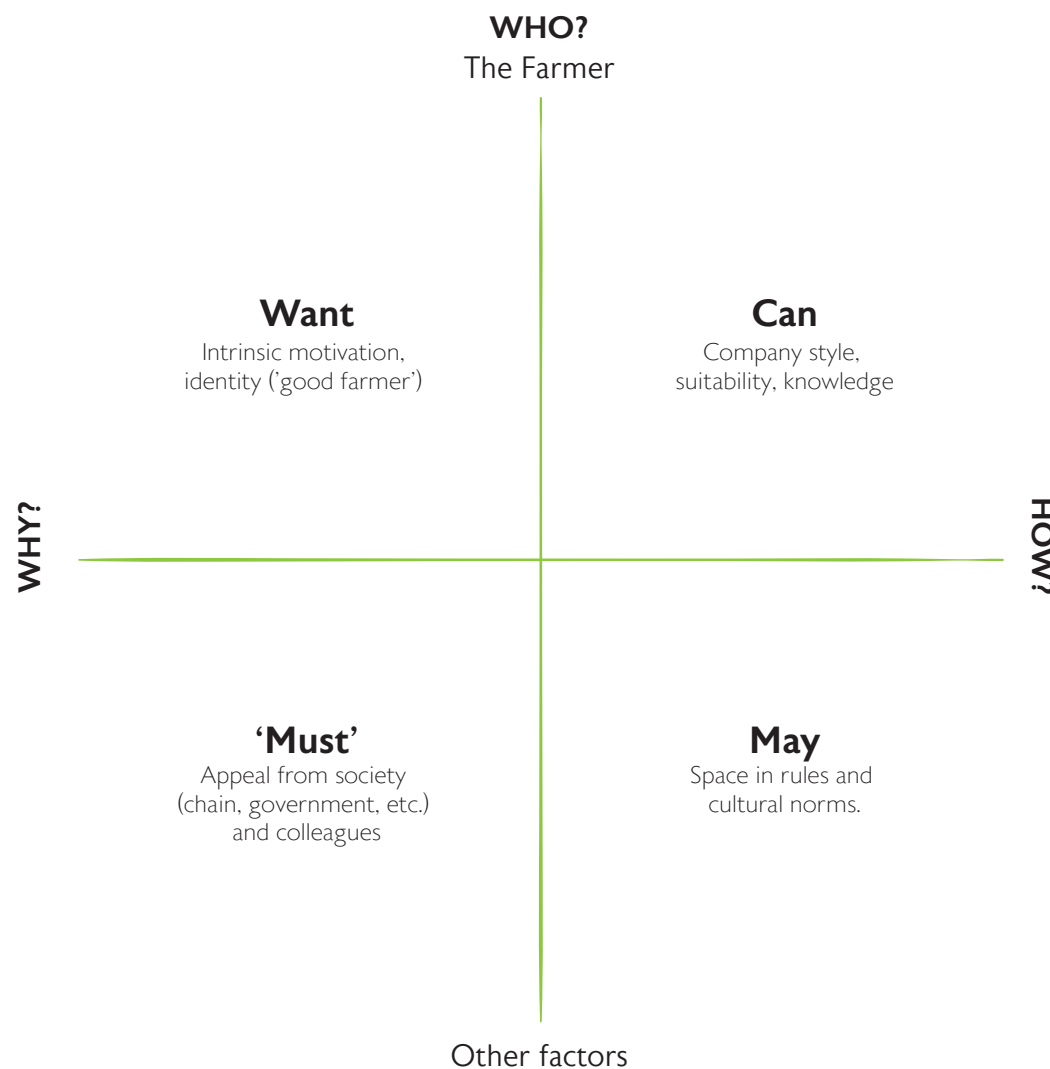


Figure 07; Framework 'Want, Can, Must, and May' (Westerink et al., 2018)

3.3 Affecting the farmer decision-making process

Westerink et al. (2018) propose nodes for steering based on the framework about Want, Can, 'Must' and May. Westerink et al. (2018) describe how each condition could be addressed to influence farmers' decision-making regarding sustainable farming. These recommendations overlap with the recommendations proposed by Rose et al. (2018) for aiming to change individual farmer behaviour. Both their recommendations are described below on the bases of Westerink et al. (2018)'s framework.

Want

Appreciation and recognition of sustainable efforts are important for farmers. Farmers want to be taken seriously; they have much knowledge and ideas for improving farming. Their motivation and enthusiasm are essential to transition towards sustainable agriculture and should be enhanced. Therefore it would help if sustainable farming becomes a part of the definition of a 'good farmer'.

Good experiences and concrete results motivate farmers to continue transitioning. Monitoring and

feedback can support this. Exchanging knowledge and experiences in farmers' networks is useful; farmers learn from each other.

Can

Farmers need concepts, options and information to be more concrete. For example, Westerink et al. (2018) state that the concept of sustainable farming and what it includes is relatively unknown amongst farmers. Thus, it needs to be communicated more to farmers to ensure they understand its ideas better. "Good knowledge exchange and education initiatives, ideally delivered in a face-to-face manner or making the most of active demonstrations, were identified as key factors in influencing behaviour." (Rose et al., 2018)

Farmers need financial compensation and a long-term perspective to change their business strategy towards sustainable farming. A sustainable revenue model is key for farmers to see sustainable farming as a future-proof option.

Major adjustments are only made a few times in a farmer's career, like farm succession. Stimulating sustainable farming strategies at these key

moments is recommended.

Besides knowledge and financing, other barriers farmers face are mentioned: experience with sustainable practices, age and cultural views on sustainable farming. Westerink et al. (2018) highlight the importance of considering these differences between farmers in communication. Rose et al. (2018) also underscore this recommendation: "Target messages carefully", first identify your audience by trying to understand them before you communicate with them.

'Must'

Control is a negative form of communication about what society expects from farmers. The tightening of rules can appear to farmers as a lack of appreciation for their previously non-statutory activities.

Farmers see citizens as an important factor in the future of agriculture. Only some citizens are willing to pay more for a sustainably produced product, so farmers experience little societal demand. This relates to what Rose et al. (2018) recommend if you aim to change farmer behaviours: you need

to prove the value of adoption. “If farmers do not perceive that there is value in adopting a new behaviour, then they are likely to stick with the status quo.” (Rose et al., 2018)

May

The idea of being unable to go back to the previous paradigm can be a barrier to transitioning into sustainable agriculture. For many farmers, it is uncertain whether a sustainable way of farming means a sustainable revenue model for them in the long term.

Next, cultural norms play a significant role in transitioning; how farmers talk to each other about the development of agriculture and the desirability or feasibility of certain developments has a major influence. Rose et al. (2018) also note the importance of including trusted people in the discussion when aiming to change behaviour.

4. Entrepreneurship

Agricultural entrepreneurs, also known as farmers, are entrepreneurs; it is in the name. Therefore literature related to entrepreneurship is reviewed. Entrepreneurs are in business that involves taking risks, managing resources, and creating value. To create this value, entrepreneurs can use different approaches. The approaches entail different ways of thinking and decision-making an entrepreneur can use. The choice of approach will depend on the entrepreneur's preferences, resources and goals.

Causation and effectuation are two approaches and can be seen as contrasted. Causation is an approach whereby the entrepreneur predicts the future to predefine a goal and find the means to reach this goal. In contrast, effectuation implies that entrepreneurs focus on their means and create something new and valuable with those means, which is introduced as new horizons in entrepreneurship by Saras D. Sarasvathy. This chapter goes more into depth on effectuation.

4.1 Effectuation

Entrepreneurs are sometimes portrayed as visionaries who can look into the future, find

a profitable opportunity, and bring together financial resources, key people and capabilities that create a sustainable competitive advantage. In this portrayal, the market opportunity is an already given fact to the entrepreneur. Saras D. Sarasvathy discovered that entrepreneurs do not behave as though the opportunity was apparent. Entrepreneurs do not always start with a specific goal; they start with a given set of means and allow the goal to emerge over time, based on the various influences the entrepreneur interacts with.

“Causal logics help us choose; effectual logics help us construct.” (Sarasvathy, 2009)

Sarasvathy (2009) identified five principles of effectuation.

1. **The Bird-in-Hand Principle:** Start with what you have and focus on you existing resources, skills and networks, and use them to create new opportunities. *“A bird in the hand is worth two in the bush.”*
2. **The Affordable-Loss Principle:** Only risk what you can afford to lose. Effectuation begins with determining how much the entrepreneur is willing to lose and with that given focus on

managing risk and minimising losses.

3. **The Crazy-Quilt Principle:** Effectuation emphasises alliances from stakeholders to reduce uncertainty. Entrepreneurs build a diverse partner network to create value and share risk.
4. **The Lemonade Principle:** Effectual entrepreneurs treat unexpected events and uncertainties as opportunities to build on them. Because effectuators begin with a loose notion of their goal, they can make up their plans on the go and use uncertainty as a resource for their goal. *“When life gives you lemons, make lemonade.”*
5. **The Pilot-in-the-Plane Principle:** Effectuation emphasises taking control of the future as an entrepreneur. “Causal and effectual logics both seek control over the future. But causation focuses on the predictable aspects of an uncertain future. Effectuation, on the other hand, focuses on the controllable aspects of an unpredictable future.” (Sarasvathy, 2009)

Depending on the circumstances, the same person can use both causal and effectual reasoning at different times.

5. Design Anthropology

It has been decided to use a design anthropological approach for the research part of this thesis. Since an anthropological approach tries to find the invisible part of culture (see figure 08), the deeper level of knowledge. It searches for the values, beliefs and attitudes of social settings.

Design anthropology is a discipline that combines elements of design and anthropology and has a distinct style and practice of knowledge production. It has its own concepts, methods, research practices, and practitioners (Gunn et al., 2013).

Anthropology is the comparative study of societies and cultures based on empirical research in social contexts. These studies' results can result in an ethnography, a description of cultures. Usually, this is a written report or book representing a particular social setting. The term ethnography refers to both the process of inquiry, immersion in social life, and the product, the ethnographic representation. A dominant method of field research whereby the researcher immerses in the social setting is participant observation. Participant observation allows the researcher to immerse

in a social setting to observe and document everyday practices. To understand the meaning of everyday events and actions for the participants, the researcher has to spend time with them and engage with their lives.

For a designer to better understand the needs and experiences of users and the context in which products are used, ethnographic data and methodologies can be of value. Design anthropology ensures designers to begin with immersion in real-life situations to gain insight into experiences and meanings to set the basis for design.

Design anthropology is more oriented towards intervention and transforming social reality than traditional anthropology. To create contextual knowledge and to develop specific solutions, methods that employ various forms of intervention are created and executed. Instead of engaging in long-term fieldwork in a social setting, a series of shorter field studies and interventions are carried out. With the generation of a new concept in mind, methods to 'foreshadow problems' that open up further questioning and

investigation can be used by designers. A method to 'foreshadow problems' is the use of sensitising concepts. Sensitising concepts draw attention to important features of social interaction and provide guidelines for research in the social setting. These sensitising concepts are often interpretive devices and function as a starting point for a qualitative study. An example of a sensitising concept is a cultural probes. A cultural probe is a designed artefact that encourages the users to

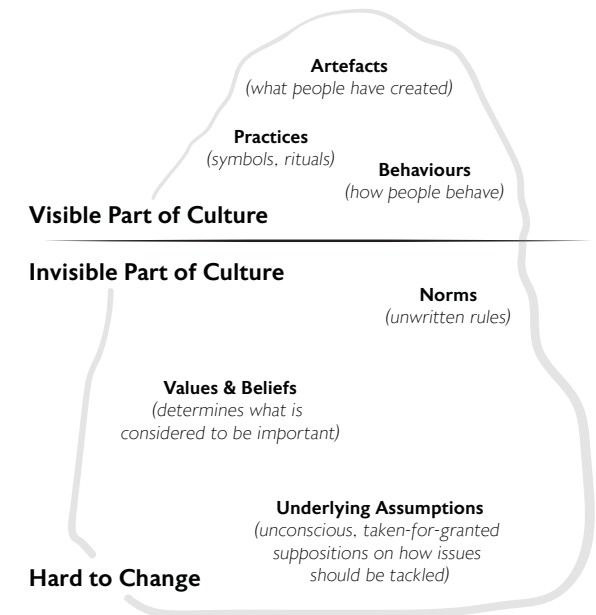


Figure 08; The Iceberg Model (Schein, 1985)

share personal stories, thoughts and feelings.

A research tool: the researcher

Another research tool in design anthropology is the researcher itself. The researcher is the one that immerses in the social setting and whose interpretations will lead to results and design directions. Therefore the researcher's background should also be kept in mind during the research.

The researcher for this thesis is me, the writer of the thesis. So let me introduce the research tool: José. José grew up on a farm in South-Holland. Her parents have a passion for cows and knew from when they were little that they wanted to become farmers. José's grandparents owned some land, cows and pigs and made it possible for José's parents to start their dairy farm. They built a stable and developed a farm where they milked around fifty cows. José was dragged around during work as a little girl and even had her swing in the milking pit. Later she helped feed the calves, milk the cows, and do some everyday chores. José loves being outside, so whenever someone needs to pick up the cows from the meadow, she did not hesitate. Around the age of ten, José's parents

decided to replace the milking pit with a milking robot. And quickly after that, other robots were introduced in the stable. Some chores and tasks disappeared, reducing the moments José could help. In 2010 the farm had to be moved, by order of the municipality. Again José's parents had the opportunity to build their farm in a new location: North Brabant. The agriculture robots company heard about the move and the new stable and suggested becoming a trail farm for their new milking robots. Only one demand: install two robots which imply milking a hundred cows. So within a year, the size of the farm doubled. Since the move, José only helped with the farming chores when asked since she discovered that the farm is not her future. Luckily for José's parents, her brother is fully committed to the farm and is now part of the partnership.

The researcher's background, in this case, can be seen as an advantage: she is not a stranger to the world, which could help to let the farmers open up more. However, because of the researchers' background, coloured glasses will be watched through. When this research is conducted by

someone else, it will give different interpretations, and thus different results, since the researcher's background will differ.

Auto-ethnography

Auto-ethnography arose out of the field of ethnography as a way to include the researcher's experience and insights. Auto-ethnography uses writing about the self in social and cultural contexts as a part of research and as a method of inquiry (Poulos, 2021).

Auto-ethnography is an autobiographical genre of academic writing that draws on and analyses or interprets the author's experience. It connects researcher's insight to cultural beliefs, practices, and experiences. Auto-ethnography makes use of deep self-reflection of the researcher. This is also applied to this thesis. The researcher's views, experiences and insights on certain topics will be described on the ripped paper pieces found in this report. Auto-ethnography is applied to provide the reader with the glasses through which the researcher is looking at things.

Research

Following the literature review, this section discusses the research executed during the span of this project. During an initial explorative field research, information was gathered to gain a better understanding of the basic principles and workings of the industry and its people. To dive deeper into the subject, a focus group was used to define the methodological approach for further research. Based on those findings, more focussed research could be planned out to target the decision-making process of young farmers. Using methods such as cultural probes (Gaver et al., 1999), participatory observation (Gunn et al., 2013), and semi-structured interviews, this section finalizes with the gathered results.

Since it has been a long time since I was at my father's and brother's farm and having no experience with water, soil and the activities of DAW, I decided to undertake some activities to get familiar with the setting. I joined the Waterkaravan, a field trip where I visited three farmers alongside other farmers and policymakers to learn about DAW's activities. Next, I decided to work with my brother at the farm to refresh my memories. And lastly, I chatted with a soil advisor to learn more about the different regulations and adjustments for soil management farmers face nowadays.

6. Initial field research: Getting acquainted with the context

6.1 Field trip (Waterkaravaan)

The 'Waterkaravaan' is one of the initiatives of DAW to allow people to visit farms that contributed to the project called 'Waterwijs Boeren'. Farmers and DAW are working on healthy soil and a futureproof company concerning water quantity and quality in this project. During the 'Waterkaravaan', the project's outcome will be shown and discussed. Next to that, it allows participants to share experiences and discuss what maintains the project's positive results. The participants of the 'Waterkaravaan' are farmers, policymakers and agricultural advisors. And on the 15th of December 2022, I was one of the participants.

First, all the participants gathered in Hengelo. Then we were driven around by the 'Waterkaravaan' bus (figure 09) to visit three farmers. Each farmer participates in a different project and thus applies differing measures. At each farm, the farmer and an advisor discuss their measures and the results. The day ended in Hengelo with drinks and the possibility to chat with everyone who participated.



Figure 09: Pictures taken during the Field trip



For this trip, I decided to take the more observant stance: Who will interact with whom? What questions are going to be asked? The trip started with introducing yourself on the bus. From this, I figured all the farmers were sitting together in the back of the bus. I was sitting in front of a farmerette and her son-in-law. The son-in-law does the tillage on the farm of the farmerette. He joined the trip to learn about other measures he could take for tillage. The farmerette joined to go on a trip and see other farms. "I had nothing to do anyway, and it's nearby."

We visited one arable farmer. He and his advisor did several scans of the farmer's land. With these scans, you can see the

different heights throughout the land, the difference in soils and more. The farmer said that since he now did the scan, he wouldn't do it again. "It was interesting to see, but I didn't need the scans to know what was happening". This resulted in an interesting interaction between the advisor and the farmer since the advisor wanted to sway other farmers to execute these scans, whereas the farmer just debunked this idea.

At the end of the day, I learned about different measures for better water and soil and the attitude of the farmers towards it. The participants were all interested in the topic and the experience of the farmers, and critical questions were asked.

6.2 Walk/work along

To get acquainted with the work that needs to be done at a farm, I went (back) to my father's and brother's farm and helped them during the morning. My father saw this as a day off, so me and my brother worked together.

My brother is 23 years old and joined the partnership one year ago. He has been participating in the farm since childhood and is now studying at a higher agricultural school. He guided me through the work and explained how and why specific tasks are done, and in which order. We started at 07.30, and the tasks which I could help with were done around 09.30.

When we entered the stable, my brother explained that they do a certain route: starting at the calves, young stock, dairy cattle, and pregnant and sick cows. This route can keep disease spread to a minimum. We started by providing the calves with milk. I remembered from the past that we used milk powder and added hot water and then needed to mix it by hand. However, my brother explained that since they have employees and interns at the farm, they let the robot make it, so there are no differences in the milk when someone else prepares it. Next to milk, some of the calves get bis and hay. My brother lays it down neatly (see figure 10) and explains

that he does that to see whether they have eaten. At the dairy cattle, the pens needed to be cleaned, and sawdust needed to be strewn in them. We rotated the tasks, and my brother educated me on the cows and their anatomy. He talked so passionately and joyfully of the cows, proud he knew so much about them. And probably that I do not. We checked the milking robot and then continued to the pregnant cows. Here we again cleaned the pens. After this, we were done and ready for breakfast.



EARLY START



NEATLY SEPARATED FOOD AT THE CALVES



MILKING ROBOT



6.3 Soil advisor

Before conducting the research, a chat with a soil advisor took place to get more acquainted with the agricultural soil and the current developments and problems. He was asked what concerns farmers have now, what the knowledge of farmers is and what he had noticed. New insights about water and soil gained from this chat are described below.

DAW aims to create and maintain agricultural parcels that function as well as possible. Different measures can obtain healthy soil. For some of them, a farmer can get funding: compensation for the potential financial damage they incur. However, once that measure becomes lawful, you are not reimbursed. For young farmers, this could be a problem. They just took over the company, so the financing is impossible. They also do not have the financial space to take the potential loss. Furthermore, farmers see no beneficial side of some regulations since some are at the expense of returns. Acreage must be surrendered, which can cause a dairy farmer difficulties with the manure discharge.

Soil management and retention of yield is

a complex situation. In the first years of implementing a measure, the output can decrease. The soil processes take a long time, and you do not see the benefits of the adjustments immediately; it takes 4 to 5 years or even longer to see the change.

As a farmer, you have to harvest. Sometimes you do things you know are not good for the soil since you still want and need to maintain returns. Farmers subconsciously know through experience where the bottlenecks are in maintaining their soil.

Some general advice the soil advisor can give: no land tillage under bad conditions, a not-too-intensive plan for the agricultural parcels, intercropping, fertilisation with manure, avoiding bare soil in the fall and limiting tillage.

Soil and water in the agricultural context are a new topics for me. Before the meeting with the soil advisor, I tried to get acquainted with the jargon and not be a total novice. With the understanding of what good agricultural soil must comply with and its current urgent problems, the meeting started immediately with all of the issues happening right now. The demands to improve the soil to make it futureproof, what that means for a farmer, and the yield create a complex situation. All the different information, standards, requirements and laws overwhelmed me. There are so many factors that you have to keep in mind, and all influence each other. I personally would not see a way to create a positive outcome on all aspects.

7. Context Research: Young farmers' decision-making

DAW has the need to motivate agricultural entrepreneurs to make sustainable changes concerning water and soil at the farm. To respond to this, agricultural entrepreneurs' current decision-making behaviour will be examined. When, where and based on what does an agricultural entrepreneur make decisions? To answer this question, a qualitative mixed method methodology is applied.

7.1 Goal & Question

Based on the stated assignment in Chapter 0 (see also below), the research aim is to determine how an agricultural entrepreneur manages, makes decisions and who influences the decision-making process.

“I will research agricultural entrepreneurs’ decision-making process when implementing farming changes. With these insights, I will design and evaluate a product or product-service combinations to encourage agricultural entrepreneurs to make sustainable decisions. This concept can also help LTO Noord to improve their support for agricultural entrepreneurs.”

The following research question and sub questions are set up for the context research:

What is the decision-making process of a young farmer when making changes to the farm?

- How does a farmer make decisions and do business?
- What are the motives for a farmer to make changes at their farm?
- What are the incentives for a farmer to start considering a change?
- Who and what does influence the decision-making process of a farmer?

7.2 Participant Recruitment

The target group for this project are young agricultural entrepreneurs (age up until 35 years) who are part of the partnership of the farm. Preferably, the participants are spread all over the country. Throughout the recruitment, the research group was scoped down to dairy farmers; however, one apple and pear grower is recruited. Since the methodology of the research is time intensive, it was decided to research seven

participants next to one pilot.

Several approaches were performed to find participants. A recruitment message (see appendix F) was set up and shared on Embrace and Nederlands Agrarisch Jongeren Kontakt (NAJK). Embrace is the platform LTO staff uses to communicate, and NAJK is the organisation that serves the interest of agricultural youth. Next to Embrace, my colleagues were directly asked to help recruit participants. Lastly, my social circle was used to contact agricultural entrepreneurs directly. My father and my brother contacted their friends and colleagues, and participants were asked if they knew more farmers who potentially wanted to participate. Every farmer that was recommended was called.

Lastly, my colleagues at LTO were asked to use their social circle to help recruit participants.

Farmers are hesitant to participate. The requesting message on the different platforms did not give any response. Presumably, the step was too big to contact me. When I did reach out to farmers, who were suggested by my social circle, they were quite apprehensive. They asked if they could see the questions first, what will happen with their answers, and for which cause their responses will be used. Here it seemed to be to my advantage that I have an agricultural background. Because, telling the participants that my dad is also a dairy farmer and what motivated me to do my research was soothing them. Nonetheless, the participants that my father requited were less suspicious: my father's endorsement was enough for them to trust me and my research. Also, the farmers that I came in contact with via an already-interviewed participant were less apprehensive.

7.3 Methodology

A qualitative approach has been chosen to reach the research goal—a (design) anthropological approach to dive deep into the farmer's world and find the answers. Since farmers are known for their closed personalities and being boorish, methods in which the researcher gets closer to the participant could help to get more profound answers. Initially, a focus group was conducted to tailor these approaches to the research group. It was decided to use probes, do a participatory observation, and conduct a semi-structured interview. These different methods and how they are applied are discussed on the following pages.

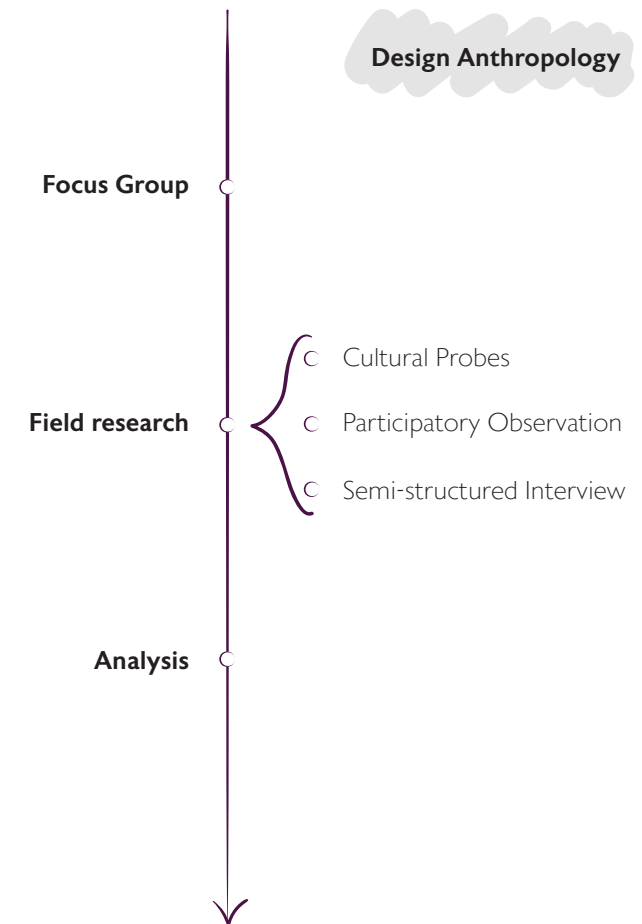


Figure 11; Overview of the research methods.

7.3.1 Design Anthropology

“Design anthropology, they propose, combines the transformative, future orientation of design with anthropological theory and cultural interpretation, systematic investigation of the past as a lens to explore the present, and a “unique sensitivity to the value orientations of various groups affected by design projects”.” (Otto & Smith, 2013)

Design anthropology combines the future orientation of design with the cultural interpretation of anthropology. Through research from the past & present, possibilities for the future can be created.

In this research different methods of the design anthropological approach are applied. The combination of sensitizing concepts, participant observation and semi-structured interview is made to find the hidden part of the young farmers culture. Emotions, routines, and rituals are mapped and visualised with participants to discover alternative futures.

To gain more insights into this approach, I contacted a design anthropologist to help me shape the different elements of my methodology. They gave me examples, methods and insights from their work. From this, I learned new ways of doing research and communicating with the participants. They taught me about participatory observation and recording and establishing the data. Next, we thought of different shapes of the probe and ways of displaying the data.

7.3.2 Focus Group (Pilot/test)

A focus group is a group interview in which (several) topics are discussed. The idea is that the social setting creates a debate around the presented topics.

The focus group functions as a pilot/test for the semi-structured interview. The questions and topics asked generate insights about the phrasing of the questions and the possible answers that agricultural entrepreneurs could give. The focus group is conducted with five students of Aeres University of applied sciences. All are studying agricultural entrepreneurship and are aged between 19 and 21. The focus group consists of two parts: an individual part and a group part.

During the individual part, the participants are asked to fill in a document (See Figure 12 and 14) about their motivation, ambitions, pride, and joy as young aspiring farmers. All participants' documents can be found in appendix A1.

The group part includes three questions about the definition of a 'good farmer' and where and with whom decisions at a farm need to be made. The

group could answer these questions by writing post-its and putting them on the table. These post-its can be found in appendix A2.



Figure 12; Participants filling in the individual document during the focus group

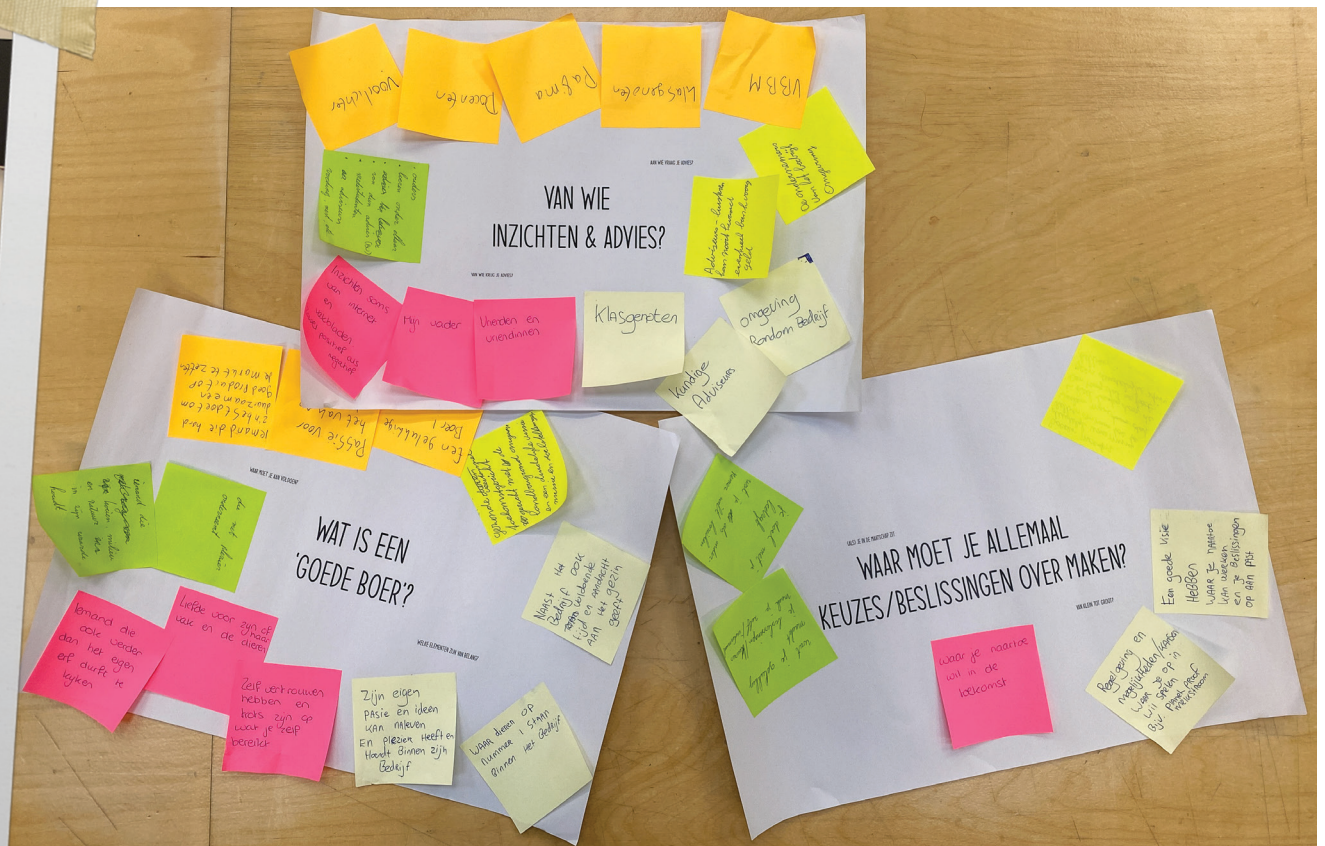


Figure 13; Brainstorm pages from the group part

WAAROM IK AGRARIËR WIL WORDEN

Ik wil agrariër worden omdat ik het een uitdaging vind om ~~er~~ zoveel mogelijk uit je bedrijf te halen. Je doet veel verschillende dingen en geen dag is hetzelfde waardoor ik er erg van geniet

HET BEDRIJF

Melkveebedrijf ± 200 koeien
en jongvee
Groningen, Ten Boer

Geen maatschap,
het is een eenmansbedrijf
van mijn vader

TROTS

WAAR BEN JIJ TROTS OP ALS AGRARIËR?

Ik ben trots op onze koeien, hoe het bedrijf loopt en trots op het feit dat je dit met z'n allen bereikt

PLEZIER

WAAR HAAL JIJ PLEZIER UIT ALS AGRARIËR?

Een van de mooiste dingen is bv. met de zonsopkomst de koeien uit de wei halen. Ook haal ik plezier uit het resultaat, als het goed loopt ben je blij ~~omdat~~ omdat dat is wat je uiteindelijk wilt.

DROMEN

Het liefst wil ik het bedrijf overnemen met mijn broertje. En dan is mijn droom om een bedrijf bij te kopen zodat we samen kunnen groeien. Ook zou ik een tweede tak willen

WAT ZIJN JE AMBITIES EN DOELEN?

zoals educatie enz.

I was a bit nervous when visiting my brother's school. Interviewing students who are about my age and they are friends of my brother... I don't want to make a wrong impression for myself and my brother. So I decided not to wear very formal clothing and be 'a fellow student'. My brother reserved a room in the faculty and welcomed everyone. We started with a low-key conversation, and they asked questions about why I am not in the partnership of my father's farm and how my student life is. When everyone was settled, I explained what the procedure was going to be: first, the consent form, the individual part, and lastly, the group discussion.

For the individual part, they all started with filling in the details of the farm. Motivation, joy and pride followed. They all had some difficulties with their ambitions since they all experienced the lack of future perspective the government is giving right now. But asking them to dream big gave

exciting answers. They all talked about the fact that they want to be happy and have a healthy family. Again a topic that is in the news often.

Hearing the stories of the aspirant farmers, I felt moved. They have dreamed of taking over the farm for years and are so motivated to become the farm's agricultural entrepreneur but are unsure if this is possible. Is their dreamed-of-farm futureproof?

The group discussions started with what they understood as a 'good farmer'. Aspects such as taking good care of animals and nature, but especially caring for the family, were discussed. Finally, it was also concluded that a 'good farmer' is a happy farmer. These were some aspects I was not expecting, and I had no idea that family and being happy play a vital role in the life of a young farmer. Next, the question about what a farmer needs to make decisions was presented to the group. This question roses

many questions from the participants. They were unsure what answers I was looking for with this question. So, I decided to ask them how I should phrase the question in their opinion. I discovered that the question I should have asked was, "What considerations do you take into account making your decisions?". Lastly, the question about who they ask for advice was well phrased and gave a list of people. In the end, the participants mentioned they liked discussing these questions and were relieved that it was a group interview, not an individual one.

7.3.3 Cultural Probes

A cultural probe is a designed material that can be everything that encourages users to share their personal stories, to express their experiences, or to reflect on their own context. (Gaver et al., 1999)

The probe triggers the agricultural entrepreneur to think about how, when, and why they made a decision. They are asked to think about a decision they made concerning farming (e.g. changing the type of food for the livestock, another way of watering the land, increasing automation, changing to biological agriculture, etcetera). Next, they are asked to write a postcard about this decision to their following and previous generation. They are given some guidelines on what they can write. This probe is sent to the participant as preparation for the visit. The probe package contains two cards explaining the research and the probe, four different postcards the participant can pick from, and the consent form for the interview (Figure 15). The package content can be found in appendix B1. The written cards by the participants can be found in appendix B2.

I looked at my home situation to figure out the probe type. My father and brother are always on the run and can only sit down for a few moments. I looked at their routine and tasks they would do during the day and for moments suitable for a probe. Some tasks may be appropriate to audio record a story whilst taking place. However, I notice that whenever I call my dad during work, he is too focused and doesn't pay attention to what he is saying. Since I want the participant to think about their decision-making, a medium that requires more thought, such as writing, felt more suitable. Since there will always be a coffee break or another moment they do paperwork, I thought writing a postcard could be an appropriate probe.

Designing the postcards was difficult. Since I want the cards to be personal, so it will give the participants the feeling that it is made for them specially. I started with the idea of finding photos of the participant's farm from now and in the past; however, this was not doable and maybe a bit eerie. So the search for the general Dutch agriculture picture began. I searched for images from an overview perspective since I wanted them to 'overlook' their decisions. Next to that, I decided to draw a postcard design myself. If all the images were not relatable for the participant, I added something specially made for them. I drew typical agricultural elements from the past, current and future on this design. The most important criterion for the cards was that they needed to convey the positive and strong sides of agriculture.

UITLEG
KAARTEN

Hoe nu verder?

Als (jonge) boer neem je dagelijks tientallen beslissingen voor jouw bedrijf, voor de toekomst. Met jouw ervaring en inzicht in de toekomst...

Hey _____, Leuk dat je meedoet met mijn onderzoek!

Ik ben José Dijkshoorn en voor mijn afstudeerscriptie doe ik een onderzoek naar hoe jonge agrariërs ondernemen en keuzes maken. Dit onderzoek doe ik in samenwerking met het Deltaplan Agrarisch Waterbeheer (DAW). Met de uitkomsten hoop ik samen met hen, kennis en informatie rond bodem- en watermaatregelen beter af te stemmen aan de behoeften van agrariërs, aan jou en jouw collega's dus.

Ik ben heel erg blij dat ik met jou mag meelopen tijdens jouw dagelijkse werkzaamheden en mag interviewen. Zodat jij je kan voorbereiden op dit interview heb ik hierbij een opdrachtje meegestuurd zodat jij alvast over het onderwerp ondernemerschap kan nadenken. De uitleg hiervan staat op de achterkant van deze kaart. Ook is er een kaart met meer informatie en onderwerpen die je kan verwachten tijdens het interview.

Verder vindt jij in dit pakketje alvast het consentformulier. Voordat ik meeloop en vragen stel heb ik toestemming van jou nodig. Ik stuur dit nu mee zodat je er eventueel alvast naar kan kijken. We zullen dit formulier ook nog doornemen als ik langskom. Ik vraag om foto's/video's te maken terwijl ik mee loop, deze zullen geanonimiseerd worden. Daarnaast neem ik het liefst zo veel mogelijk audio op, dit omdat ik het moet transcriberen voor mijn onderzoek en ik niet zo goed ben in het hele gesprek onthouden.



Voor vragen en/of opmerkingen kan je bij mij terecht.

1/4

Ondernemerschap van jonge agrariërs

U wordt uitgenodigd om deel te nemen aan een onderzoek genaamd "Ondernemerschap van jonge agrariërs". Dit onderzoek wordt uitgevoerd door José Dijkshoorn BSc van de TU Delft in samenwerking met het Deltaplan Agrarisch Waterbeheer (initiatief van LTO Nederland en het Deltaplan Agrarisch Waterbeheer) voor haar afstudeerscriptie van de Master Design for Interaction.

Dit onderzoek is inzicht opdoen over ondernemerschap van jonge agrariërs: de beslissingsproces en de drijfveren. U wordt gevraagd een beeld te geven van uw ondernemerschap. Dit zal gedaan worden aan de hand van het meelopen van de werkdag en uw werkzaamheden en een interview.

U zullen gebruikt worden om, samen met de andere opgedane data, inzichten te krijgen in het ondernemerschap van jonge agrariërs. Dit zal vervolgens gepubliceerd worden in de literatuur en/of andere media. Daarnaast zullen er vanuit de opnames of notities van het interview interessante inzichten worden getrokken, die waardevol zijn om los te publiceren in de scriptie. Dit alleen als u daarvoor toestemming geeft.

De aan dit onderzoek is volledig vrijwillig, en u kunt zich elk moment terugtrekken en op te geven. U bent vrij om vragen niet te beantwoorden. U heeft het recht aan te geven dat u niet wilt worden gefotografeerd of gefilmd, hierbij zal uw data verwijderd worden uit het onderzoek. Dit kan ook via de volgende gegevens worden bereikt.

CON
FOL

I decided that the participants did not have to return the cards to me since I would add a step to the probe, which may be too much. As a farmer, you work 24/7 and have a long to-do list, so I wanted the probe to be accessible and not too much work. Because of this, I already anticipated that some participants would not write the cards. In the end, four participants wrote postcards. The participants wrote the card towards a previous generation to their parents or their granddad. Reading the cards made me feel gifted since some stories were personal and emotional. All participants were grateful to take over the farm and were thankful to their ancestors for building it, and hoped their ancestors would be proud of their way of farming. Writing a card towards the next generation was seen as complicated since they do not yet know if there will be a next generation. For the future generation, all participants wrote about the current political situation and their views on it.

< Figure 15; The content of the probe package

Pa bedankt!

Dankbaar ben ik voor jou/jullie inzet en moeite
o jullie levenswerk aan ons over te dragen.

Graag schrijf ik deze brief om de keuze/beslissing om
natuurlijker te gaan boeren toe te lichten.

Uiteindelijk zou ik graag met mijn brar Hent op een
duurzame en verantwoorde manier voedsel produceren die
bij draagt aan de gezondheid van mens, dier en milieu.
Laatste jaren is best een zoektocht geweest om te
ontdekken hoe ik wil leven/boeren. Al eerder ontdekte
ik dat ik passie voor mens, dier en natuur heb.
Na een masterclass van Joël Salatin, vele youtube video's
en boeken later, zie ik veel kansen en oplossingen in een
vorm van regeneratieve landbouw. De basis van een
samenleving is namelijk de voedsel productie en de
(nutritionele) kwaliteit daarvan.

Jaring Brunia heeft onze boerderij bezocht en een presentatie
gehouden over zijn visie op de melkveehouderij. Hij en vele
anderen hebben mij geïnspireerd.

Allereerst wil ik graag benoemen dat de voorgaande manier
van boeren niet fout was. Ik denk dat er veel kracht in
schuilt! Ik geloof wel dat regeneratieve landbouw veel oplossingen
kan brengen op huidige knelpunten op de wereldwijde voedsel
productie.

Mijn radicaliteit kan resulteren in te grote rigoreuze stappen.
Ik heb jou/jullie daarin ook hard nodig! Graag zoek ik met jullie
naar een weg waarin we op natuurlijke wijze de bodem
gaan voeden en verzorgen. Daar mee hoop ik dat we
ook mens en dier veel gezondheid kunnen brengen!
Ik hoop met kleine(re) stapjes en een gedegen plan grote
dromen en doelen te bereiken met elkaar!

Hartelijke groet en veel Liefs [Pilot]

Hoi opa
ondanks dat ik u niet bewaart heb mee gemaakt heb ik veel
over uw ~~gehoord~~ gehoord. Ook krijg ik met regelmaat het verwoord;
dat heb ze van opa geerd! Wat ik zeker niet erg vindt.
Vandaag de dag bouwen pa en ik verder aan het bedrijf waar
u ooit heeft overgenomen van uw vader. De beslissing
van u en pa om bij de verplaatsing naar Oudemolen te
gaan ben ik dankbaar voor. Hierdoor zit het bedrijf nu
op een levensvatbare plek denk ik, vandaag de dag is
het bedrijf een stuk groter als dat toen u er nog was.
We melken met Robor de 250 melk stalfkoeien. Het Songvee
hebben we uitbesteed. Dit staat bij een andere boer die
het voor ons opfokt tot Valf voeren. Door te kiezen
voor veel automatisering o Melkrobot, melk Robor S
drinkautomaat. Kun ons pa het meeste werk nog alleen
af en welk in ~~meer~~ nog 4 dagen buiten de deur bij
Exlan. Daar zie en leer ik veel van andere bedrijven. Zo
ben ik heel blij en denk ik dat het heel verstandig is geweest
dat u heeft gekozen voor maar 1 quater op het bedrijf.
dit loopt anders zo vaak mis. Verder heb ik om nog
wat verbreding naast thuis en het werk te krijgen gekozen
voor wat ~~bestuur~~ werk. Zo ben ik voorzitter bij de KPS.
Zit ik in de crv Songereraad om te spreken over de
Coöperatie. De Folkering trekt mij niet zo. Ook zit ik
nog in het bestuur van studiehuis gassel. Alleen maar erg
leerzaam. Bedankt voor de start en de opzet van het
bedrijf en ik hoop dat u net zo achter de kiezen staat
als wij.

groetjes

[P2]

7.3.4 Participatory Observation

“Participant observation involves the long-term immersion of a researcher in a social setting with the aim to observe and document everyday practices comprehensively and in detail” (Gunn et al., 2013).

For the participatory observation, the participant is asked if the researcher could join a working day, or a part of one, and help with the daily routine. In this way, the researcher already sees the farm and experiences what the farmer does daily. During the participatory observation, questions about the farm, work, decisions and anything that seems interesting or relevant are asked. Since the researcher sees and experiences certain situations and phenomena with the farmer, it will be easier to discuss them. This participatory observation can be seen as an ice-breaker for the semi-structured interview.

The notes of each participatory observation can be found in appendix C.

A day for most farmers starts early. Most of the time, I was asked if I could be there around 8.00 in the morning. When I arrived, they already did certain tasks. The day started with putting on an overall and boots from the farm, because of possible disease spread. The participants always asked why I wanted to work with them. It seemed to them like I put myself in much trouble. Luckily, I know what I signed up for: cleaning the cubicles of the cows, distributing straw over the pens, and feeding calves...

When entering the stable, the farmer already started telling about the general information of the farm: the amount of cows they milk and the amount of hectares of land. From this, it was easy to ask about the management and history of the farm. During the different tasks, I saw that they made changes to machines or had other ways of doing tasks, leading me to ask about it. For example, the pens of cows will be strewed with sawdust. My father does that

by hand: throwing a handful of sawdust in the pens from a bucket. Whereas one of the farmers bought a small machine you push forward to strew the sawdust. Some farmers even added hooks or compartments to take tools while strewing.

During working with them, I felt them getting more comfortable around me. Participants started telling stories themselves: things they were proud of, something they figured out, etcetera. They loved to show the farm and what they had accomplished. Many elements were already discussed during the participatory observation, which was a good start for the semi-structured interview. Around 9.30 it was time for a coffee break, which also gave the time to execute the interview.

7.3.5 Semi-structured Interview

“A semi-structured interview is a qualitative research method that combines a pre-determined set of open questions with the opportunity for the interviewer to explore particular themes or responses further.” (RWJF - Qualitative Research Guidelines I Semi-structured Interviews, 2006)

Semi-structured interviews were conducted to allow unexpected information to be gathered. An interview guide was set up to ensure each topic is discussed and so the consistency of the results. The themes and questions were formulated based on the initial field research and focus group. Some of the themes and questions could already be discussed during the participatory observation. The general outline of the interview was as follows:

- Introduction of the research and the researcher;
- Informed consent form;
- General questions about the farmer: age, type of farm, partnership, etcetera;
- Motivation and routines of the farmer;
- Deliberation of the probe;
- The decision-making process, with the use of

an example;

- Anything the participant would like to share.

See Appendix D1 for the complete interview guide.

The interview was voice-recorded and took place at the farm wherever the participant preferred. For the topic 'the Decision-making process', a poster was designed to make an overview of the different steps while making a decision with the participants. The poster's design was a meadow with a fence, where the fence represented the starting point (see figure 17). A particular decision the farmer made will be used as a starting point, where with the use of post-its, a path will be formed to highlight the different steps during the decision-making process. The poster gave an overview of the idea towards the actual change and the steps in between (see figure 18).

To refine the methods and questions, a pilot study took place. See Appendix D2 for the reflection on the pilot studies and the changes that took place.

The interview notes, and the computer-generated transcripts of the interviews can be found in

appendix D3.

The consent form was added to the probe, so the participants could already read it. I did this because, from my own experience, I feel so pressured to read the form as quickly as possible when the researcher is there that I don't know what I am reading. The interview script was adjusted on the spot since certain topics were already discussed during the participatory observation. Considering the participant and I were already working together for around 1,5 hours, I experienced the interview as a low-key conversation. I allowed the participant to ask questions about my 'agricultural situation' since I wanted them to experience the interview the same way. During the interview, the participant and I could refer to certain things we had seen outside, which helped me get more specific and explained answers.

All in all, the participants opened up during the interview and gave elaborate explanations and stories. I was not always able to ask all the questions within the time frame. However, the whole experience

(working with them and the interview) gave me the answers I was looking for (and even the ones I was not looking for).

Using the poster helped me get an overview of the decision-making process and what factors have influence. The participants were able to help write post-its and helped structure them. It was a good tool to narrow down the process into small steps and let the participant think about why they did a certain step more in-depth. Since all the participants just quickly told the story about the process and the actions and then thought they were done with it.

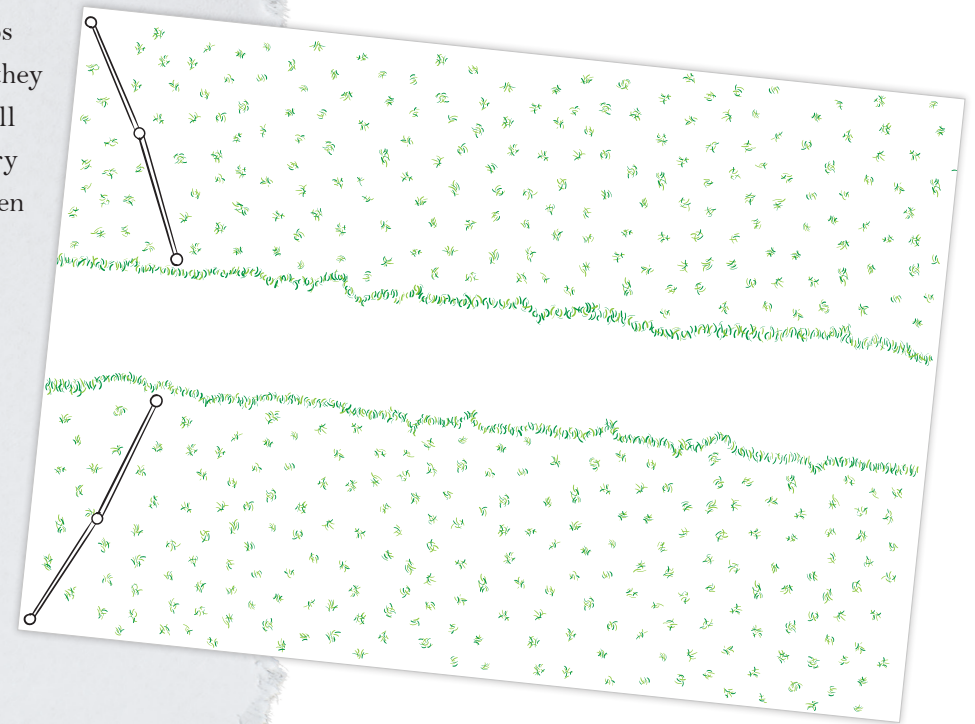


Figure 17; Design of the poster used during the interview



Figure 18: Results of the poster after the interview.

7.3.6 Analysis of inquiries

The inquiries resulted in a lot of scattered information that needed to be analysed. The different methods gave the following output: written postcards, observation notes, photos and voice-recorded interviews and posters. Different ways of analysing qualitative data were looked into. For the analysis of the interviews, a coding tree could be applied. However, this is a time-intensive method when working individually. Next, analysing the data using statement cards (Sanders & Stappers, 2013) was considered. This method builds on using interesting quotes from the interview transcription combined with the researcher's interpretation. All statement cards of all interviews will be clustered into overlapping themes. Again this is a time-intensive method when working individually, so only some aspects of this method were used for the analysis. The different outputs were reviewed, and interesting quotes, interpretations and insights were selected and written down on post-its. Each participant had their own colour post-its during this process. After each inquiry, these post-its were clustered into overlapping themes and answers (see figure 19). Clusters and themes arose based on similar

answers patterns that appeared next to the researcher's feeling, interpretation, and experience with the data and participant. The clustering process was ongoing: while adding the post-its of a participant, the clusters were revised; this resulted that during the process, clusters changed, grew, shrunk or became related to each other. Pictures have been made to see the progress and changes throughout each clustering session. The final clusters and themes were subtracted after adding the last participants' post-its and one revision. The used quotes can be found in the computer-generated transcripts of appendix D3. All the written post-its can be found in the appendix E1, as well as the generated clusters. From the different themes, requirements for the design could be formulated. They will be discussed in chapter 9.

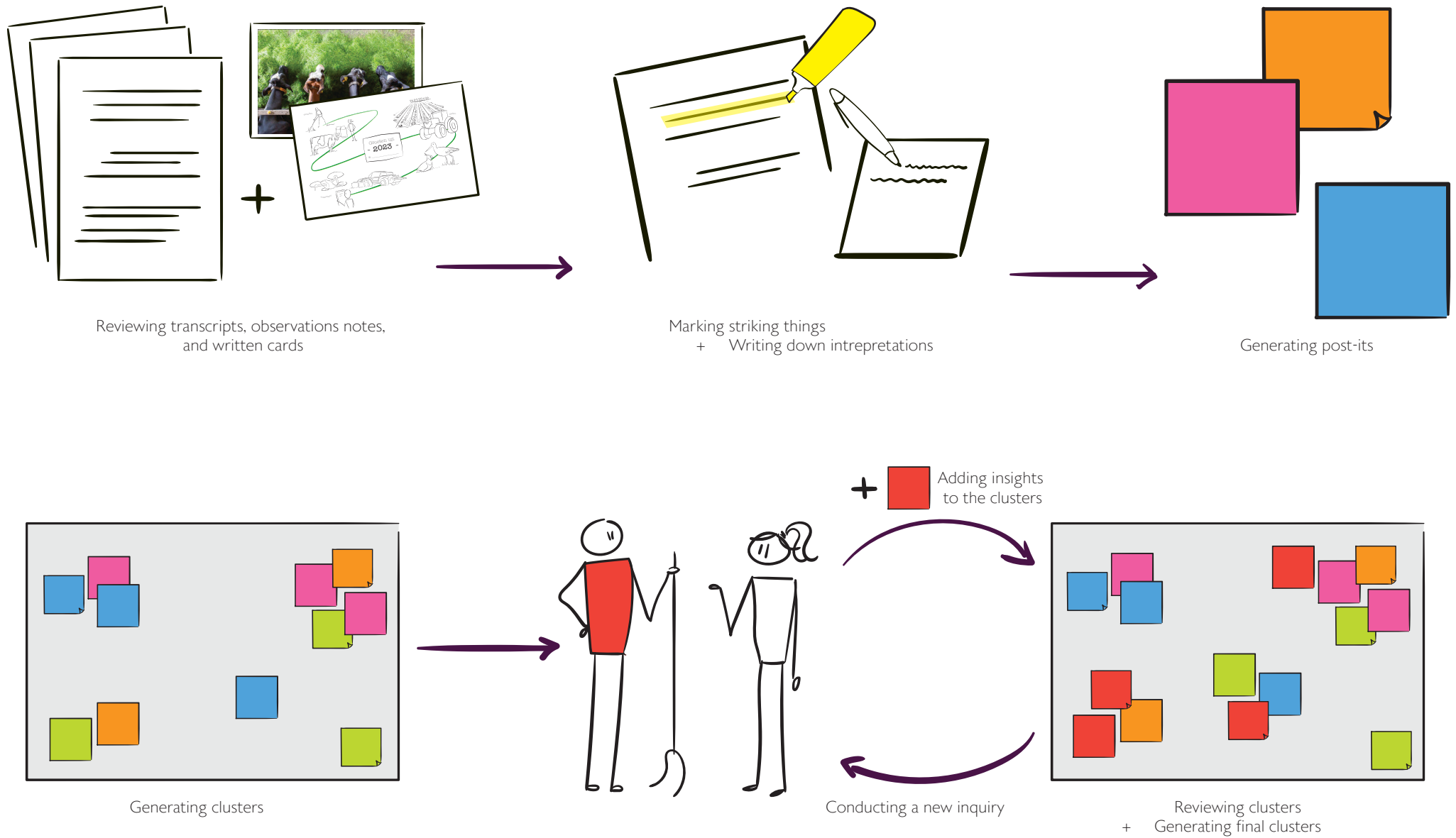


Figure 19: Overview of the clustering process

7.4 Results

This sub-chapter gathers all the data attained through the discussed methodology and elaborates on the results thereof. Due to the anthropological nature of the research, the participants are introduced in the perspective of the author for clarification of the findings. After the initial introductions, the results are presented in three distinct themes: the young agricultural entrepreneur, choices and decision-making, and a partnership full of generations. Quotes and perspectives of the participants are used to enable for a thorough review of the inner workings of the young farmer.

7.4.1 Participants

Eight different people participated in the qualitative research. For each participant, a personal representation of their characteristics was made to ensure not to lose the different personalities and let you, as a reader, empathise with the different stories. These can be found on the following pages.



Figure 20: The participants

Participant Yellow is 35 years old.
They is in a partnership with their
father, uncle and brother on a mixed
farm (dairy + arable + energy)..

- Milking 250 cows;
- Milking robots;
- Works with employees;
- Transitioning towards
regenerative farming;



58

Participant Orange is 26 years old
and in a partnership with their
parents on an organic dairy farm.
However, they is now hiring another
farm together with their boyfriend.

- Milking 60 cows;
- Milking robot;
- Has a full-time job besides being
a farmer;

Participant Red is 23 years old. They are in a partnership with their parents on a dairy farm.

- Milking 250 cows;
- Milking robots;
- Has a 4 day job besides being a farmer.

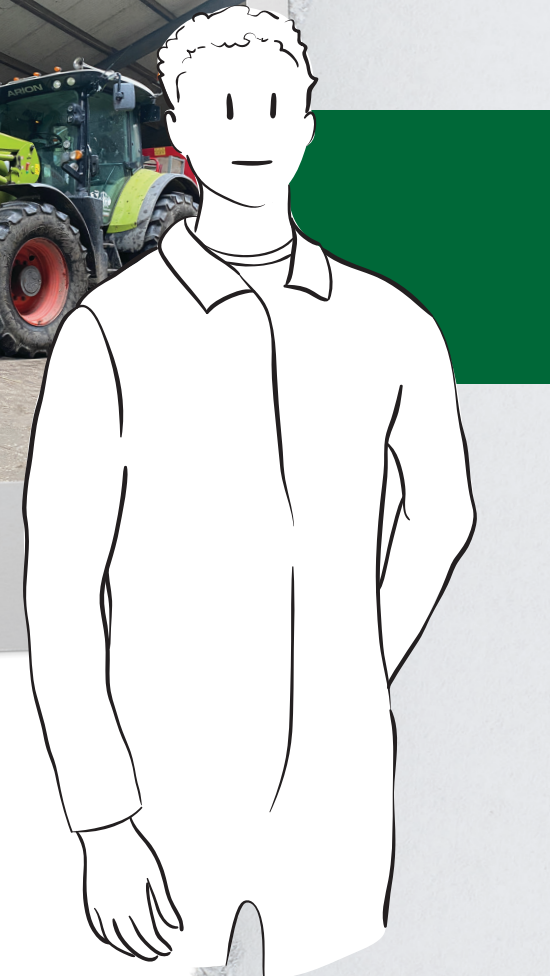


Participant Purple is 19 years old and is a fruit grower of apples and pears. They are in a partnership with their parents.

- 22 hectares of land, of which 8 hectares of apples and 14 hectares of pears;

Participant Green is 20 years old and in a partnership with their parents on a dairy farm. They also keep beef cattle for their farm shop. They also own 80 sheep as hobby animals.

- Milking 50 cows
- Milking parlour;

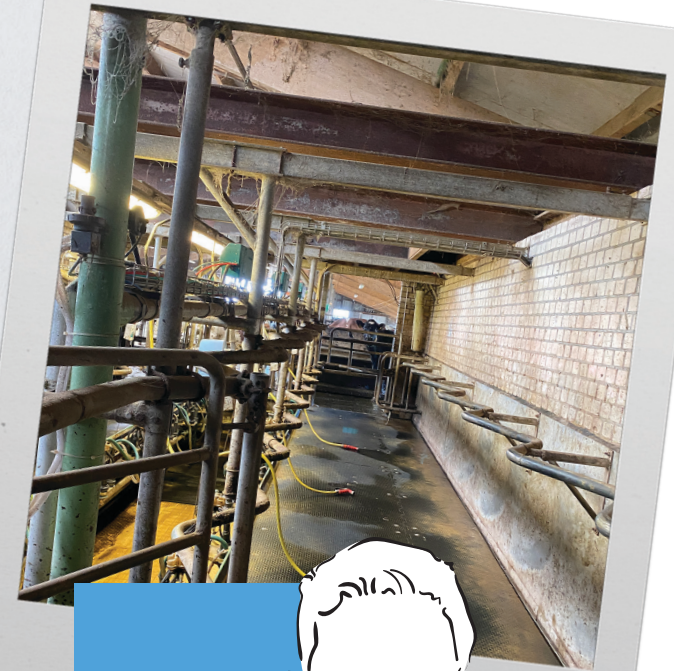
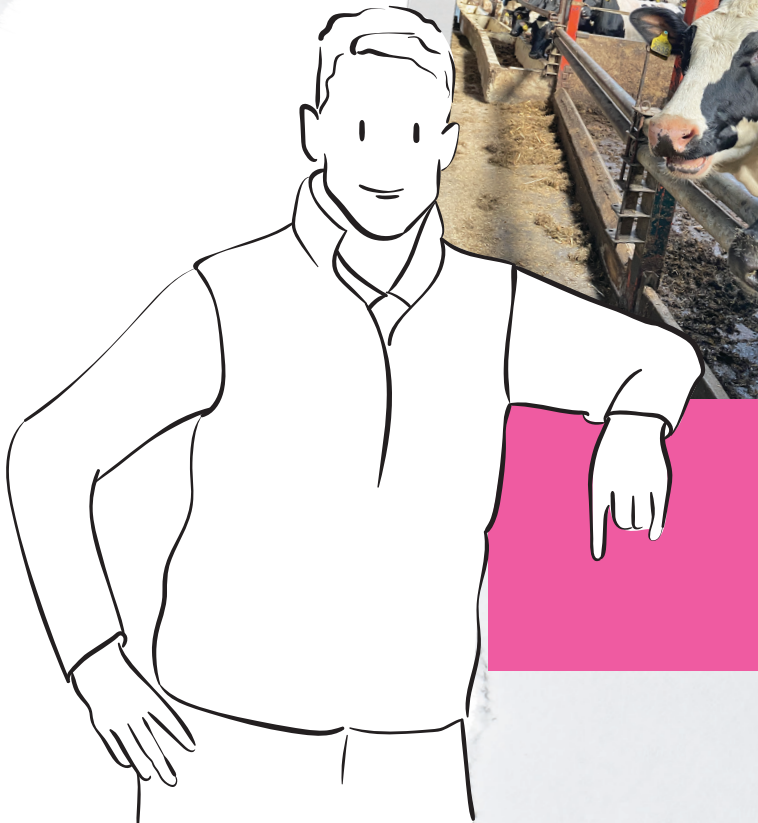


Participant Emerald is 30 years old and in a partnership with their parents and brother. They own two farms, one location milking with a robot, the other in a milking parlour. The location with the milking parlour has a grazing day and night policy.

- Milking 110 cows in total;
- Also a contractor;

Participant Pink is in a partnership with their parents on a dairy farm. At this farm, they work towards sustainable business operations.

- Milking 120 cows
- Milking parlour;
- Planet Proof milk



Participant Blue is 24 years old and in a partnership with their parents on a dairy farm.

- Milking 90 cows
- Milking parlour;
- Meadow bird management;
- Has a 4 day job besides being a farmer.

7.4.2 Themes

Three main themes can be derived from the qualitative research that helps answer the research question: 'The young agricultural entrepreneurs', 'Choices and decision-making', and 'A partnership full of generations'. These themes are based on the repetition of answers by different participants and are used to sketch a story that can represent all the participants. The three main themes will be described on the following pages, where quotes from some of the participants are presented to provide more insight into the outcomes.

Young agricultural entrepreneurs

Motivation

Young agricultural entrepreneurs are driven and motivated. They feel gifted with the option to take over the farm from their parents and are looking forward to shaping it in their way. Their motivation to become a farmer is the freedom, the variety the work gives, and the opportunity of being an entrepreneur. Their peers are mostly the ones that motivate young agricultural entrepreneurs to become one and get better.

Responsibility to society

Producing high-quality products for society is paramount for young farmers; it is their pride. They also feel a responsibility to produce healthy food for the community.

Joy

Being in and working with nature is what gives them joy.

Vision

Young farmer all emphasise the importance of having a vision or goal for their farm. This vision is based on what they, and most of the time also their parents, believe is best for the farm. These desired results differ per farmer; for some, it is production increases; for others, the animal welfare and for others is the environment, etcetera.



"However, we simply do not believe in that." - Participant Purple

"Maar ja daar geloven wij simpelweg niet zo in"

"We believe it is better and cheaper."

- Participant Red

"Wij geloven dat het beter en goedkoper is."



Family person

Family plays a big role in the life of (young) agricultural entrepreneurs; they work with them, have a partnership together, and want to ensure everyone is cared for.

“And make sure Mom and Dad have a place to live, that we earn a good living and that my brother and sisters also have something to share.”

- Participant Pink

“En zorgen dat pa en ma een plekje hebben om te zitten, dat wij een goede boterham hebben en dat mijn broer en zussen ook nog iets te delen hebben.”



Practical and easy

The way the farmers work and how their farm is arranged is based on their needs: practical, easy and fast. Their routine work should be executed efficiently so that no unnecessary time is wasted. Preferably, practical and easy solutions are put together by the farmer themselves.



[About the pen for sick and pregnant cows] **“We have to walk this whole way... that is quite a chore” “That’s why we want to move the straw pen.”**

- Participant Orange

“We moeten dit hele stuk lopen ... dat is best een hele klus.”

“Daarom willen we het strohok verplaatsen”

“Our father had screwed something on top of it. That the tool could be stored on top, he simply finds it easier that way...”

- Participant Red [Participant now don't have to walk back and forth to get the tool]

“En dan had ons vader er iets opgeschroefd. Dat die schapper erop staat, dat vind hij toch makkelijker...”



“And then you simply start improving again. Because it can be done faster or something can be better.”

- Participant Emerald

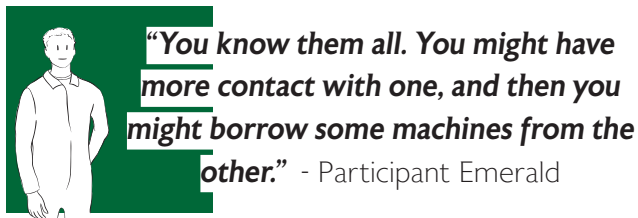
“En dan ga je gewoon weer verbeteren. Omdat het dan weer sneller of iets beter kan.”

History

History and location affect the farm. The way the farm is organised was decided generations ago. And young farmers hope their ancestors are proud of what they made of the farm.

Neighbours

Young farmers have a give-and-take relationship with their neighbours who are equally farmers: some share machines, or help each other out. The neighbours are in the same boat, which creates this connection.

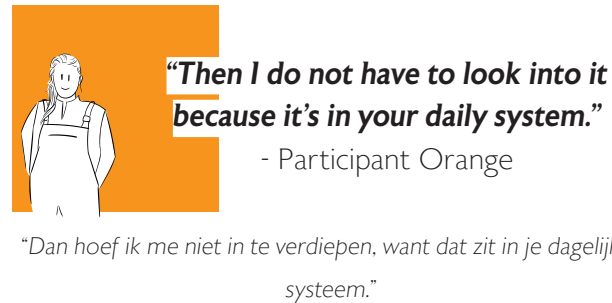


"Je kent ze wel allemaal. En met de een heb je meer contact mee en dan leen je wat machines van de ander."

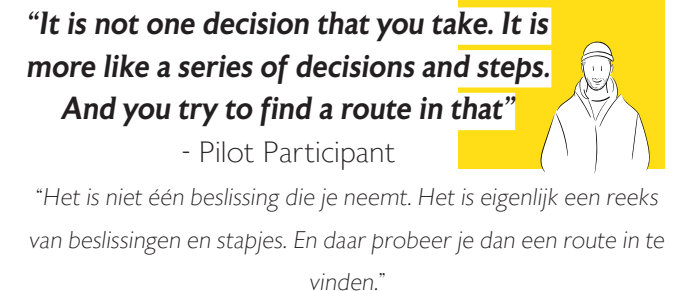
Choices and decision-making

Daily vs big choices

Farmers notice that they do not experience daily choices as decisions. Daily choices are repeated tasks built into your system and are made based on experience.



On the other side, there are big decisions. Farmers deem a decision to be big when investments are involved. They are decisions a farmer needs to think about since they impact the company structure. Big decisions are often rolled out in smaller steps/iterations.

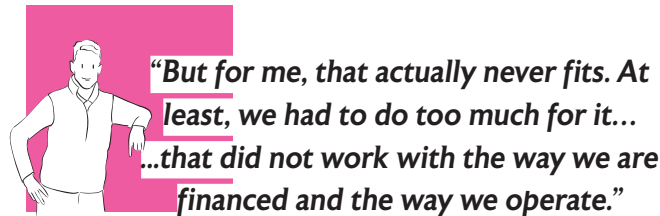


Short vs long-term decisions

There is some overlap between short- and long-term decisions with daily and big decisions. Daily choices are often short-term decisions and will be made quicker and easier by the farmer. These decisions will be based on the resources and knowledge they have. Conversely, for long-term decisions, a farmer will gather information and try options before making a choice. Farmers stated that a farm visitor has influence or helps with the decision for short-term and daily choices.

Factors that influence their decision

Farmers mentioned some factors influencing decisions in the last stage; they were essential for determining whether to proceed: The decision or change should suit the farm, and the new practice should have proof that it is possible and preferable have multiple advantages.



- Participant Pink

“Maar dat past mij eigenlijk nooit goed. In ieder geval, daar moesten we teveel voor doen... ..dat paste gewoon niet bij de manier hoe dat wij gefinancierd zijn en hoe dat de bedrijfsvoering gaat.”

“So I want to be green and sustainable, as much as POSSIBLE”

- Participant Purple



“Dus ik wil graag groen en duurzaam zijn, zover het mogelijk is.”

You ultimately decide for yourself

All participants emphasised that the farmer ultimately makes the choice when it comes to finalising a decision. You can collect information, talk with fellow farmers or get advice from an advisor, but they will never make the decision for you. It is important for farmers to keep that control over making a choice; they do not want things imposed on them.

“But I still bought it because I thought it would work out. So actually, he advised against it. But then you decide for yourself.”

- Participant Green

“Maar toch gekocht omdat ik denk dat het wel uitkwam. Dus dan eigenlijk adviseerde die het niet. Maar ja, dan kies je toch zelf.”



[Concerning contracts and financing] **“That you can always still make the choice, so to speak.”**

- Participant Pink

[Concerning contracts and financing] “Dat je zelf altijd nog de keuze kan maken zeg maar.”

Making choices includes...

...Getting triggered. By pet-peeves, problems or investments.

...Considering various options and trade-offs.

“This is the disadvantage, the advantage, this is faster, that is the other part. Some things you quickly have to calculate, and then you know it.” -

Participant Red

“Dit is het nadeel, het voordeel, dit is sneller, dat is het andere.

Sommige dingen moet je even rekenen en dan weet je het wel.”



...Doing trials for small changes. Those do not need investment or are part of a future vision.



“If they are not big issues, you can just try by yourself.” - Participant Green

“Als het geen grote dingen zijn, dan kan je het gewoon zelf proberen.”

Path

Different paths made during the interviews were analysed and compared. First, it was investigated why this decision was made. A distinction could be made between different triggers. Based on the interviews a trigger could be when something has to change; a certain thing at the farm has to change since a change in legislation, for example. Next, a trigger could be that the farmer wants things to be different like something needs to be renewed or want to remedy an annoyance. Lastly, a trigger could be that the farmer sees things differently and has a different vision for the farm. Based on these triggers, the paths have been divided to see if a conclusion can be drawn within and between these three categories.

In figure 21, a visualisation of the different paths together is shown. A more detailed visualisation will be presented on the next pages for each category trigger. The paths are drawn as arrows from the trigger till the final decision taken.

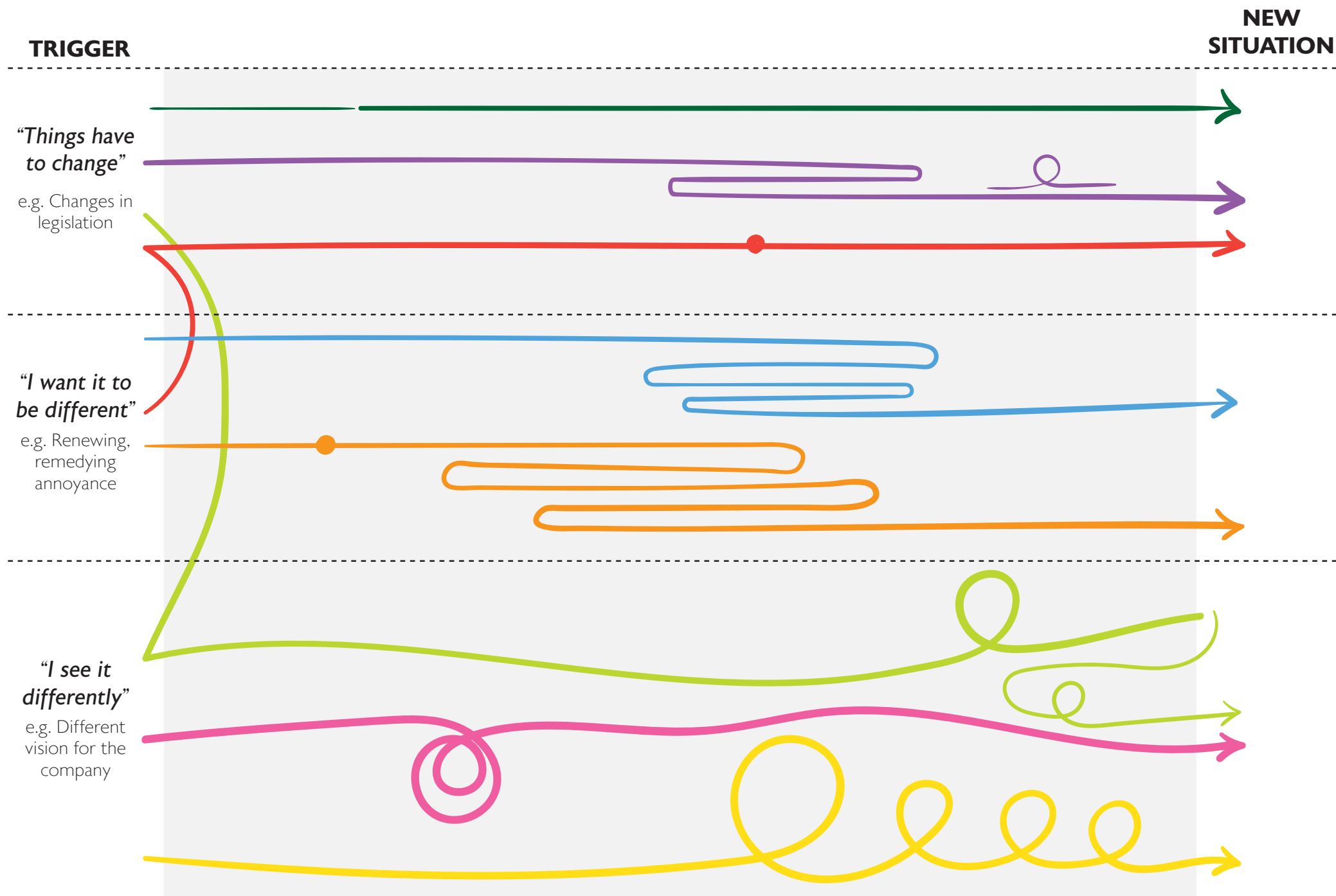


Figure 21; Visualisation of the decision paths.

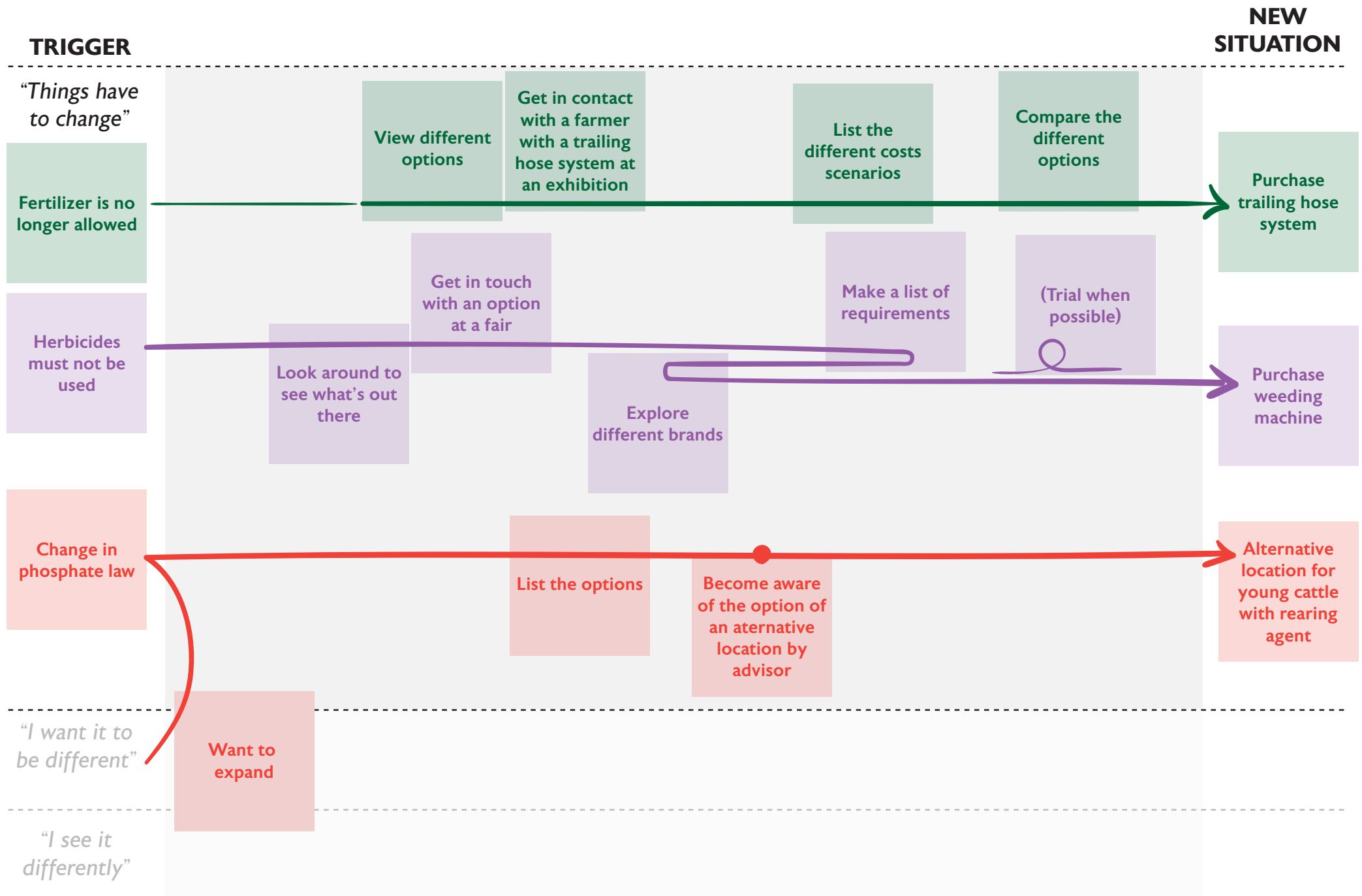


Figure 22: Paths with the trigger "Things have to change"

“Things have to change.”

Participants Emerald, Purple and Red described the steps for a choice that needed to be made due to a change in legislation.

For Participant Emerald, the fertilizer that they used became prohibited. So the search for a new way of fertilizing the land started. At an exhibition, Participant Emerald came in contact with a farmer who used a trailing hose system and was convinced of this method. Different cost scenarios were considered: buying the system itself or hiring someone who owns the system every year. The decision was made to buy the system based on the cost scenario. Later, they improved the system for their farm.

Participant Purple had quite a similar process as Emerald; in this case, the start was the prohibition of herbicides. Participant Purple got in touch with the option for a weeding machine at a fair and was convinced. They then set up a list of requirements they look for in a weeding machine and started exploring different brands. The choice was made when they found a weeding machine which matched the requirement specifics. Participant

Purple noted that if there were no regulations for removing weeds mechanically, they would have to craft something themselves, before investing in a new machine.

For Participant Red, however, the journey started with wanting something different: to expand the farm. The changes in the phosphate regulations brought criteria to this expansion. The expansion was an ongoing process already set into action when the change in law happened, and therefore, the decision became triggered because something had to change. They needed a plan for the young cattle, different options were listed. However, an advisor informed them of another available farm: which could a suitable alternative location for the young cattle. This moment is visualised with the red dot on the arrow. Participant Red contacted the farm, made a plan with them, and agreed on them becoming the rearing agent.

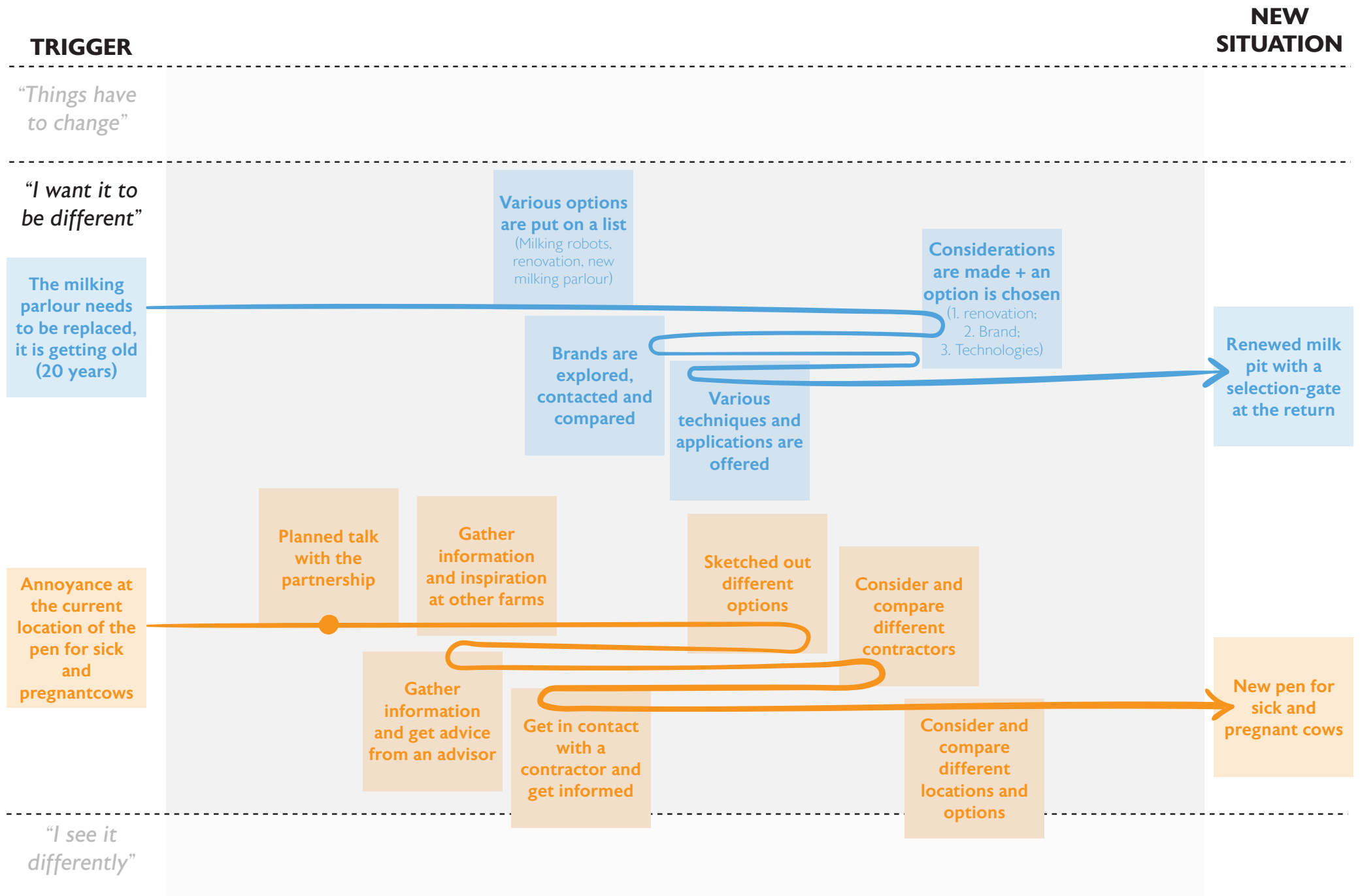


Figure 23: Paths with the trigger “I want it to be different”

“I want it to be different.”

The path of Participants Blue and Orange started with the fact that they wanted something to change. Participant Blue wanted to replace the milking parlour since it was over 20 years old. Participant Orange got annoyed by the sick cows' pen's current location and wanted to relocate it. The dot on the path of Participant Orange represents the planned talk with the partnership about what they wanted to change.

Both participants deliberated during their choice process. Participant Orange did that during an early stage in the process. They went back and forth between gathering information and comparing and considering the options: gathering information at other farms, comparing different type of pens, gathering information from an advisor, considering and comparing different contractors, and gathering information from a contractor and considering and comparing different locations and options. In comparison, Participant Blue went back and forth between listing options and comparing and considering: From listing and choosing a brand to listing and choosing a model to listing and choosing technical specifications.

“I see it differently.”

Participants Green, Pink and Yellow all described a path that started by changing their perspective. They were intrinsically motivated to change something on the farm, they thought it was the better option.

For Participant Green, changes in legislation led to even more conviction that the changes they had in mind would be better for the farm and the future. Since the change Participant Green made was not imposed, the choice process was more triggered by the intrinsic motivation of Participant Green.

All the routes have been visualised with loops; these represent trials. For Participant Pink these loops happened early in the process, since they needed to explore and learn more about different ways. By doing several internships and visiting farms, they gained new insights and more information. After each information loop, Participant Pink judged the experience and made the loop again on another farm. During this information-gaining process, Participant Pink realised what would be the optimal solution and made the decision.

In contrast, the path of Participant Yellow has several loops late in the process. This Participant has a clear vision and starts a process of trial and error for different practices. Participant Yellow stated that a continuous trial process would get them to the vision of a regenerative farm. A failed approach will lead to trying something else and figuring out what would work on their farm.

The loop in the path of Participant Green also represents a trial. After gathering information and considering different options of herbs, they tried implementing one herb into their grassland. This trial's success led to adding another herb to the grassland, which was visualised with the smaller arrow with a loop. If this is a success, trials of other herbs would also take place until a full herbaceous grassland is realised.

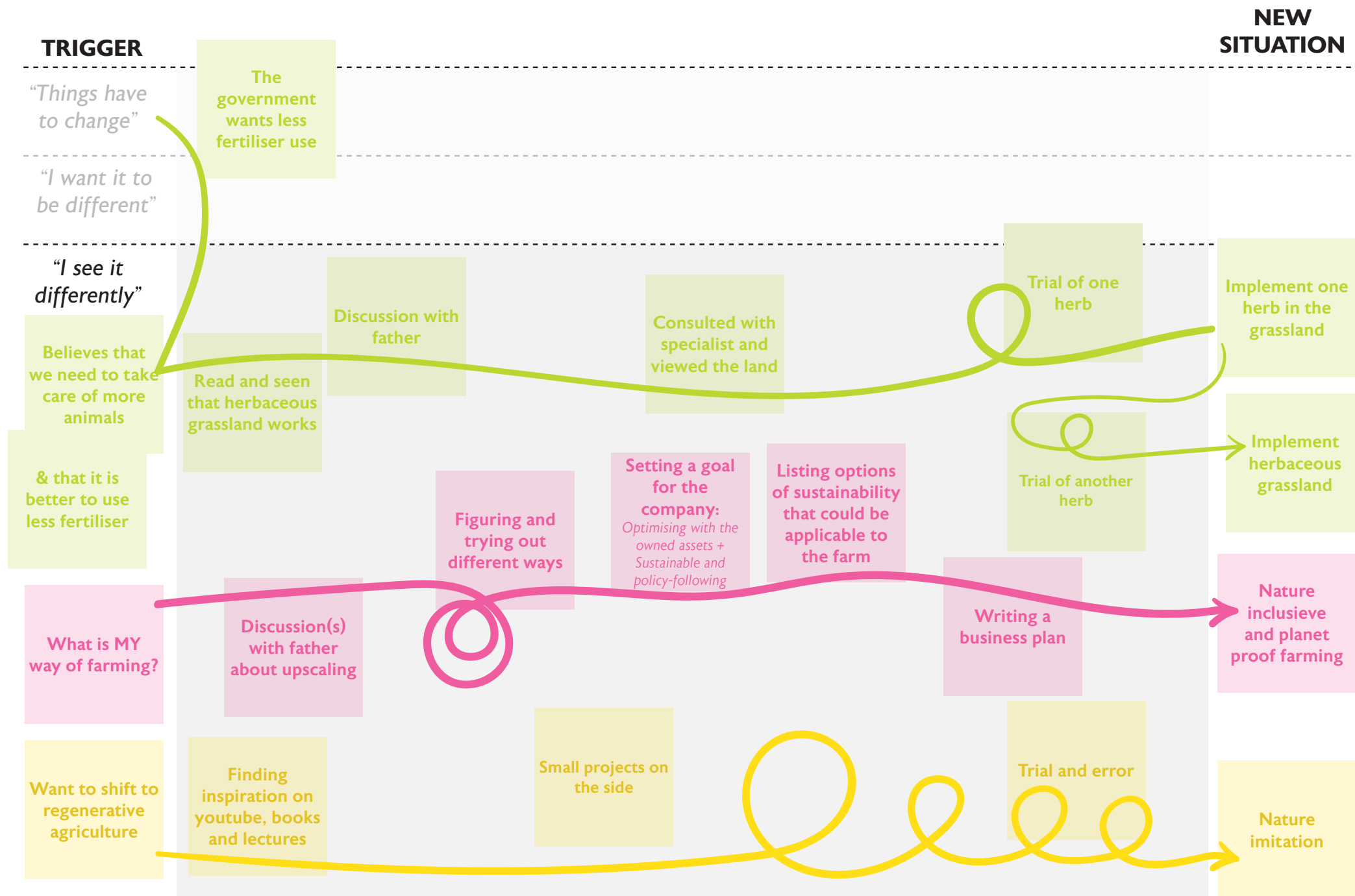


Figure 24: Paths with the trigger "I see it differently"

A partnership full of generations

Finding your own way as a farmer

Young agricultural entrepreneurs are searching for their way as a farmer. They feel the need to find their own way of running a farm. The young farmers prefer to fill this quest with hands-on experience at other farms, such as internships.

“But I didn’t know then and chose my internships for that. I didn’t really know HOW to farm...” “I based the choice on that, actually ultimately based on the internship periods and therefore on further development.” - Participant Pink

“Maar ik wist toen op dat moment niet en daar heb ik toen mijn stages voor uitgekozen. Wist eigenlijk niet zo goed ja HOE te boeren...” “Daar heb ik de keuze op gebaseerd, eigenlijk uiteindelijk vanuit de stageperiodes en daardoor op door te ontwikkelen.”



“Also learning from others what you want, but especially what you don’t want.” - Participant Blue

“Ook leren van anderen wat je wel wil en wat je ook vooral wat je niet wil.”

Want to broaden their perspective and knowledge

Next, they want to broaden their perspective and knowledge outside the farm. These two needs show that they value the importance of hands-on experience.



“Do not only look at your own situation and what is best for you.”

- Participant Purple

“Niet altijd alleen maar naar je eigen hachie kijken wat jou het beste uitkomt.”

“When you do an internship, you see a lot. As a farmer, you sometimes get a coffee with your neighbour, but you do not spend a day with them in their stables.” - Participant Red

“Als je zelf stage loopt, dan zie je ook van alles. Als boer ga je wel eens koffie drinken met de buur, maar je gaat niet bij elkaar in de stal meelopen.”



“... that is great about going to other companies, you said that yourself as well... when you tag along, you get even more of a feel.” - Participant Green

“... dat is het mooie van op andere bedrijven kijken, maar dat noem jij natuurlijk net zelf ook, een beetje meelopen... Dan krijgen we nog iets meer gevoel mee.”

Running the farm together

The young farmers are in a partnership with most of the time their parents, the older generation. This generation has grown up with different standards.



“Everything that is not grass is weed. That is the definition my dad grew up with.” “So that makes it not easy to convince him.” - Participant Green

“Alles wat geen gras is, is onkruid. Met die term is mijn vader ook opgegroeid” “Dus dat valt natuurlijk niet me om altijd te overtuigen.”

The older generation has grown up with different standards

The older generation grew up with and is educated with intensive agriculture, efficiency and optimum yield. Whereas the younger generation is growing up with the need to become more extensive and sustainable. This contradiction gives the younger generations the feeling they need practical proof to convince the older generation.

“For example my dad, he never spends time in other people’s stables. So he doesn’t know another way.”

- Participant Red

“Zeg maar ons pa, die komt nooit meer bij iemand anders in de stal. Dus die weet niet hoe het anders kan.”



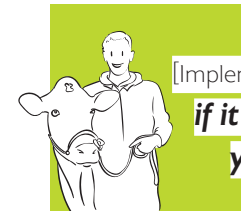
“I know that with them you need to visualise things. They have to hold it in their hands, feel and smell it... Only then can they do something with it.”

- Pilot Participant

“Ik weet van ik moet bij hun dingen gewoon visualiseren. En ze moeten het in handen hebben: voelen en ruiken... Dan kunnen ze er pas iets mee.”

Convincing the older generation

The younger generation also emphasises the importance of quickly seeing the result of an adjustment. As soon as the older generation sees the positive effects, they are more easily convinced to take the next steps. The older generation prefers measurable effects.



[Implementing herbaceous grassland] **“Because if it does not have a good result in a year, then it just will be grass.”**

- Participant Green

“Want anders als het geen resultaat heeft over een jaar, dan gewoon gras.”

The participants also noted that pushing new innovations or practices is difficult since it feels like you imply that the past generation did it wrong. But that is not what they are saying. Namely, the way the older generation works was what was needed in the past. Now, we have other demands and need to find new ways.

How the previous-presented results proportionate to the researched literature in chapters 2 and 3 can be found in Chapter 14: Discussion.

Overwhelmed by data, was what I experienced. Working two to three hours with a farmer and an interview of about one hour generated much data. While working my way through it, I realised I have much in common with my research group. The love for being outside, animals and the freedom at a farm is relatable. But it goes further than having the same interest.

During conversations, I often got asked what my stamp on this project will be, how far I want to push sustainability and what I want to design. I often answered these questions: "I do not know yet". When I was asked why I did not know, I realised that I brought myself into a struggle. What I am going to design is something that my father and brother can use. They will judge my work, and I want them to be proud of what I make and that it is helpful for them. I am too scared to push sustainability to its fullest potential since I feel my father and

brother do not relate to that, even though it is what I believe in. I found myself in a quite a relatable dilemma as my participants. How can I convince my family that this is a way to go without hurting their feelings or saying they did it wrong in the past?

To start the design phase, a design scope must be defined. Therefore, a design brief was developed, and the concept's main function was determined. Different criteria were established to achieve the main function. Furthermore, some interesting starting points for the ideation were also established.

8. Design Brief

What stood out the most was the difficulties the younger generation experience being in a partnership with an older generation:

Being a young farmer on a quest to figure out what your way of farming will be, hands-on experiences play an essential role. Working or doing an internship at another farm or agricultural-related company are ways to find answers to this question. This hands-on experience may give insight into different practices and may interest the young farmer perhaps to implement it on (partly) their farm. When interested in a new measure, the younger generation feels and experiences that they need to convince the older generation in the partnership. The differences in education, experience and view can stand in the way of implementing something new.

This experienced difficulty is an exciting design opportunity for an interaction designer. Therefore, there has been decided that this experienced

difficulty, convincing the older generation as the younger generation, is the starting point for the design phase. Looking at the stated assignment in Chapter 0, the to-be-designed product or product-service combination should encourage young agricultural entrepreneurs to make sustainable decisions. As highlighted above, it is not only the younger farmer who decides to implement a new practice; the older generation is also involved. So to encourage the younger generation, the to-be-designed product or product-service combination should help and support the younger farmer to convince the older generation.

*"I will research agricultural entrepreneurs' decision-making process when implementing farming changes. With these insights, **I will design and evaluate a product or product-service combinations to encourage agricultural entrepreneurs to make sustainable decisions.** This concept can also help LTO Noord to improve their support for agricultural entrepreneurs."*

9. Design Parameters

Before ideating and designing, design and performing criteria are set up based on the previous chapters.

First, the main function of the to-be-designed product or product-service combination was determined: **Supporting the young farmers to convince the older generation in the partnership to make a step towards implementing a sustainable practice.**

9.1 Design criteria

Design criteria were composed to ensure the main function. These criteria were based on the research results and the assignment given by DAW. Next, some interesting starting points for the ideation were initiated.

Criteria based on research

Criterion **01**

“The design should emphasise bringing the two generations together: use it together.”

From the research, it was interpreted that now the younger generation gains (hands-on) experience with measures and has to translate this to the older generation. Therefore it has been decided to let the design be something both generations use simultaneously so they both have the experience.

Criterion **02**

“The design should give the users insights into the sustainable measures that are implementable on the farm.”

Based on the research, there could be concluded that mainly the older generation misses insights from measures; this could be insights into the effect, the implementation or execution, or the vision of the other generation on the measure is. The design must give insights into (one of) these elements.

Criteria given by the DAW

Criterion **03**

“The design should encourage farmers to make sustainable choices.”

This project was set up with the importance of farmers deciding to implement sustainable measures. So the use of the design should lead to actual consideration of implementation.

Criterion **04**

“The design should mainly focus on sustainable measures related to water and soil.”

Since the DAW deals with the measures related to water and soil, the design should prioritise these measures.

9.2 Potential starting points for ideation

Gain (hands-on) experience with the measures.

The younger generation emphasised the importance of hands-on experience and noted that the older generation no longer has that opportunity. Visiting a farm or going on a field trip does not give you the same insights as experiencing.

Gain an understanding of each other's vision.

The generations have grown up with different standards of farming. It creates a gap between the visions of the generations, and sometimes it is hard to understand where some opinions come from. Therefore there could be thought of concepts that help the generations to understand each other's view on farming.

Gain insights on what your way is of farming.

As a young farmer, next to convincing the older generation, you are also trying to find out your way of farming. Your job is to shape the farm in how you think you want to be farming.

The previous chapter concluded the research phase with a design opportunity. The described scene and the design parameters form a starting point for this thesis section: create. This section describes the ideation towards three concept directions, choosing a direction and conceptualising this concept towards a final design.

10. Ideation

Different ideating methods were used to get to three concept directions. First, How-Tos were used to start creativity. The answers to the How-Tos were used to come up with some initial ideas. After that, a creative session took place, where brainwriting, -storming and -drawing were used to end with three possible concept directions.

10.1 How-Tos

The starting points for ideation proposed in the previous chapter were used to create “How-Tos”. How-Tos are statements written in the form of questions that stimulate brainstorming and idea generation. The following questions were some of the questions set up for the How-Tos:

- How to experience (new information)?
- How to get an understanding of each other?
- - How to figure out your way of working?

Two people, next to the designer, participated in the How-Tos. To keep their minds open, these

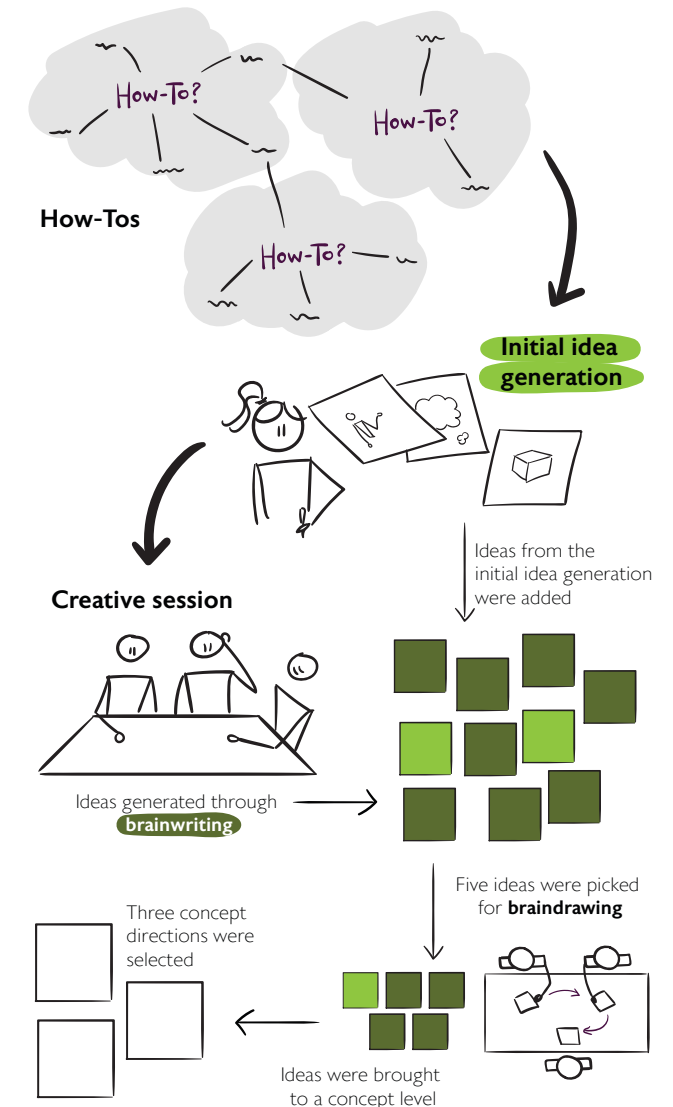


Figure 25: Overview of the different methods used during the ideation

participants have not been informed regarding the purpose of the outcomes. There were no restrictions and judgement while answering the questions of the How-Tos. In appendix G1, an overview of the How-Tos questions and their outcomes can be found. These outcomes provided inspiration for the next step.

10.2 Initial idea generation

The outcomes of the How-tos functioned as inspiration and starting point to come up with ideas. These ideas could be out-of-the-box, as the session had no restrictions. Through first diverging, generating as many ideas as possible for outcomes of a How-To, and then converging, defining the ideas, seven defined ideas were generated. The ideas named 'the intern', 'get ready for take-over', 'your experimental garden', 'junk corner', 'inside the earth', 'bird-view', and 'seeking' can be found in appendix G2.

10.3 Creative session

A creative session with four participants took place to get to three concept directions. They were informed about the key takeaways of the research and the design scope. This was followed by asking elaborate questions and brainwriting of all the participants.

Brainwriting starts with individuals writing down their ideas on their own. After fifteen minutes, the participants were asked to share their thoughts and ideas, which resulted in them building on or having new ideas. Some How-tos were incorporated during the discussion of the ideas. The brainwriting and -storming results can be found in appendix G3.

To bring these ideas to a concept level, braindrawing was used. With braindrawing, participants draw an idea on a piece of paper. During several rounds, they pass the papers among each other to build upon one another's ideas. After every round, participants presented what they added or built on the idea. As a starting point, the participants could choose ideas from the brainwriting session and start elaborating. Two ideas of the initial idea generation were added to

the braindrawing session. There were five rounds, each consisting of four minutes. The results of this session can be found in appendix G3. Ultimately, the group was asked to order the generated ideas based on the most promising or interesting. From these ideas, the three most promising were picked to work out and become concept directions.

11. Concept Directions

This chapter elaborates on the different concept directions that have been designed on the basis of the creative sessions mentioned in previous chapters. In total, three different directions are presented, with each direction focusing on another aspect of gaining insights into a sustainable measure. The first concept direction entails a simulation, which gives users insight into the possible effects of implementing a measure. The second concept, a conversation prompt, gives users insight into the views of each other on a particular measure. The third and last concept direction, experimentation, provides users insight into how measures can be implemented on a farm.

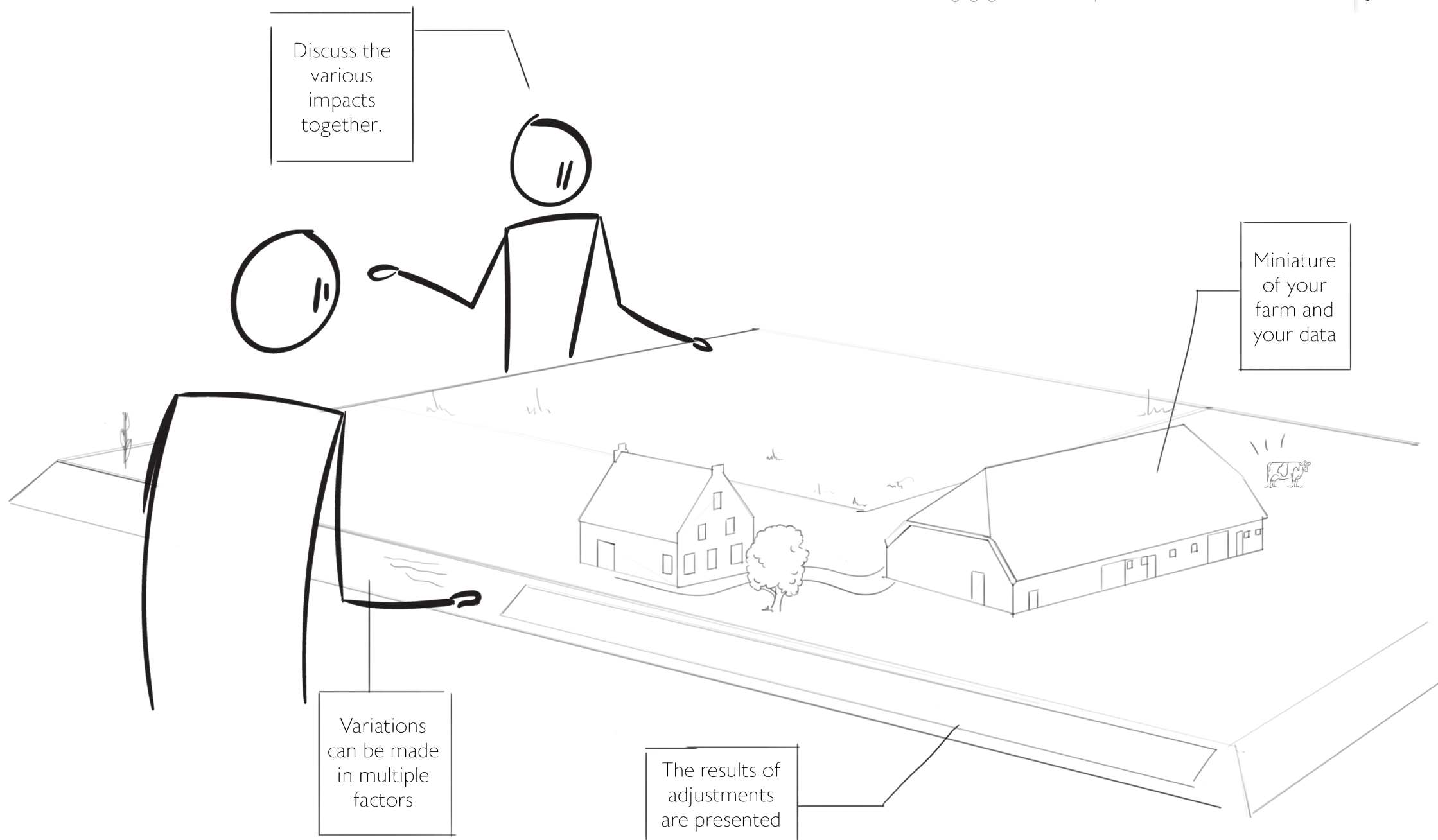
‘What can my farm become?’

11.1 Simulation

New practices influence several factors on the farm and have a different approach: some are unknown to the older generation in the partnership. When a young farmer wants to implement a new practice, the older generation can be hesitant since they are unsure if it will work or generate the same performance results. Therefore, young farmers feel the need to have proof to show that other ways of farming work and will not decrease the yield. Since the results of implementing another way of farming will take some time, say several years, a real-life tryout is not an option. A possible solution could be simulating the different interventions and their effect over the

years. So that, hopefully, they take the step to execute new practices.

In the simulation, the farm of the partnership will be shown in a 3D perspective whereby the farmers can change different aspects of their farm. For example, vegetation or maintenance on an acreage. While implementing other practices on their ‘model farm’, the simulation shows its effects on different levels in the future, like yield, nutrition score, and score on the climate guide. The simulation will allow the farmers to play around and see how different approaches influence their farms.



11.2 Conversation prompt

Farmers need a trigger for a topic/issue requiring a decision to talk about or discuss it. Right now, this trigger is something farmers encounter during work—for instance, the annoyance of missing a particular tool at a certain spot. This comes up when seeing other members of the partnership during work or the coffee break. Then, discussion and decision ensues to buy an extra tool, build a storage spot, etcetera.

But when does one talk about water and soil? Since a visual object will never trigger this topic nowadays: casual mentions during consultation moments are near non-existent. Therefore, a prompt is needed.

There are two possible solutions for this occurrence. On the one side, possible visual prompts in and around the farm to trigger the topic. On the other side, possible ways to force the subject during a conversation. For instance a podcast.

The podcast will put together the older and younger generation in the partnership and let them discuss different or new practices and their views on them. This podcast opens up the conversation about the subject and could help create an understanding between the different generations. The podcast could function as a trigger for other farmers.

Create a trigger

OR

Force the subject

Share opinions on topics and possible adjustments

Discover **each other's** way of doing things and ambitions

Differences and similarities

Tractor cabin as a place to think about alternatives?

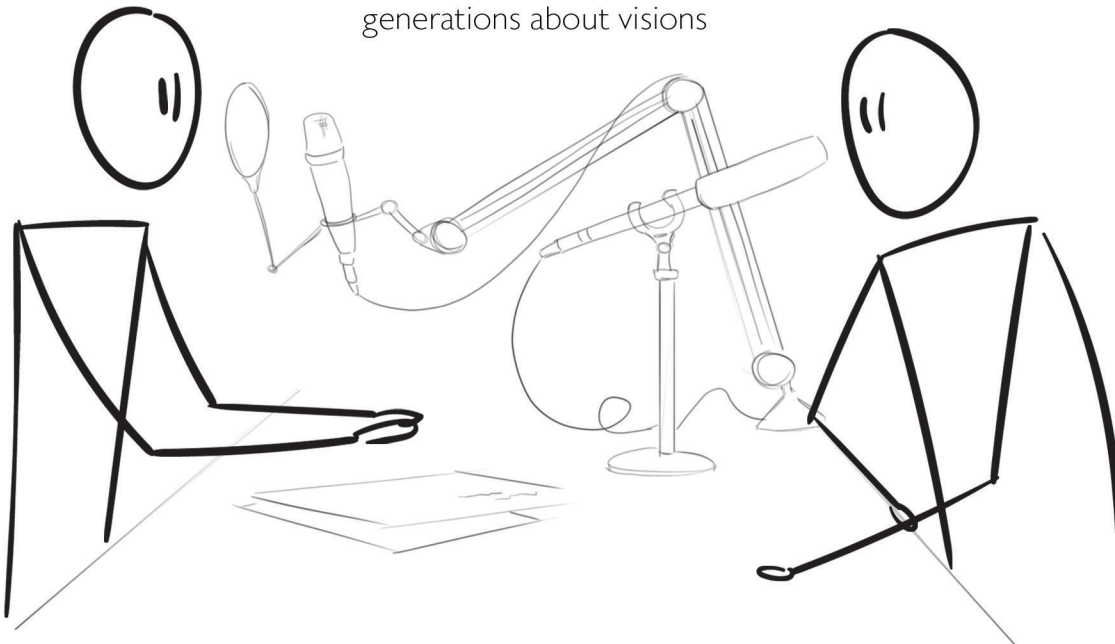


On the steering wheel?

Stickers on the window?



Podcast with conversations between two generations about visions



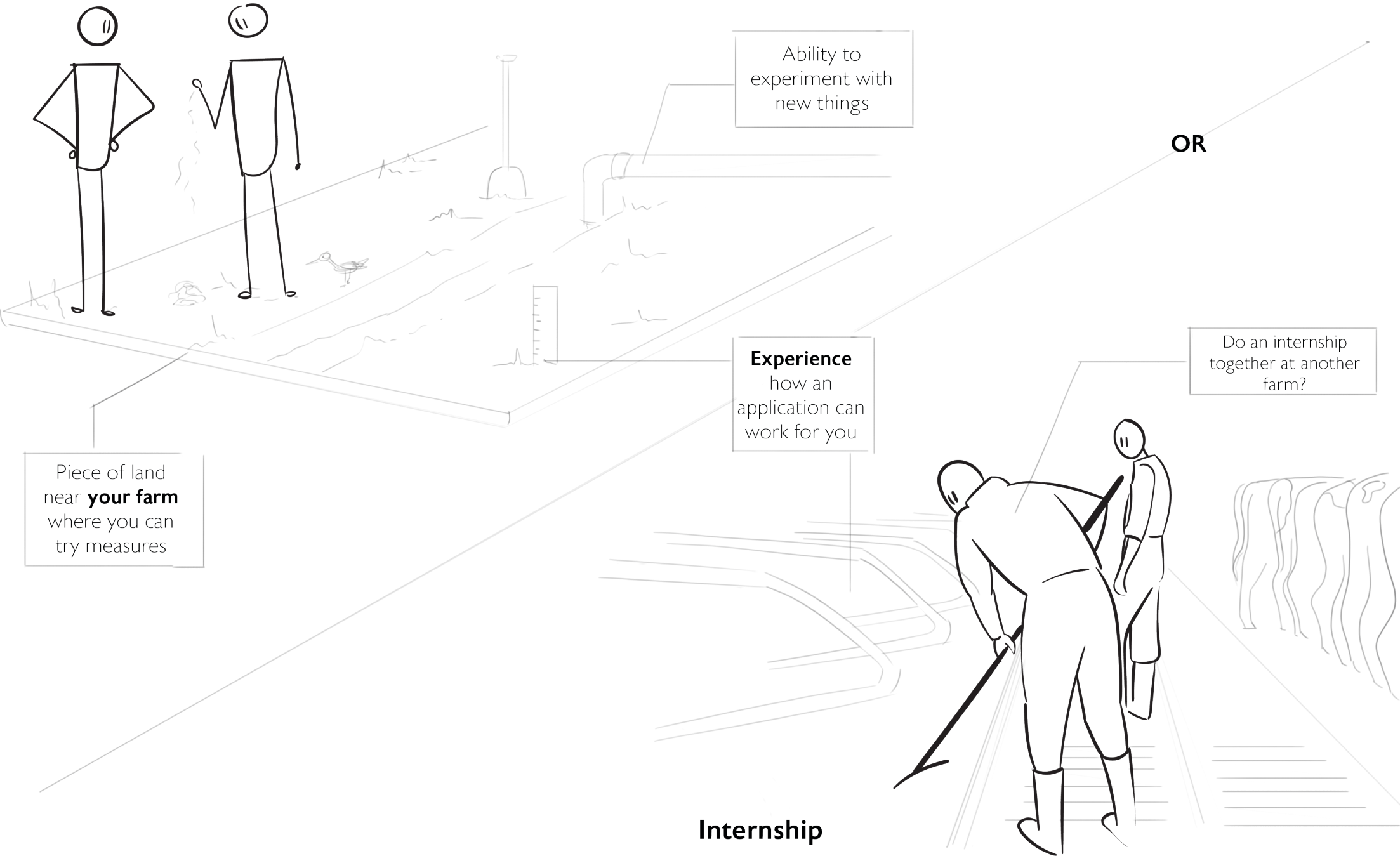
11.3 Experimentation

The younger generation values the importance of hands-on experience and feels they need this practical proof to convince the older generation. Working with new practices or material is more valuable than seeing or learning about it. There could be a need for the younger generation to let the older generation have hands-on experience with new practices as well.

Two different ways to create this hands-on experience with new approaches by both generations were thought out. The first is an experimental acreage, a parcel of land where the farmers can

try different practices. The second is the idea of allowing both generations to do an internship together at another farm.

By letting the younger and older generations do an internship together, they can experience a different way of farming. Walking and working with a farmer who does certain things completely differently can open eyes for the generations and can perhaps give ideas about how to implement certain practices on their farm.



12. Concept Selection

This chapter weighs the different concepts against one another. After validating the concepts with the target audience of young farmers, their preferences were identified and used as further design parameters. A full list of these parameters then allows for referential grading of the concepts using the Harris Profile technique. This chapter concludes with a concept choice, which is further conceptualised upon during the project.

12.1 Validation with colleagues and farmers

During a meeting with some colleagues of LTO Noord, the concept directions were pitched. Feedback was asked on the concepts. They were not explicitly asked which concept they preferred, but their preferences could be deduced based on the discussion after the pitch. Their opinion was also used to create the hierarchy of the concepts described below.

The three concept directions were presented to farmers by a prompting board. They were asked which direction(s) they preferred and to give feedback on all the concepts. Each time, the

concepts were presented in a different order and as objectively as possible. In total, three farmers were asked to comment on the concept directions, and their comments and feedback were combined and gave the following order of preference for the concepts:

12.1.1 Simulation

“An excellent tool to get insights into YOUR farm and make it discussable.”

After presenting the different concept directions, the young farmers started immediately talking about this concept. They were enthusiastic about the idea of instantaneously seeing the consequences for YOUR farm. Right now, you can see how certain measures are implemented at other farms, but how the measure will translate to your farm is hard to visualise. And the assurance that it will work for your situation is something that farmers need before making a decision.

The farmers stated that the implementation results (primarily numbers) are the essential information they need. But the visualisation of your farm could help to get an idea of what it can become.. And will maybe help convince you to

implement the measure if, for example, you see flowers around your farm. The farmers asked what parameters will be shown in the simulation: yield? Score on the climate guide? Or business goals? They also wondered how realistic the simulations would be since many factors influence whether a measure will work out for you. Furthermore, they stated the conditions with which the results will be achieved should also be displayed.

Farmers can use this tool to help the discussion between the different generations. However, they were unsure if the older generation would view it as helpful, or rather demanding change.

12.1.2 Experimentation

“Walking along with a farmer who made it work is interesting since it is often in the details.”

Doing an internship with the older generation was a concept all the young farmers found exciting. They noted that it is all about the details for some measures to be successful. And these details only become apparent when you are given the opportunity to experience these measures. Having the option to find out how a farmer makes

a measure work and how they implements it could help to decide if a particular measure is also applicable to your farm.

However, the young farmers were unsure if the older generation could be convinced to do an internship again. Do they have time for this? And do they want to make time for this? It seems like the younger generation should (again) convince the older generation to make this concept work.

The acreage where you could experiment was seen as a viable concept. However, the farmers stated that not every farmer would have the physical and financial space to execute this concept. One question was prominent when discussing this concept direction: who will pay the costs of the loss in yield or the risks of a failed harvest? Without financial compensation for the farmer, this concept will not find ground.

12.1.3 Conversation prompt

“It is important to create a chance to talk about it, but I am not sure this is the way to go.”

The young farmers say that having repeated

meetings or chatting about future options is good. Though preferably scheduled; otherwise, it will not occur. They also mentioned that a moderator leading the conversation is nice since everyone can say what they think or need. Recording a podcast matches the described scene by the farmers: it creates an opportunity for the generations to sit together and discuss their visions. The young farmers noted that it is important to find a good host, someone who not takes sides.

The young farmers only think the older generation will not be the podcasts audience. With this statement, there could be concluded that the triggering effect of the podcast will only work for the younger generation.

Designing a prompt in the farmyard that triggers to think about water or soil could be something that could work. But since there was no embodiment of this concept, it was hard to give feedback. The young farmers also could not visualise what the prompt should be.

The farmers also noted that combining all three concepts would enrich each other. Since there first need to talk about the subject, then gain information and validation on how it will work on your farm, and lastly, get hands-on experience with the practice to know how to execute measures. However, to convince the older generation about certain practices, they feel that the concept direction of simulation will be the most suitable.

12.2 Harris profiles

Next to validation with farmers and LTO Noord colleagues, the concepts have been evaluated with a Harris profile. “A Harris Profile is a graphic representation of the strengths and weaknesses of design concepts with respect to predefined design requirements.” (van Boeijen et al., 2020). The listed criteria in chapter 09 are used for his evaluation. The main function of the to-be-designed concept is also incorporated in the Harris profile by rephrasing it as a criterion.

Criterion
00 “The design should support young farmers to convince the older generation in the partnership.”

Figure 26 shows the Harris profiles for the three concept directions. The concepts have

been generated with the requirements in mind. Therefore, the different concepts could be expected to have an overall positive outcome. The extent that the concept meets the requirement is determined on a four-point scale.

According to the Harris profile, concepts 1 and 3 are the most promising concepts. Since the criteria are ranked on importance, concept 1 scores best. This result and the validation outcome with farmers and LTO Noord colleagues led to the decision to pursue concept 1 further. This

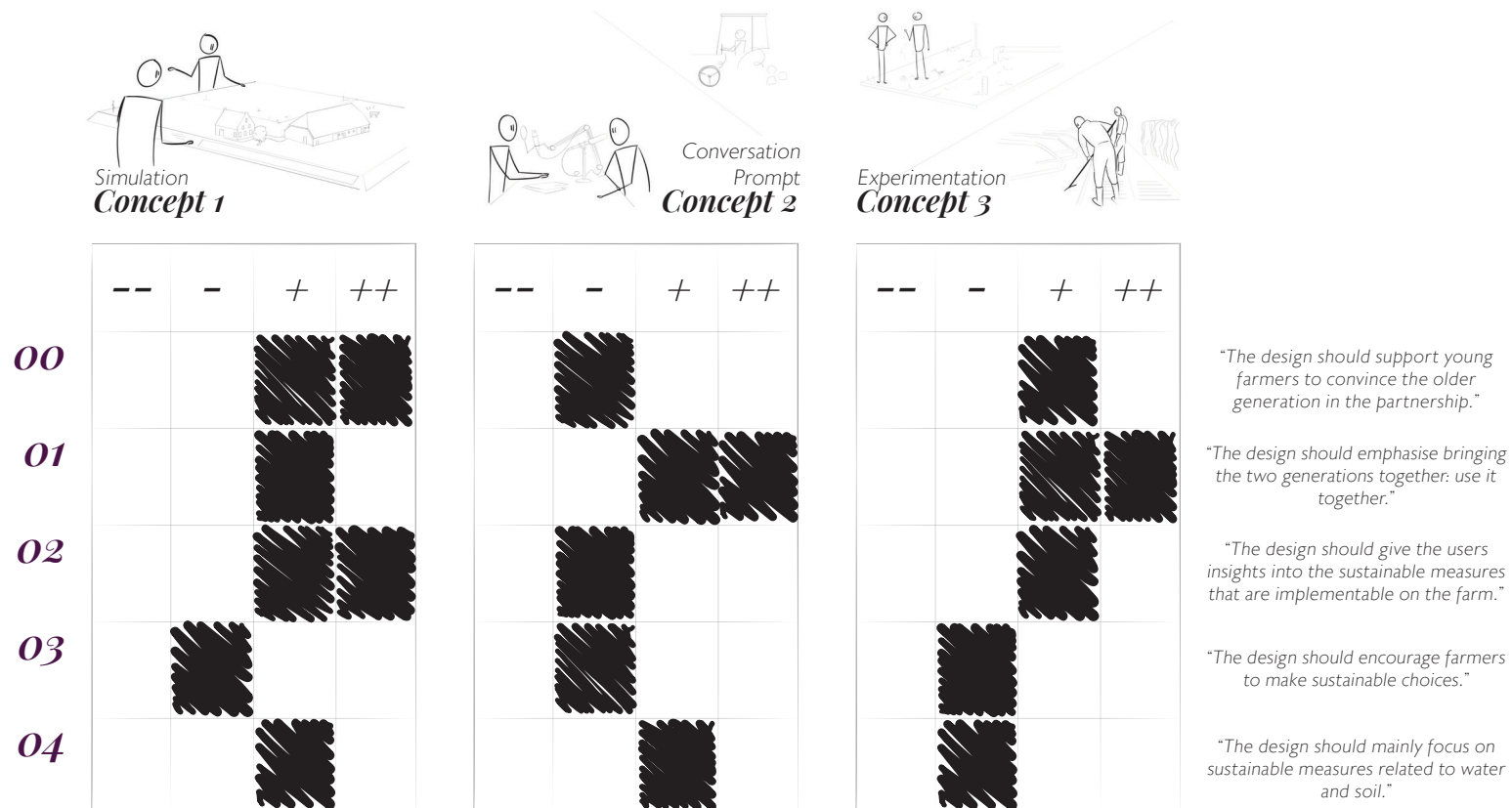


Figure 26; Harris Profile of the three concept directions

concept offers the most design opportunities compared to the other concepts. The concept has a negative score for criterion 3: encourage to make sustainable choices. This criterion should be considered during conceptualisation to ensure the final concept will meet this criterion. Even though concepts 2 and 3 are not chosen, they have their strengths. For conceptualising concept 1, these strong elements can be used to increase the potential of the final design, like the strength of bringing two generations together.

12.3 New parameters to incorporate in the final concept

The validation with farmers is used to add design parameters for the concept direction of simulating the possible future farm.

For a design whereby farmers can simulate measures on their farm, the main function is **giving the users insights on what the effects of implementing certain measures on the farm would be** to encourage them to implement new practices.

Based on the validation with young farmers, two criteria are added:

Criterion
05 “The design should essentially show values and supportively a visual representation of the farm.”

Criterion
06 “The design should address both generations.”

13. Conceptualisation

The previous chapter discusses the decision to continue with the concept direction of simulation. In this chapter the concept is finalised into a preliminary design. Using three different aspects of design – the technical feasibility, the interaction qualities, and the implementation – this chapter shapes the concept to its final potential within the scopes of this project. This final outcome is presented in the following chapter.

13.1 Defining the concept

The concept presents a visual representation of the farm, primarily land and a special layout. And, of course, showing the data. The technical feasibility, interaction qualities, and concept implementation

are explored and determined. This process of conceptualising a final design consists of different phases of iterating and detailing. With this, the technical feasibility, interaction qualities, and concept implementation become more detailed and apparent. In figure 27, the process is visualised and in which phases which element became more set. In the first phase, the shape and technical feasibility of the concept were the main focus. The interaction qualities were taken into account during all the phases but were the main priority during the second and third phases. The implementation was examined in the last phase. For each of these elements, this chapter describes the decisions that led to the final design.

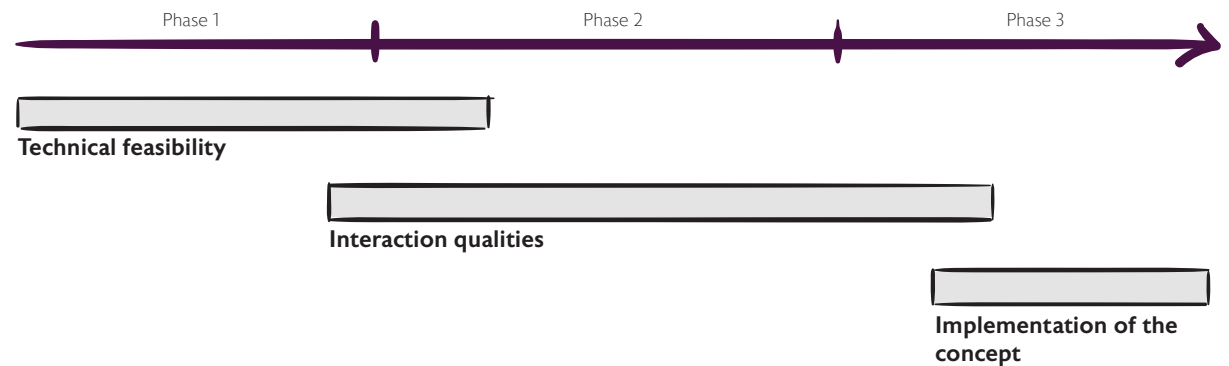


Figure 27 Conceptualisation process divided in phases.

13.2 Technical feasibility

To define the technical feasibility of the concept, creating a simulation of a farmer's farm, research into existing websites and software was conducted. This also gave insight into what data is needed to simulate the farm and the current data outputs. Next, there is also looked into various existing farm simulations and games.

There are already a lot of tools and websites that give farmers insights into the current status of their parcels. For example the Kingloopwijzer, BedrijfsBodem WaterPlan, Open Bodem Index and WaterWijzer. These tools range from defining farmers' current chemistry, nutrition and soil structure values, predicting yield loss, giving insights into how different measures affect your scores, and giving recommendations. Figure 28 shows an overview of all the used parameters in these tools.

A questionnaire was conducted to determine what parameters farmers prefer to be shown in the concept and in what way. The parameters were also ranked by the participants based on importance. Next, the participants are asked

how they want the parameters to be shown or visualised. And furthermore, the conception for the interface to input parameters was asked. The questionnaire can be found in appendix I1. A rough design of the data visualisation was defined with the questionnaire outcomes.

Many farming games exist; a grasp of games has been checked out to explore different ways of visualising and simulating a farm. These games range from two-dimensional top-view visualised farms to real-life three-dimensional immersion. A collage of these games is shown in figure 29. This research showed what is possible to envision a farm and helped to determine the visualisation of the farm in the concept.

- **Loss of earnings** (*Opbrengstderving*)
- **Water quality** (*Waterkwaliteit*)
- **Carbon sequestration** (*Koolstofvastlegging*)
- **Critical performance indicators**
(*Kritische prestatie indicatoren (Biodiversiteits-Monitor)*)
 - **Permanent grassland**
Blijvend grasland (% van totaal areaal)
 - **Protein from their own land**
Eiwit van eigen land/eigen regio (% van totaal eiwit in voer)
 - **Nitrogen soil surplus**
Stikstofbodemoverschot (kg N per ha)
 - **Emission of ammonia**
Emissie van ammoniak (kg NH₃ per ha)
 - **Greenhouse gas emissions**
Emissie van broeikasgassen (kg CO₂-eq per ha en per kg melk, inclusief de footprint)
 - **Herbaceous grassland**
Kruidenrijk grasland (% van totaal areaal)
 - **Natural and rural habitats**
Natuur- en landschap (% beheerd land met contract van totaal areaal)
- **Soil structure** (*Bodemstructuur*)
- **Organic matter balance** (*Organische stofbalans*)
- **Environmental and climate performance**
(*Milieu- en klimaatprestaties (Kringloopwijzer)*)
 - **Nitrogen soil surplus**
(Stikstofbodemoverschot)
 - **Ammonia**
(Ammoniak (kg per GVE) & Ammoniak (kg per ha))
 - **Greenhouse gases per kg of milk**
(Broeikasgassen per kg meetmelk)
 - **Permanent grassland**
(Percentage blijvend grasland)
 - **Protein from their own land**
(Percentage eiwit van eigen land)
- **Infiltration and drainage** (*Infiltratie en afwatering*)
- **Soil compaction** (*Bodemverdichting*)

Figure 28: Current parameters in tools and websites that give farmers insights into their farm performance.



13.3 Interaction qualities

The interaction with the design is the main focus of this concept and, thus, this thesis. Different generations are to use the concept, and it is preferably used in collaboration. Many elements should be considered and defined for the interaction with the concept. Figure 30 shows a timeline of the evolution of the concept based on the interaction qualities.

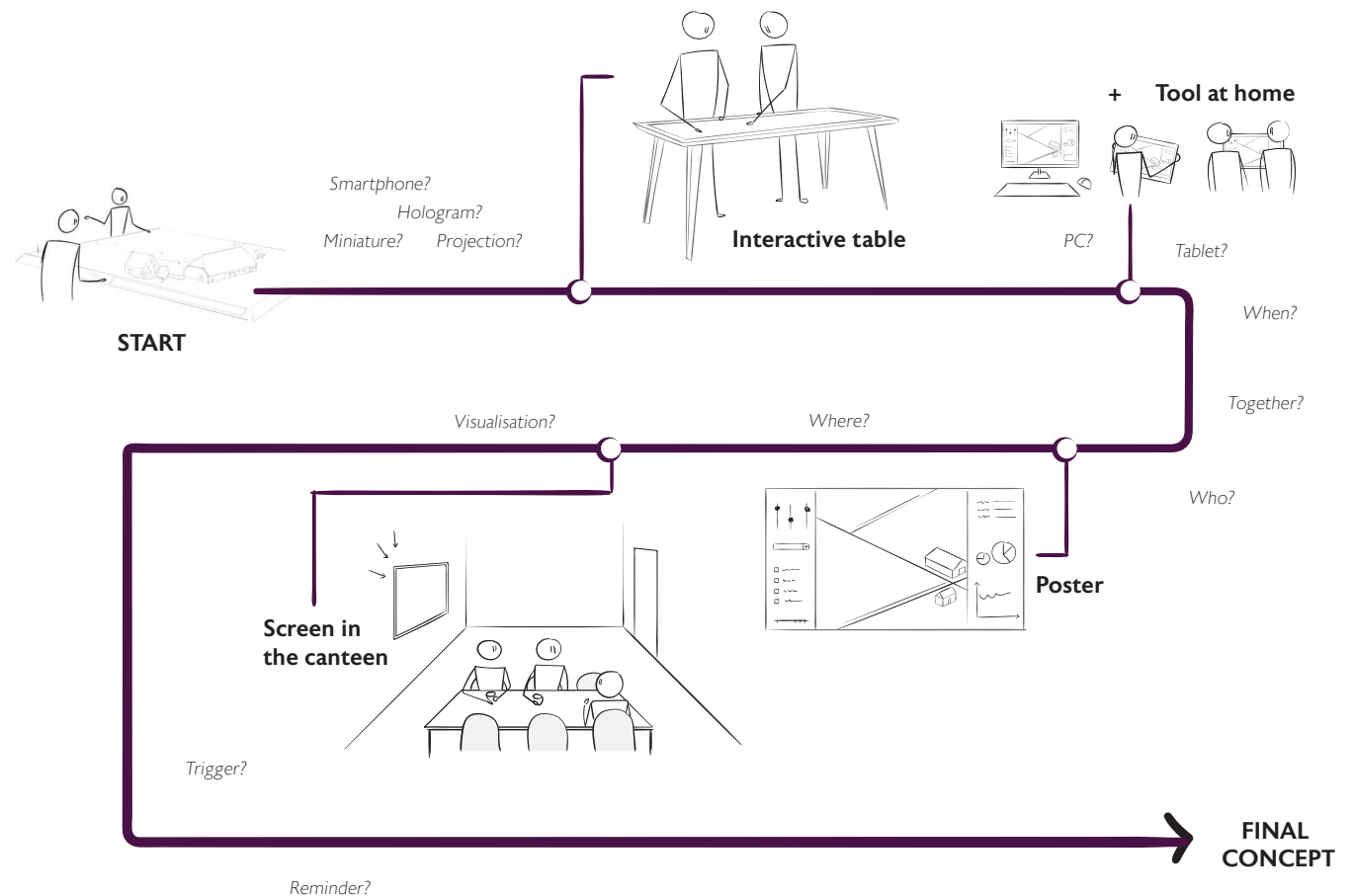


Figure 30: The evolution of the concept based on the interaction qualities.

The start is an important factor for the concept. When, where and how do farmers start using the concept?

During the first phase, while looking at what means would fit the concept, an interactive table for exhibitions and open days came to mind. Here an expert could introduce the tool to farmers and make a start on a simulation of their farm. However, during a feedback session with colleagues of LTO Noord it was concluded that farmers do not want to put their entire business and values on the table during an exhibition. So a trial of the tool at an exhibition and the possibility of going into detail at home was the answer. But the screen of a PC was not an envisioned interaction since this would require someone to take the initiative to work with the tool. It would also not stimulate working with the tool with multiple generations at the same time.

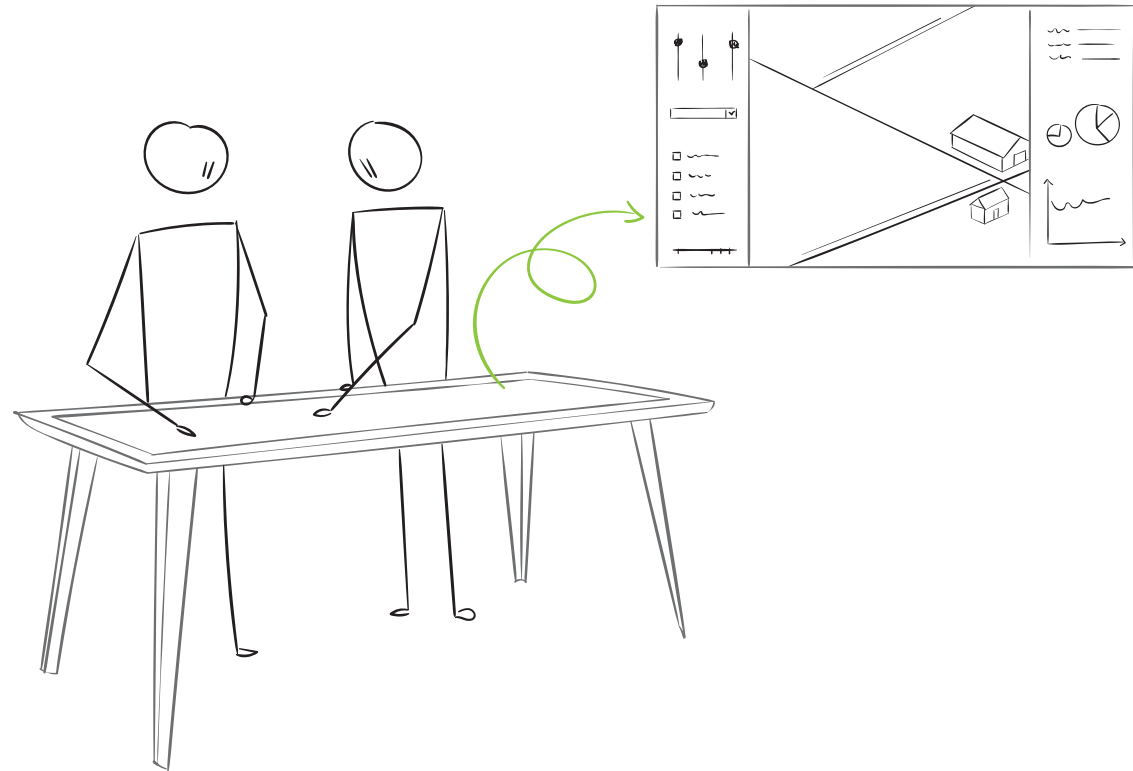


Figure 31: Interactive table for exhibitions.

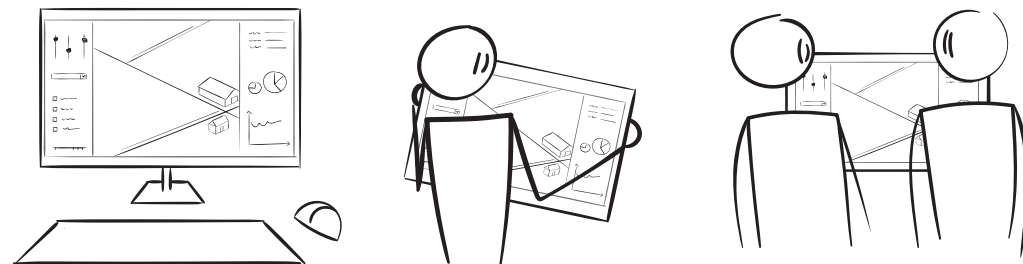


Figure 32: Tool in use on a PC or tablet at home.

For the envisioned interaction, it was decided that the use of the tool should not need planning. It should be a small step to get in touch with the tool. So again, there was looked into different means, this time ones that could provide a low-key use. Tablets and table projections were come upon.

But not only the instrument influences the aspect of low-key use. In phase two, the start of the use at home was more looked into. While retrospectively the context research, the posters and calendars hanging in the canteen or kitchen were rediscovered. The farmers use these tools regularly in a location where all the employees and farmers meet, talk and take breaks. Another benefit is that these tools are already used for generations. The idea of implementing these calendars, planning tools or posters into the concept was devised to use the interaction with these tools as a starting point for the interaction with the concept.

So, the idea of combining the graslandkalender with the simulation was born. The graslandkalender is a calendar where the farmer

tracks and plans the land cultivation that is done per parcel. This data can also be used for the simulation, resulting in frequently updated information on the fields. All this information (graslandkalender and simulation of the farm and data) will be presented on a digital screen in the canteen, replacing the posters. This will result in continuously getting in touch with or seeing the

screen and, thus, the concept. The use scenario of the concept up until this point is shown in figure 33.

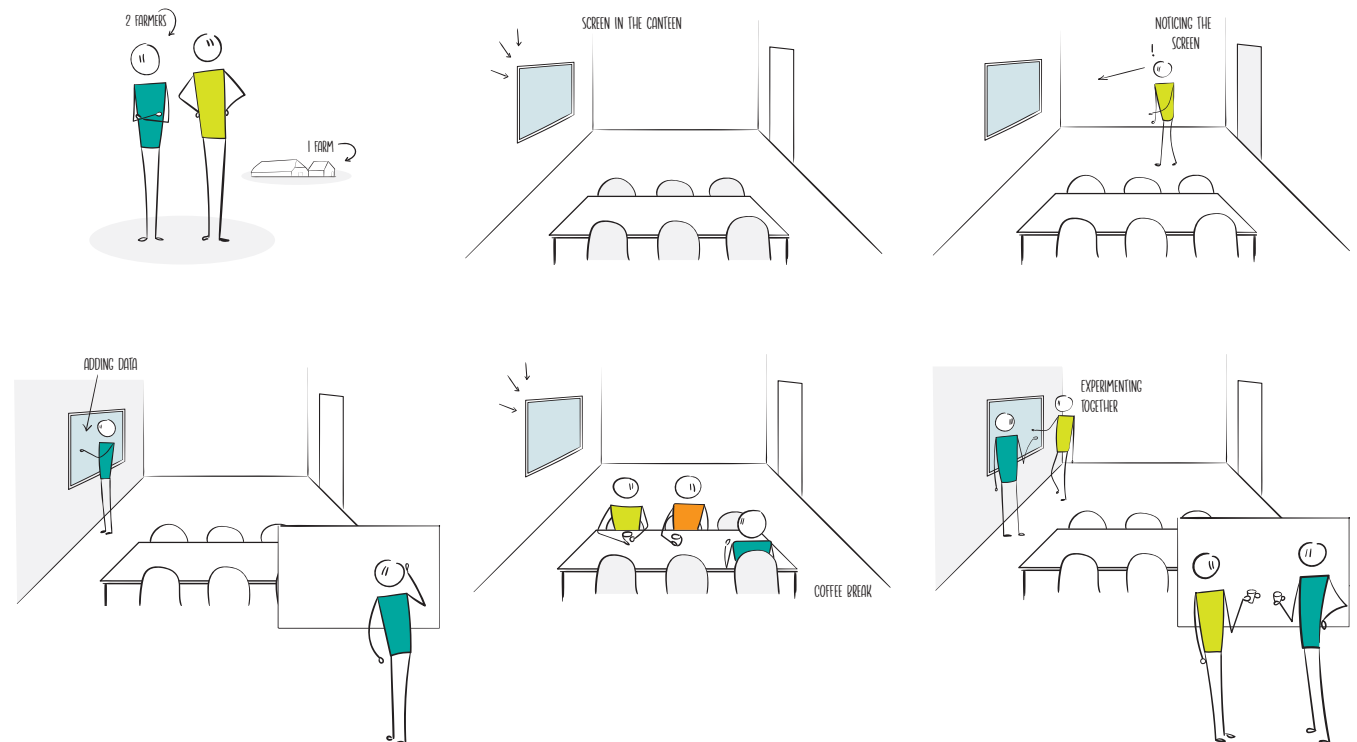


Figure 33: Use scenario of the concept

Then the step towards experimenting and the dialogue about change must be made. Dropping values could be a trigger for a farmer to look into it. So to trigger the farmers to change something, the lowering values will be emphasised on the screen (will enlarge or change colour). When farmers notice this, the experimenting can start. One of the farmers can take the lead in this by starting the experimenting mode and trying different changes and measures. The experimenting mode functions like slides during a presentation, it is the visual support and proof for the possible change.

The last part of the interaction is the reminder about your experiment and making the decision to change. Big changes or decisions are not made in one day; it takes some time. Sleeping on it and looking back at the details of the proposed change is needed to make a decision. Therefore the concept will give the farmers a 'reminder' of their experiment(s). The shape of this reminder was thought of in the last phase.

The final shape of the reminder need to be explored more. For this thesis, it has been

decided that the screen will remind the farmers of their experiments. For example, showing a time-lapse how the farm could change by their changes or a notification at a certain parameter. A possible reminder outside the screen could be a notification on the phone.

Also, the visualisation was thought of in the last phase. Collages were made to create an overview of all possible ways to visualise a farm or data and what type of means could match the concept. These can be found in appendix I2.

13.4 Implementation of the concept

To implement this concept, several things need to be considered. First, the envisioned software needs to be made. Since it requires complicated programming, the cost of implementing the concept will be high. Since LTO does not have the financial capacity, investors or other funding should be looked at. Since the tool is based on the software of already existing tools, there could be looked into collaboration with these tools. Secondly, the screen needs to be acquired by the farmers. This screen also requires an investment. There could be argued on who will make this investment; asking farmers will make it less likely for it to be implemented. Since then again, they need to invest, thus make a big decision. Enable a grant, or a deal could work to purchase it.

14. Final concept

This chapter presents the concept SoilMate as it is to be delivered to LTO Noord. After the conceptualisation process described in the previous chapter, the concept has been optimised within the constraints of this project. To elaborate on the full scope of this concept, this chapter defines how the concept is interacted with through use, as well as the data that can be derived from the concept. The concept is then presented through a user scenario to create a true understanding of the working and feeling of the SoilMate concept in practice.

14.1 Introducing SoilMate

Based on the conceptualisation and outcomes of the validation, the following final design is proposed:

SoilMate

SoilMate is a tool whereby farmers can experiment with new measures on their own (digital) farm. SoilMate embodies itself as an interactive screen in the canteen or kitchen (wherever the coffee break occurs). It simulates the farmer's farm and the



Figure 34: The final concept: SoilMate, in use.

possible results of implementing measures.

The interactive screen in the coffee break area involves users interacting with it whenever they have time during work or the break. And since the simulation is combined with planning tools (e.g. Graslandkalender), the farmer can combine work with looking into future possibilities. SoilMate gives access to the planning tool, the 3D visual representation of the farm, the current and possible future data of values, and the possibility to experiment and apply changes on the farm.

14.2 The use

The starting point of using this concept is the planning tool 'Graslandkalender'. The planning tool is an existing calendar that farmer have used for ages. A farmer writes down per parcel what type of land cultivation and when it occurred. This will be done regularly. A 3D visualisation of the farm is shown and 'scrolls' through time to make the farmers aware of how the farm will change in the upcoming time. Also, the outcomes of different values are displayed on the screen. When filling in this tool or walking past the screen, the screen

creates triggers (like values in a crucial state or underachieving parcels) so the farmers can look into the parcels and start simulating.

14.2.1 Experiment

When the farmers want to see what and how they can do things differently on different parcels, they can decide to start simulating possible futures. The start of this is selecting a parcel or the entire farm, and the panel where changes can take place will open. Here the farmers can for example change crop type, type of cultivation, planning of cultivation, climate, and/or add a new measure. In the 3D view, a visual simulation of these changes will occur; sometimes, this requires a time-lapse to see how a change will play out during the different seasons.

At the bottom of the screen, these changes' potential results will be added to the graphs and values. So the farmers can see what the changes will do for their farm.

The user scenario is visualised in figure 35, on the following pages.

14.3 Data in- and output

To create the simulation, data of the farmer is used. This will be done through data connections. There could be thought of suppliers, advisors and the Kringloopwijzer. With this data, the current values will be calculated and used for the predictions. Next, the input in the Graslandkalender will also influence the predictions.

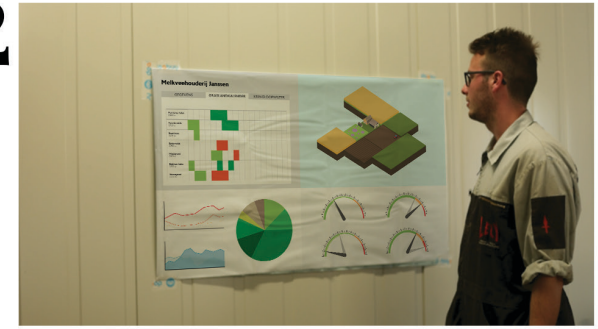
The output will be various variables in different types of graphs. Each graph shows the results of last year, current year and prediction of next year. This shows the farmers the progress they are making (or not).

1



Two generations in a partnership of a dairy farm.
Working together.

2



The tool gives access to the graslandkalender. The graslandkalender is used by the farmer to monitor the cultivation per parcel.

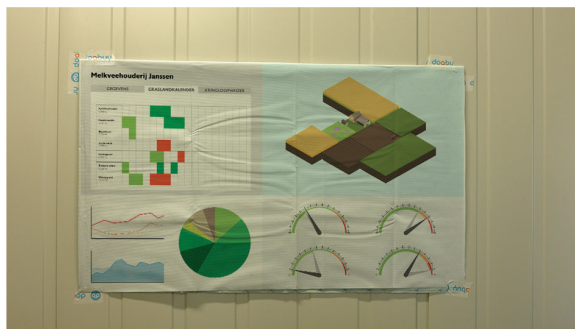
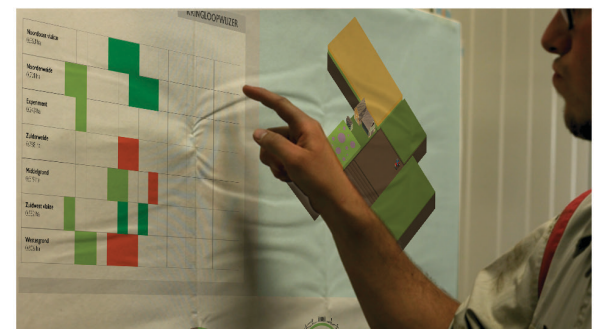


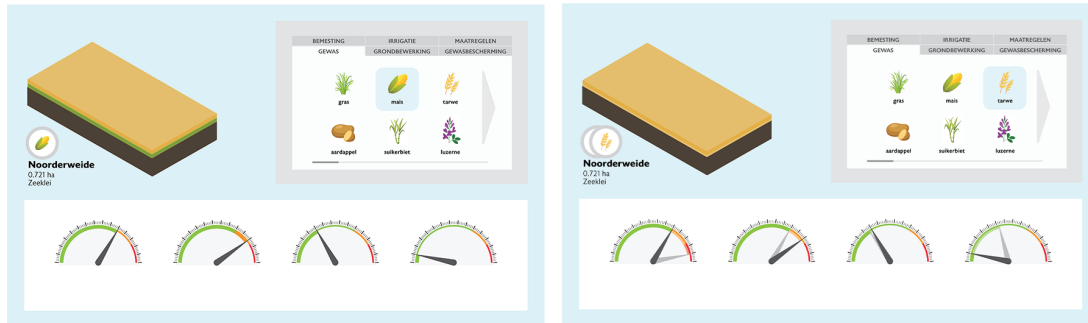
Figure 35; User scenario >

In the canteen, SoilMate is installed.



When adding data to the graslandkalender, SoilMate will update the simulation of the farm.

3



SoilMate enables farmers to look closely at a parcel and its status. In the simulation, the farmer can make changes to the parcel and see the effects of it on different parameters.

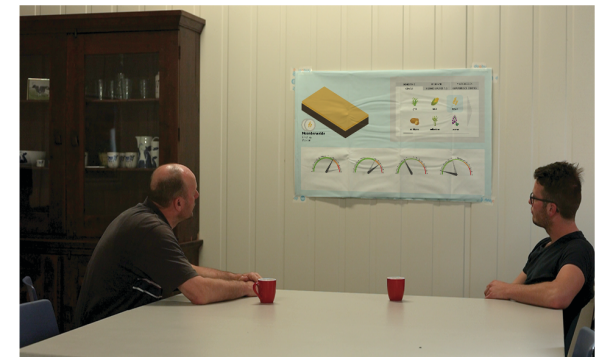
4



Later, the parcel is again discussed during the coffee break. The farmers open the tool and try the discussed options to see if the envisioned solution will indeed increase the performance of the parcel.



Farmers can experiment with changes per parcel on the screen and then discuss possible solutions to increase that parcel's performance.



After finding the 'perfect' solution, the farmers decide to implement the tried-out measures and changes to the parcel.

15. Discussion

LTO Noord backs its members, agricultural entrepreneurs, in responding to the mandatory transition the agricultural sector needs to make. The LTO Noord initiative DAW mainly focuses on knowledge transfer about water and soil measures towards agricultural entrepreneurs. DAW perceives that the implementation of the transferred knowledge, by farmers is yet a step too far. This thesis was set up to help LTO Noord and, thus, DAW improve their support to encourage farmers to implement sustainable measures on their farm, based on the decision-making process of young agricultural entrepreneurs.

Young farmers are driven and motivated to take over the farm and shape it as it works for them. The motivation to become a farmer is the freedom, variety of work and entrepreneurship.

The results indicate that the decision-making process is particular per farmer. Small decisions were not considered as choices by the farmers, therefore the created paths during the interview were all 'big' decisions; they all require an investment or a change in farm management. For each participating farmer, the path is unique.

However, some correlations could be made. For all the paths, there was a defined begin and end. As shown in the results, the paths could be divided based on the starting point: "Things have to change", "I want it to be different", and "I see it differently". Chapter 5.4.3 describes the correlations within these categories. Looking at all the paths together, it could be noticed that all the paths have steps that encompass gathering information about and exploring options. Also, comparing and considering options can be found in all the paths. The farmers indicated that trying or doing a trial of something is a preferred step in the decision-making process but not always possible. It was noted that decision-making on a farm is done by a partnership since multiple generations lead the farm. The results showed that the younger generations in the partnership feel they need proof to convince the older generation when they want to make a change. Mainly caused by the different standards the older generation grew up with. So to encourage young agricultural entrepreneurs to make sustainable decisions, the older generation in the partnership should be convinced. Preferably this is done by 'experiencing' the proof that the sustainable measure works and

is better.

The presented results are compared with the theories of the reviewed papers. Looking at the proposed frameworks in Chapter 3.1, the results support some elements of these theories. For the 'Triggering change' cycle proposed by Sutherland et al. (2012), a trigger event or opportunity needs to occur to let farmers deviate from their maintained steady course on the farm operation. For the found paths during the field research, a defined starting point that started the decision-making of the farmer was discovered. However, not all these starting points could be considered a trigger event described by Sutherland et al. (2012). Sutherland et al. (2012) describe the trigger as an event that occurs what the farmer decides to respond to. This description could be stated true for the paths within "Things have to change". For the two other starting points, "I want it to be different" and "I see it differently", it could be argued that there is no such a trigger event. For these categories, the need and intrinsic motivation of the farmer is the start to start making a decision. This given fit the concept of lenses of Farmar-Bowers & Lane (2009). They state that

the intrinsic interests and family considerations of farmers are used to actively create opportunities. To create opportunities, suitability and availability of an opportunity are critical factors. This suitability refers to the fact that the opportunity must satisfy one or more motivations. The field research found that farmers prefer a decision with multiple advantages, which confirms this. The availability refers to the fact that the opportunity must only require the possessed or immediately accessible components, which can be found in the results of farmers preferring to try out with owned means first.

This 'actively creating of opportunities' by farmers can also be related to the theory of effectuation: 'They start with a given set of means and allow the goal to emerge over time'. The mentioned principles by Sarasvathy (2009) can also be found in the results. The participants' answers correlate to the fourth principle, 'The Lemonade Principle'. For all the participants, events, uncertainties, and opportunities cross their path, and they see it as an opportunity to build on. Also, 'The Affordable-Loss Principle' can be found in several answers of the farmers; making a decision always consists of considering different options and listing the costs

and risks of these options.

Further looking at farmers' decision-making, the presented stage of active assessment in the 'trigger change' model (Sutherland et al., 2012) can be found in the results of all participants actively gathering information to assess the different options.

Altogether, principles from both presented frameworks on farmers' decision-making can be found in the results of the field research. Additionally, the concept of lenses proposed by Farmar-Bowers & Lane (2009) and the answers of the participants can be related to the theory of effectuation.

The results also build on the existing evidence of factors influencing farmers' decision-making. The presented theme 'a partnership full of generations' builds on the importance of the farm household characteristics presented by Edward-Jones (2006). The factor 'feeling confident' can be found in the importance of gathering information before the participant decides. Gathering information creates more confidence and control over the to-be-made decision. The results, however, do not validate the influence of the farm characteristics

on the decision-making behaviour, nor the farmer characteristics. Yet the influence of the social environment is emphasised by the results. Lastly, the relative advantage of a decision is also found in the results; all participants associate cost with big changes.

The generalizability of the results, however, is limited by the limited amount of participants. Due to the time-intensive research method, only eight participants were included. Next, it took some time before the participant recruitment progressed. For the analysis, time was a limited factor in executing analysing methods that are more valid, like a coding tree or statement cards. The current analyses can be repeated but will not give the same outcomes since the analysis is all based on the researcher's interpretation of the data.

With these limitations in consideration, the found results are valid for the purposes of answering the research question. The research methodology generated the needed outcomes to answer the question and design directions. Moreover, as described above, the results correspond with the

theories discussed in the literature review.

To justify the results from this thesis, more participants should be included in the research. Avenues for future research include the extent of influence of the social environment, the management of partnerships and how they do business.

Further research, design and development are needed to implement the final concept. To establish the user interface of the concept, further research is needed. There could be thought of performing a study on similar systems to better understand which user experience elements should be included and what would be key factors of the systems success. Designing the system and applying it in a use case with young and older farmers to assess the viability of the intervention could follow. From here, the interface design and software development to realise the simulation can take place.

16. Conclusion

This thesis aims to identify the decision-making process of young agricultural entrepreneurs and the influences on this process. This thesis furthermore aims to eventually design a product that encourages them to make sustainable choices. Based on an anthropological approach to qualitative research, it can be concluded that the decision-making of young agricultural entrepreneurs is influenced by their fellow farmers in the partnership. The designed concept, therefore, supports the young agricultural entrepreneurs to convince the older generation in the partnership to make a step towards implementing a sustainable practice.

Considering the personality of the research group, research methods that get closer to the participant were used. A combination of a probe, participatory observation and a semi-structured interview were conducted to get more profound answers from the young agricultural entrepreneur. The generated outcomes match the expectations; however, the used research method also generated unexpected/unpredicted results. First, the found values of the young farmers, like the responsibility they feel for society and the importance of

family, were striking. Next, the fact that most of the young agricultural entrepreneurs have a job besides being a farmer stood out. And lastly, the struggle of being a young agricultural entrepreneur in a partnership with older generations with other beliefs and education attracted attention. The last finding was the starting point for the generation of a design: an interactive screen that enables farmers to experiment with measures related to water and soil on their farm in a digital world.

To finally detail the proposed final concept and make it implementable, further research is needed. In this thesis, the interaction aspects of the concept are thought out but could be underpinned with further research. Next, to bring this concept into this world, the design and visualisation of the screen should be researched, next to the technical functionality.

The start of this thesis was the need for LTO Noord to improve their knowledge transfer and communication with agricultural entrepreneurs to motivate them to make sustainable decisions and changes on the farm. The conducted research created insight into young farmers' decision-

making process and revealed a 'problem' that could be addressed. The interplay of the different generations in a partnership should be considered by LTO Noord when supporting farmers in making the transition. It is recommended to involve and emphasise both generations and their view on the different practices and services LTO Noord provides. Next, SoilMate could help young farmers to convince the older generation of new and sustainable measures that can be implemented on the farm as the concept gives the young farmers the evidence the older generation needs.

17. Personal reflection

It was a struggle. But I knew that beforehand since I prefer to work in a team, and this project was not.

Looking back at the beginning, the planning I made was too optimistic. First, the recruitment of participants took longer. The target group was difficult to reach and did not respond to the recruitment message. I had to approach potential participants by myself, which took more time. In hindsight, I could have approached participants more actively at the beginning of the project. The data analysis also took more time than foreseen. Since I am not that familiar with analysing this amount of qualitative data, it took quite some time to find an approach that suited me and the date. However, this approach was still time-consuming and took longer than I anticipated. With this gained experience, this process will go faster in the future since I now know what methods there are to analyse data.

This project I struggled the most during the designing phase. I constantly felt that I did not know enough about the target group, which is

interesting since I could swim in the amount of data. This could be due to the fact that the data is not specific enough. In hindsight, I could have done more desk research and literature reviews to focus the research more. With this, a more detailed design could have been carried out.

During this project, I experienced significant personal development. In the last weeks, I had set my perfectionism and doubt aside since I had no time for it. Making choices has always been tough for me, and I again struggled with this. I may have lingered too long on one part of this thesis. I also learned that, even though I am doing this project alone, I am not alone. Initially, I struggled with informing and updating people about my project, but I became better. It also became easier to ask for help; people apparently like to help.

I again picked a complex topic for a project; I apparently like to challenge myself. Even though it was a hard project, I am happy with the outcome and the journey I took. I can conclude that I managed to fulfil this project and gained more confidence in me being a future designer.

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X**Y****Z**

19. Appendices

A. Focus Group

- A.1 Individual documents
- A.2 Group discussion outcomes

B. Cultural Probe

- B.1 Package content
- B.2 Written cards

C. Participatory Observation Notes

D. Semi-Structured Interview

- D.1 Interview guide
- D.2 Reflection pilot study
- D.3 Transcripts

E. Analysis of inquiries

- E.1 Written post-its
- E.2 Generated Clusters

F. Participant Recruitment

G. Ideation

- G.1 How-Tos
- G.2 Initial idea generation
- G.3 Creative Session

H. Concept Selection

I. Final Concept

- I.1 Technical feasibility - Questionnaire
- I.2 Interaction qualities - Collages

J. Initial Design Brief