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Scenario analysis of European small and medium farms under the influence of digitalisation and sustainability demand

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List of Acronyms

AI	Artificial Intelligence
CAP	Common Agricultural Policy
EU	European Union
EuDEco	European Data Economy
Fig	Figure
IoT	Internet of Things
IT	Information Technology
SMF	Small and medium-sized farms
QR	Quick Response

PREFACE

What inspired this thesis are the many young farmers I see and follow-on social media.

Their stories never fail to move me to tears.

We see their successes and their crises.

I love to see their passion and commitment to their land, their animals, the environment, and society. The stories of weather, crops, disease, births and deaths are heart-wrenching.

These farmers feed us. Several times a day. But they struggle deeply. They struggle with high levels of stress, anxiety about fluctuations in demand, financial hardship, a job that is physically and mentally demanding. But also, I understand, they get a lot of satisfaction from their work.

These hardworking small and medium farmers deserve better. Because they work our land, they look after the animals of our land, and they feed us. Nothing should be more important in our society than supporting our farmers. For this thesis, I wrote to farmers on social media to take part in my research. Unfortunately, not a single farmer was available to share their insights as they were working 16-hour shifts, harvesting, during the summer month when I was collecting my data. So, experts from the agri-food industry, research and consulting will have to contribute. Don't worry, most of the experts are young and have long personal experience of farming. They know how hard the job is and have decided not to work on a farm anymore.

To compensate, the author wanted to let a farmer speak in this preface, using her Instagram videos to describe her struggles. This way, the author could not bias what was said and the farmer did not have to waste any more precious time. Here we hear from Skadi, 26 female farmer in Germany in her Instagram video from the 26.10.23:

“So, at the moment I'm really frustrated because it's just so difficult to market organic grain, precisely because we have batches that are just not suitable for the food industry due to the weather conditions, but only have feed quality. And that, of course, makes marketing even more difficult. I know that many other farmers also have the problem that they can't get rid of their organic grain and that many organic farmers are stuck with it. I don't know how it is with conventional farmers. I don't know. I definitely know we're not alone in this, but it's really incredibly frustrating because you get the same answer from everybody: *“It’s difficult. The market doesn't give it. No interest. Our warehouses are still full with last year's goods. And that's simply because the organic market has collapsed so dramatically due to inflation and also due to the buying behaviour of consumers.”* That it is really, really frustrating when you

have worked a whole year for it, the warehouses are basically all full, what is something you can be happy about. But the produce is not wanted by anyone, because just and so it is now, the goods are rather cheaply imported from abroad, then to buy their own goods from their own country of origin. And that, of course, absolutely depresses the market prices and the market in general. And that's really something that just frustrates me at the moment and makes me really sad. These are all things that make you wonder how things are going to continue. Because the fact is that we farmers don't have that much to sell. It's always a matter of sectors. Either you have pigs, or you have cattle, or you have dairy cattle, or you have arable farming. And that's where our income is, our main income over the year, for example, grain. And then it's just the case that if you live mainly from grain, then of course you have to sell grain at peak times in order to survive for a whole year on the proceeds, so to speak. And that makes things even more difficult. Especially in the course of all the ever-increasing prices, we naturally have the problem that the prices are all rising. Production costs are getting higher and higher, but the products are worth less and less. And that is actually such a basic problem, which is also politically made and no idea wanted. I don't know. But for the individual farmer it's quite frustrating. Why am I doing this to myself? That's just the bitter truth that I deal with every day, where you really have to ask yourself whether you're still doing this to yourself. That's why I can understand so many companies and there will still be so many companies that quit their jobs because they simply don't want to do it anymore. Because it's unfortunately the case that if it's purely about making money, then we're in the wrong sector here. And in the end, many of them are only able to make it, and I'm referring to smaller family businesses or medium-sized businesses, because they exploit themselves or never take their own working hours into account, count them or factor them in. Because I believe that if we were all to do that, to calculate our own working time in all business processes, we would probably be shocked at what really comes out in the end. But that's another story. I would like to tell you now, however, what the only possibility is that you out there, who are watching my story right now, can support these farmers or these farms in general. And for us on the farm, the key is really our direct marketing and our farm store, because without our regular customers and without our customers who store in the farm store, we would not have been able to survive many a lean period. And that's just simple... It's also really the case that I can only say again and again that it's most beneficial for us if you buy directly from us in the farm store. We know that the prices with us are significantly different than in the supermarket and that you also cannot compare. But you must always keep in mind that what you pay us in the farm store goes directly to us one to one, so that it really helps us to buy here locally from us, to purchase the meat directly from us, so

that we generate sales in the farm store and can keep our heads above water with the sales. That is the key for times like now, to somehow survive. So again, the appeal is to buy directly from the farmer if you have the opportunity. I know that it is very difficult for many families at the moment, even with all the rising prices. Especially when you go shopping, you notice it on the receipt. But then maybe just really think about limiting just meat consumption so that you really specialize in good meat from the farm. Because that simply helps us the most. Because we can no longer rely on politics, I think."

You hear her frustration, her desperation for her situation. Therefore, this thesis is dedicated to all small and medium-sized farms, in the hope to give them applicable strategic advice. The scenarios in this thesis are meant as a warning, a wake-up call to politics and consumers. I hope to surprise you with the outcomes and nudge you to a more sustainable and better future.

Lena Kampa

1 INTRODUCTION

The agri-food sector plays a crucial role in the European Union (EU), providing food and making a significant contribution to the EU economy (European Commission, 2017a) and provides environmental and social goods, due to the multifunctionality of farm activities (Zasada, 2011). EU farmers face a fast-changing environment every day, from politics, like changing regulations on fertilizer and pesticide use, livestock management, environment and climate, economic changes like in consumer demand and rapidly changing technology innovations like artificial intelligence (AI) (Lencsés & Mészáros, 2020). They need to make an informed decision based not only on the current information, but also on experience, crop cycles and future implications for the farm prosperity. Even though European farms face high requirements in food quality and safety standards and have to follow very high sustainability regulations (van Wagenberg et al., 2012), farmers, especially of small and medium farms (SMF), struggle financially (Berti & Mulligan, 2016).

As Information technology (IT) continuously develops further and digitalization's disrupts various industries, agriculture is slowly adapting digital solutions in the EU (Gabriel & Gandorfer, 2023). Advanced technologies such as precision farming, Internet of Things (IoT) applications, and data-driven decision support software have the potential to optimize agricultural processes, enhance productivity, and reduce environmental impacts (Garske et al., 2021; MacPherson et al., 2022) and with this development to disrupt the agrifood industry (Dolfsma et al., 2021). But SMF in particular are struggling to adapt to digital technologies (Gabriel & Gandorfer, 2023) .

On the other side of the food value chain are the European consumers, who became increasingly aware of their environmental impact of the products they are consuming (Wunderlich & Smoller, 2019), urging the farmers to adopt sustainable practices that preserve natural resources and mitigate climate change effects.

The development of a highly digitalized agriculture and consumers demanding sustainability could lead to a food data economy (Wolfert et al., 2023), which could be a possible solution to make farming and food production more efficient (Garske et al., 2021; Verbeek et al., 2019) and help with the decision-making but also to increase transparency for consumers (Walter et al., 2017; Wolfert & Isakhanyan, 2022).

Due to better data exchange, climate data and fitting crop variations can be applied, and with better data exchange consumers can have a more transparent understanding of how their food

products are produced (Walter et al., 2017). And farmers could use data, as an additional product to sell in the ecosystem of food systems to other actors, but also to increase the value of their products, as they can increase the transparency to the consumers. The data economy for food systems could be used to solve or at least improve environmental, waste, and transparency issues above (Wolfert et al., 2023).

Digitalisation and sustainability are megatrends that have the potential to have a major impact on the EU agri-food sector, transforming it towards a more sustainable future (Garske et al., 2021; Verbeek et al., 2019), and could have a significant impact on the SMF.

But emerging digital technologies which comes with the data economy have already disrupted other industries and therefore the adaption of the data economy in the agri-food sector comes with its very own uncertainties, as this sector comes with its very one unique characterises (Verbeek et al., 2019). The adaption of digital technologies, which would finally result in a food data economy is still low, compared with other industries, like automotive or the IT sector (Verbeek et al., 2019). Despite the evident benefits and rising demand for IT integrated farming practices and sustainability-driven agricultural products (Verbeek et al., 2019), there exists a complex interplay between the IT integration levels of EU farms and the sustainability demand of EU consumers. This interplay requires a comprehensive analysis to understand how these two dimensions interact, influence each other, and potentially shape the future SMF in the EU. Future scenarios are needed to assess how the dimensions can influence the EU SMF performances.

With the new research project data for food, the EU project aims to define data economy for agri-food systems for the first time and create a platform for trustful and fair data transfer.

Even though technology has increased digitalization dramatically over the last decades and makes handling big data possible, the concept of data economy in the agri-food system is relatively new. Research connecting data economy and the agri-food sector in the EU is lacking (Verbeek et al., 2019), and the extent of the impact on farm performance in future is uncertain.

This is evident from the fact that the term data economy for food systems is not yet a defined term, and a search for “data economy” in Web of Science only yields130 results. If searching the combined terms "data economy" AND (agri* OR food) result only in six results, in February 2023.

Further the connection of farm digitalization and sustainability demand of the consumer, is not yet assessed to the knowledge of the author, in the context of a future analysis, and how this interplay influences the farm performance of SMF in the EU.

In recent literature which wrote about future scenarios regarding digitalization and sustainability in the EU agriculture, foremost political and technological aspects were assessed. Such papers are *Future agriculture systems and the role of digitalization for archiving sustainability goals. A review* (MacPherson et al., 2022), and *Scenarios for European agricultural policymaking in the era of digitalisation* (Ehlers et al., 2022), look in potential futures for the agriculture of the EU regarding megatrends of digitalization and sustainability, but the objective is to archive sustainability. No other publication in foresight paper in the EU agriculture investigated how SMF will possibly be financially affected by those trends. Additionally, by looking into law and policy MacPherson et al. (2022) acknowledge the of lack of consideration of the consumers influence demanding in shaping the agriculture product systems.

Because digital agriculture is still relatively new and consumers' increasing awareness of sustainability is influencing the industry, there remains a significant level of uncertainty regarding how it affects the farm performance of SMF in the EU. This uncertainty leads this master thesis to their primary objective to perform a scenario matrix analysis, mapping the varying IT integration levels of EU farms against the evolving sustainability demands of EU consumers, to assess how the farm performance will be influenced. By exploring multiple scenarios and potential outcomes, this research aims to shed light on the different trajectories that European agriculture might follow based on different degrees of IT-adoption and consumers sustainability focus.

To accomplish this primary objective, the following secondary objectives must be met, i) a comprehensive list of forces, drivers, trends, and uncertainties which influence the dimensions IT integration level in EU farms and the consumer sustainability demand; ii) an uncertainty and impact grid which visualize the impact and uncertainty of the identified forces, drivers, trends, and uncertainties; iii) influence diagrams of each scenario on how variables influence farm performances under the influence of the dimensions; iv) consensus-based scenarios that depict potential futures for the integration of digital technologies on farms and aligning them with consumer sustainability preferences; v) recommendations for improved farm performance, based on the scenario analysis results.

To achieve the research objective, the following key questions will be addressed:

What are possible future scenarios for European SMF along the dimensions of IT integration level and sustainability demand of EU consumers, and how will the farm performance be influenced?

Measurement Questions:

- What are social and technology trends, drivers, forces, and uncertainties which influence the performance of European farms in the data economy.
- Which of these factors have the biggest impact and uncertainty on the performance of European farms in the data economy.
- How are these factors interlinked and influencing each other to reach the four different scenarios?

The scope of the thesis are European SMF, which might participate in the data economy in the next five years. Digitalization describes the socio-technical process of the use of digital technologies and its impact on human activities (Nambisan, S., Lyytinen, K., Majchrzak, A., & Song, M., 2017). This definition is used to narrow the research scope as only social and technology factors are assessed, as they are the core characteristics of digitalization.

To reach the named objectives in the chosen scope a Delphi study is proceeded to explore future trends and potential scenarios concerning the digitalization of farms and consumer´s sustainability demand. By engaging a panel of experts, this study aims to identify possible developments and challenges in the frame of the dimensions of IT integration level on farm level and consumers sustainability demand in the next five years. This research will adopt a mixed-method approach, while mostly qualitative techniques and one quantitative assessment to reach the impact/uncertainty grid. Secondary data sources, such as academic literature and official reports, will be utilized to comprehend the current IT integration levels of EU farms and the sustainability preferences of EU consumers. Additionally, these sources are used to collect social and technology factors, trends and uncertainties which will influence the dimensions. The gathered factors will be assessed after impact and uncertainty by experts in a survey. The resulting primary data will be discussed in focus groups to develop influence diagrams behind each scenario of the matrix.

The scenario matrix analysis will provide a systematic framework to explore the plausible future outcomes based on varying combinations of IT integration and sustainability focus.

The following context chapter describes the scope of the thesis and the academic background. This is due to the specific EU agri-food sector and the complex topic of data economy. The EU food system is described, with focus on the special conditions of SMF, as well as the digitalisation in the EU agriculture. Further the dimensions of the scenario matrix described and a current state in the EU is given. In the chapter on theoretical background, the dissertation presents an exposition of strategic foresight theory along with the essential concepts of emerging technology and disruptive innovation. The argumentation explores the applicability of these theories to this thesis. Chapter four describes the Scenario dimensions and the potential impact of digitalisation and changing consumer demand in the EU agri-food sector to support the choice of the matrix dimensions, IT integration at farm level and consumer demand for sustainability. This leads to the scenario matrix. Further a PEST analysis is on the scenario dimensions conducted, to describe the special conditions and environment of the agri-food economy. This is followed by literature research on influencing factors, which are then used with the PEST conditions to write assumption scenarios for SMF under the scenario dimension influence in five years. These assumptions scenarios are used in the discussion to compare them to the expert based once in the results. In this way can the literature-based scenarios be compared with the expert-based once, to see the differences between them.

The methodology section describes the research design of the Delphi study. The Delphi study is used in order to assess an uncertain future of farm performance in a possible data economy. Experts are asked for their assessment in several iterations, which finally lead to the descriptions of possible future scenarios for EU farmers in the data economy. The methodology section describes the data collection and analysis in detail. The primary data will be collected through two expert surveys and two expert focus groups. Intermediate results of the experts' surveys and parts of the focus group will be presented in the methodology sections, as the intermediate results do not answer the research question but are necessary results for the following iteration steps.

In the result chapter the experts influence diagram for each scenario are described, as well as their reasoning for their assessed development. Further in the results four scenario storylines are presented, which are written based on academic literature, experts' assessment, and the authors interpretation. Lastly in the results the expert's assessment on how the farm performance of SMF will develop in each scenario, in five years' time, will be presented and interpreted in light with the literature. In the discussion, the assumption scenarios are compared with the expert-based scenarios, the scenarios are assessed on their data economy and disruption

level. Following this, the implications of each scenario are described for all SMF, EU citizens, and EU policy, and recommendations are given to strategically manage possible future developments. Finally, the limitations of the thesis are described and critically reflected, and conclusion of the research is given.

2 CONTEXT CHAPTER

In the following the context in which the thesis is written is described. First it will describe the food system in the EU, with its market structure, problematic negotiation position of farmers, and especially the situation of EU SMF. This is followed by a description of data and data economy, and how it can be applied to the EU agri-food sector.

2.1 Food system and SMF in the EU

The EU is a major producer and exporter of agricultural products, and agriculture and food provide employment to around 44 million people in the EU, making up approximately 10% of the workforce (European Commission, 2017a). The EU's Common Agricultural Policy (CAP) governs the agriculture and food sector in the EU, aiming to ensure a stable supply of safe and high-quality food while promoting sustainable development and supporting rural communities (Agriculture and rural development, 2022a).The CAP is funded through the EU budget and implemented by member states. Recently, the EU has focused on promoting sustainable and innovative practices, improving traceability and transparency in the food supply chain, and ensuring food safety and quality (Agriculture and rural development, 2022b; EIT Food, 2022).

SMF play a significant role in ensuring food and nutrition security worldwide, as supported by various studies (Ebel, 2020; Food and Agriculture Organization of the United Nations FAO & Lucas, 2018; Rivera et al., 2020). These farms, which are smaller than 50 hectares, are estimated to contribute between 51% and 77% of the globally produced commodities (Herrero et al., 2017). Moreover, SMF have a positive impact on rural communities by providing employment and livelihood opportunities (Borychowski et al., 2020). Additionally, they play a crucial role in sustaining agricultural biodiversity and contributing to environmental sustainability (Polcyn, 2021).

But even though the EU wants to support their farmers with subsidies and supports rural development with the second pillar of the CAP, the numbers of farms are drastically decreasing, since the early 2000th, which is affecting mostly SMF (Schuh et al., 2022). While the land use for agriculture is relatively steady (eurostat, 2023), which results in farms getting bigger. This can be explained due to a number of challengers SMF in the EU faces, in comparison to large-scale farms over 50 hectares (Berti & Mulligan, 2016). In Europe small farms are typically integrated into concentrated agricultural supply chains dominated by a few large supermarket companies (McCullough et al., 2008; Vettas, 2007). This setup results in centralised procurement systems, where most food goes through large aggregation and distribution centres.

Supermarket competition exerts constant pressure on suppliers to enhance efficiency, reduce costs, and meet stringent quality and safety standards (Vettas, 2007). These characteristics create unique obstacles for SMF to access markets. They face challenges due to their limited production capacity, higher transaction costs, and inability to benefit from economies of scale (Rivera et al., 2020). Additionally, complying with the exacting standards demanded by supermarkets can be more difficult for SMF due to their limited assets and capital, which reduces their bargaining power with buyers (van der Meer et al., 2007). EU farmers experience price volatility due to seasonal production and steady demand (Tothova, 2011), which is further influenced by extreme climate phenomena like droughts and flooding. Additionally, input factor prices, such as energy and fertilizer, are steadily increasing, adding to the price volatility (Velazquez, 2011). This leaves farmers in a weak negotiating position and makes them price takers, directly affecting their income (Madre & Devuyst, 2016). The low and fluctuating income leads to farmers leaving the occupation (Agriculture and rural development, 2022a; fi compass EAFRD).

This dependency on buyers makes farmers reliant on the actors in the food system, while consumers highly depend on farmers' work and products. Structural trends favouring intensive production and large-scale farms with low margins and bargaining power are the primary reasons for the decline of SMF (Schuh et al., 2022). Despite these challenges, SMF farms employ various strategies to remain resilient, adapt, innovate, and sometimes thrive. Firstly, they can leverage cheap or free family labour, possess extensive knowledge of the local context, and have flexibility in entering and exiting the market (Poulton et al., 2010). Secondly, many small farms have improved their collective action by forming associations or cooperatives, enabling them to tackle issues related to scale, market power, coordination, and transaction costs (Rivera et al., 2020). Thirdly, there has been a shift from producing undifferentiated commodities to focusing on differentiation and specialization to add more value (Vettas, 2007). Finally, some small farms have chosen to bypass modern procurement chains and sell directly to consumers through farmer's markets and other community-supported agriculture initiatives (Bundesinformationszentrum Landwirtschaft, 2023; Rivera et al., 2020)

Additionally increased data usage, meaning monitoring, analysis, transfer, and utilization for decision-making purposes, has the potential to help SMF in the EU to address these challenges (Aubry et al., 2022). They could market their produce better and cultivate their produce more efficient, and increase the sustainability of their production (Weber et al., 2022). But the

adaption for digital technologies is often another financial challenge for these specific farms (Aubry et al., 2022).

Berti and Mulligan (2016) present a more sophisticated strategy to improve the competitiveness of small farms, by creating food hubs. New value creation strategy based on share value can develop through rethinking products, markets, and supply chain. The creation of food hubs is a strategy of a collective small farms to scale up the local food system, and increase market access for SMF, without the need for individual scale up developments.

2.2 Digitalisation EU agri-food sector

Functions of digital technologies are monitoring, decision support and communication (Mouratiadou et al., 2023). These functions can help increase the sustainability in agriculture (Verbeek et al., 2019). Therefore, the level of IT integration on farm level can be an indirect indicator for the farm sustainability itself. There is significant potential for digital innovation in the agri-food sector. This includes precision farming and food tracing using blockchain technology. However, investments in this sector remain relatively low compared to industries such as healthcare and IT (Verbeek et al., 2019).

2.2.1 Data

Data is a term used to describe informational units, either written or numerical, that are conveyed utilizing certain machine language systems, allowing for appropriate technological interpretation (Monino, 2021). Data is a fundamental component of any production, just like labour or physical capital (Opher et al., 2016). It is not substitutable, and it's worth can change over time, as it becomes more or less relevant (Olaleye et al., 2022). Data is characterized as nonrival asset, since it can be used by several users at once (Agata, 2020). But it is not automatically a public good, since users can have exclusive rights (Olaleye et al., 2022). As technology has become increasingly digitalised, the amount of data collected, analysed and stored has grown exponentially over the last few decades (Syed, A., Gillela, K., & Venugopal, C., 2013).

2.2.2 Data economy

Data economy is not a clearly defined term yet. Since multiple valid definitions are given, it can be defined as an umbrella term, which includes multiple aspects which will be described in the following.

The European commission defines data economy as an ecosystem of different actors which collaborate to ensure the accessibility and usability of data in different ways. In this ways market players are enabled to derive value, by developing a broad spectrum of usages with the ability to significantly enhance daily living (European Commission, 2017b). It includes creating, collecting, storing, processing, distributing, analysing, elaborating, transmitting, and utilizing data made possible by digital technologies (Azkan et al., 2019). The German Association for the Digital Economy adds the aspect of monetization of information based on obtained data that is converted into useful information using an algorithm and then made accessible based on business management functions. The association names five main actions in the data economy: i) data extraction and ii) data preparation, iii) information extraction, iv) information provision, and finally v) information utilization, in which value is created from raw data. Through advancing digitalization, a data economy can complement, adapt, or even replace current value creation methods as well as function as its own business model (German Association for the Digital Economy, 2018).

In conclusion, in the data economy, data is collected, shared, analysed, and used to create value. As a result, data has been called the new oil, as it becomes as valuable as oil and fuel in the modern economy. The overall driver for this development is the mega trend digitalization, which makes it possible to handle big data (Belaud et al., 2019). The immediate transfer of valuable data in agriculture and food sector has the potential to lower climate damaging emissions, incentivize producer as well as consumer to a more sustainable production and consumption, potentially decrease food waste (Bimbo et al., 2021) and, therefore, become the missing link to a circular agriculture and food economy.

The data economy in the agri-food sector refers to the economic activities and value creation related to the collection, storage, analysis, and use of data in the agriculture and food industry (Wolfert & Isakhanyan, 2022). Data is increasingly being used in the agri-food sector to improve efficiency, productivity, and sustainability, as well as to enhance the traceability and transparency of the food supply chain (Wolfert & Isakhanyan, 2022).

2.2.3 Model of European data economy

The *Modelling the European Data Economy* (EuDEco) initiative is a European Commission Horizon 2020 project that aims to contribute to the understanding of the data economy in the EU. The EuDEco developed a model, which describes the main elements of the data economy and the interdependencies between them. The model aims to help experts to understand the

complexity better. The project concluded that the data economy is a complex adaptive system (Bachlechner et al.).

The main elements are agents, artefacts, strategies, and environmental factors, which will be described in the following.

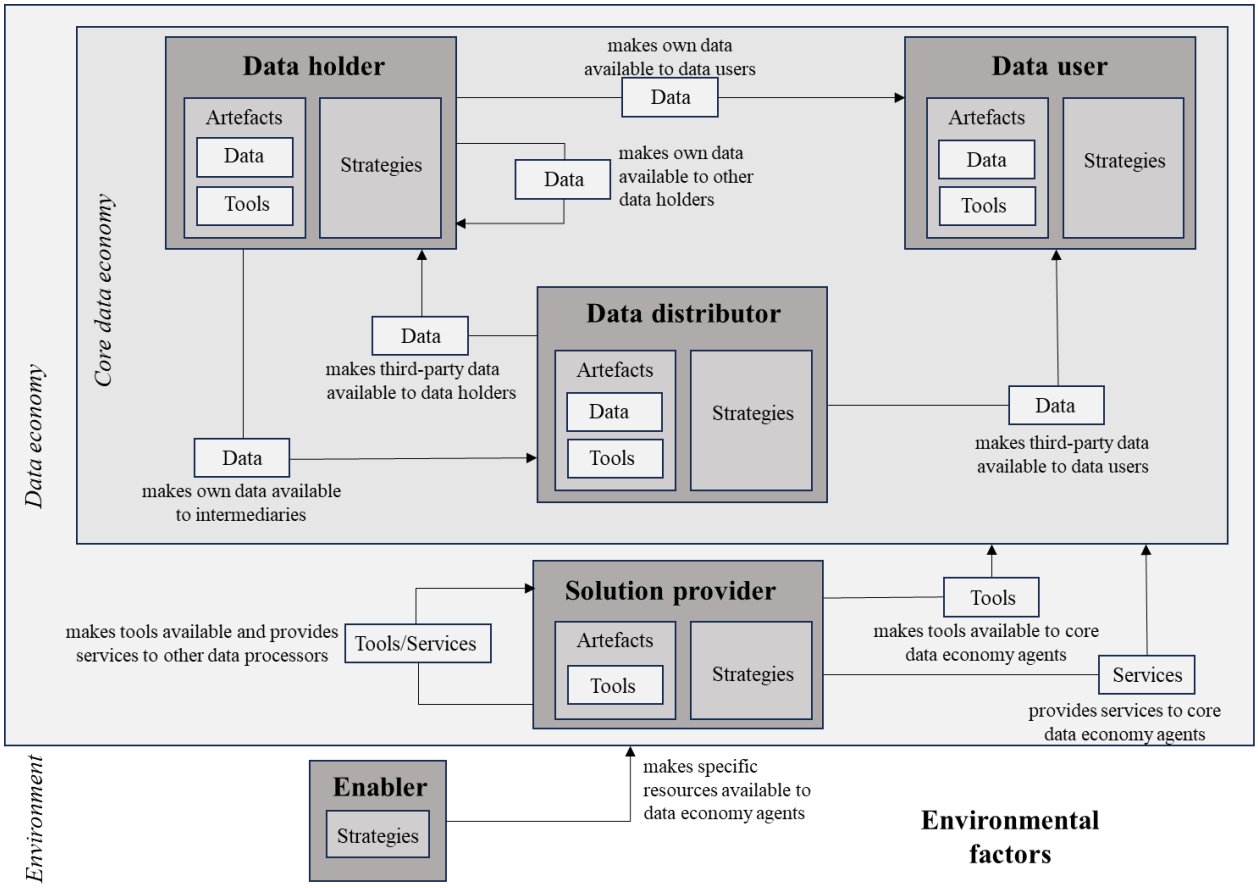

Figure 1: Model of the European data economy

Source: WP5 Recommendations and observatory D5.2 Final report– 29 January 2018

Agents interact with each other and can adjust to them and their environment. Agents act with a certain purpose and react to their surroundings. The group of agents in the model can be differentiated of data holders, data users, data distributors, solution providers, and enablers (Bachlechner et al.).

Artefacts are used as tools from agents, which may have characteristics that cause agents to behave in a certain way. The two main artifacts used by agents in the data economy are data and technologies (Bachlechner et al.).

Strategies define how agents respond to their environment and work toward their objectives. Strategies are permanently improving themselves, by observations of one's own actions, as well as the acts and successes of other agents (Bachlechner et al.).

Environmental variables influence the future development of the European data economy and determine its existing condition. The EuDEco has a strong emphasis on technological, socioeconomic, and legal aspects (Bachlechner et al.).

The three main players in the data economy are data holders, data users, and data distributors, who interact in the core data economy. Data holders are the players who create and collect data in the first place. The created data can be a by-product or a main product. Data users use the collected data for decision-making (Bachlechner et al.). Therefore, it is possible that data users are the same agents as the data holder. Data distributor's role is to make the data available to other parties and connect data holders (Bachlechner et al.). The three main players use more tools and services to use data in novel ways to produce high-value business and benefit the most from new business models. By using data and technology to promote value creation, they define the data economy. In the distribution step tools are used, which is provided by the solution providers, who support data activities with fitting technologies. In this way solution providers assist the main agents in collecting and valuing data from the data economy.

All other agents of the data economy and beyond receive resources from enablers, such as capital, standards, infrastructure technologies, or training. Enablers provide non-data-specific technologies and services in contrast to solution providers (Bachlechner et al.). Even though enablers are not directly involved in the data economy, they are important for its operation since they establish the environment.

3 THEORETICAL BACKGROUND

Within the era of agriculture 4.0, which is characterized by unprecedented technological advancements and rapidly changing global dynamics, the agri-food industry needs to adapt and embrace innovative strategies to meet the demands of a dynamic marketplace, like the changed sustainability demand of EU citizens.

This master's thesis chapter explores the key concepts and definitions relevant to the future of the food industry, focusing on strategic foresight, trends, scenarios, emerging technologies, disruptive innovation, the potential of digitalisation and the development of data ecosystems. By studying these concepts, we aim to shed light on how they can significantly disrupt the traditional food value chain.

3.1 Strategic Foresight

Strategic foresight encompasses methodologies and practices that allow organizations and researchers to anticipate and prepare for future challenges and opportunities (Georghiou, 2008). It involves studying trends, uncertainties, and potential scenarios to inform long-term decision-making and strategic planning (Berlage, 2020). In the context of the agri-food industry, strategic foresight plays a crucial role in understanding how emerging factors may reshape the value chain, thereby enabling stakeholders to position themselves advantageously. In the case of this thesis to enable SMF to position themselves into the framework of digitalization and consumers sustainability demand, by assessing trends and developing a scenario matrix.

3.1.1 Trends

A trend describes a profound social and cultural movement that will continue for at least a decade. It affects several areas of the consumer's life and a large part of society and the market (European Foresight Platform, 2022). It expresses original human needs and aspirations and predicts what their needs will be.

Trends can be divided in mega, meso, and micro trends, where mega trends influence on a global scale, a meso trend on national scale or micro trend on events, innovation, and phenomena (Postma & Papp, 2021). Digitalization is a mega trend, as it refers to a development in society that determines broad groups along all demographics, technologies, and politics. These mega trends can be labelled as driver for future developments (Postma & Papp, 2021). Meso trends influence not all but domains of society. Meso trends can be recognised in multiple sectors or markets, regions or nations and therefore have different appearances depending on the situation. Micro trends happen on a smaller base of events and phenomena and on a timeframe of smaller

than five years. Micro trends can be assessed as start-ups, innovations, and products and can have a similar form as an emerging issue. Monitoring micro trends helps to identify meso trends, but they change frequently (Postma und Papp 2021).

3.1.2 Scenarios

The scenario method is probably the most developed technique in the field of strategic foresight and has branched out into numerous derivative techniques. Scenarios are the archetype of foresight processes and describe potential developments of different futures (Bishop et al., 2007). Scenarios are critical for thinking creatively and deeply about the future. A future scenario is an insightful story about one or more possible future situations and can therefore be used for potential futures. They are based on currently available information. A scenario is also a description of the logical sequence of events and processes leading either in phases from the present to the future situation (predictive scenarios) or from the future situation back to the present situation (normative scenarios, back casting). Bishop et al. (2007) therefore defines a scenario as a product that represents a possible future state or tells the story of how such a state emerges.

The scenarios should represent developments for better or for worse. They should be plausible, relevant, but also challenging (Berlage, 2020). Crucial to the strategic foresight process, however, is the discussion of the extent to which futures can or even will differ from the present (Duinker & Greig, 2007). Therefore, questions on what the worst or the best case could be and what if questions are fundamental to the process.

Peter Schwartz, one of the major fathers of scenario techniques, sees scenarios as a tool to order the perception of alternative future environments in which one's decisions will have an impact. Alternatively, scenarios can be seen as a set of structured ways to effectively envision about our future.

It is important to note that scenarios do not merely extrapolate the trends of the present, as trend forecasts often do. For Schwartz, scenarios are designed to help people re-perceive the prevailing mental images of their environment. The task is to challenge assumptions about how the world works. The purpose of scenarios is to help change the view of reality. In this respect, the relevance of scenarios improves the more diverse the information and sources of information are.

Three types of scenarios exist. Predictive scenarios which answer the question "What will happen?", explorative scenarios answers, "What can happen?", and normative scenarios "How

can a certain future be achieved?". As this master thesis developed the scenarios with their dimensions before questioning experts, see chapter 4 - Scenario Dimensions, this thesis generates normative scenarios. Even though the scenarios are predetermined, with different dimensions levels in each scenario, the storyline of each scenario is based on experts-based influence diagrams and how they can be achieved. As the mega trends digitalization and sustainability demand of consumers have an uncertain development ahead for SMF in the EU.

The aim of working with scenario analyses is to simulate potential futures in terms of their characteristics and implications. In brief, scenario analyses answer the question of what could happen. In contrast, visioning describes what options for action one has against the background of a scenario.

To simulate potential futures the 2x2 scenario matrix is the most widely used method. It is also called the "double uncertainty" method. Each of the matrix axes represents a significant uncertainty dimension in the system under examination.

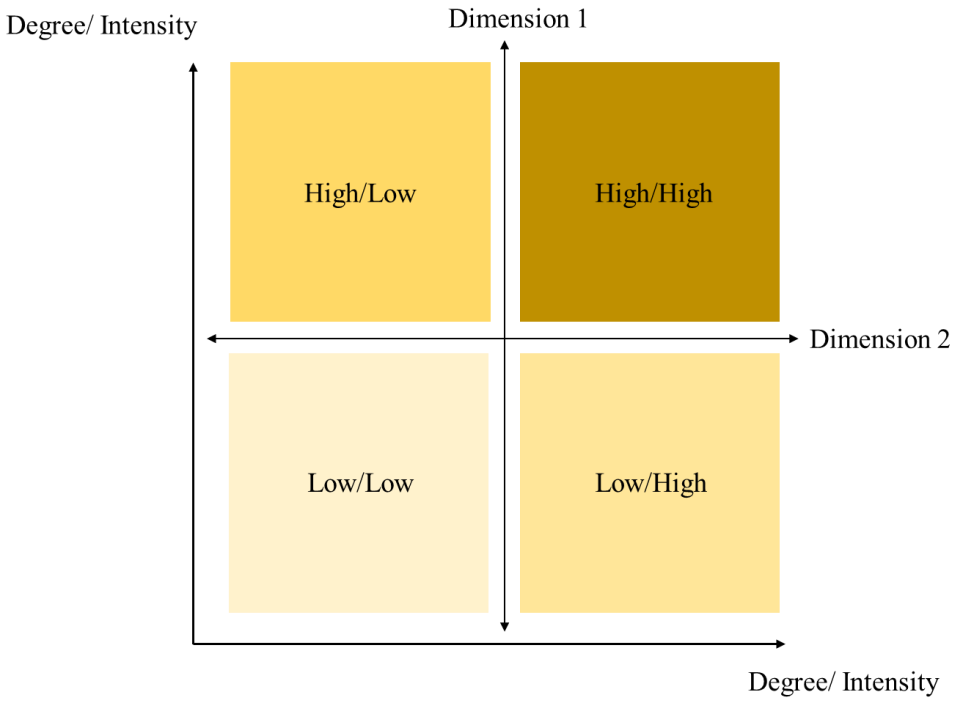

Figure 2: 2x2 Scenario Matrix

Source: Berlage (2020)

The opposite ends each indicate a strong or weak expression of the uncertainty. The scenarios then emerge in the quadrants of the matrix, from the connection of the uncertainties. If all the scenarios are considered equally plausible, it is impossible to decide which scenario to have faith in. Thus, it is necessary to prepare for all of them.

Scenarios are used in the context of uncertainty, which is also an important concept in the following theories: emerging innovation and disruptive innovation, as it is uncertain how an innovation or technology will develop in a new market. In addition, the increased use of big data and digitalisation in general, and the technologies used to implement a data economy, are often defined as emerging technologies or disruptive innovations. This is problematic because it is not clear to which theory the term data economy can be applied. Emerging technologies or disruptive innovations are also often used synonymously (Si & Chen, 2020), although they have different conceptual backgrounds and can be used in different ways. In the following, both concepts will be described in detail and then compared in order to gain a better understanding of both concepts and their clear distinction. To this end, both terms will be discussed in more detail in order to implement the appropriate formulation and place it in the correct theoretical context. First, both theories will be introduced, then similarities and differences will be analysed, and finally a conclusion will be drawn as to which theory best fits the data economy for the agri-food sector.

3.2 Emerging technologies

Rotolo et al. (2015) defines emerging technologies by five attributes: 1) radical novelty, 2) fast growth, 3) coherence, 4) prominent impact, and 5) uncertainty and ambiguity.

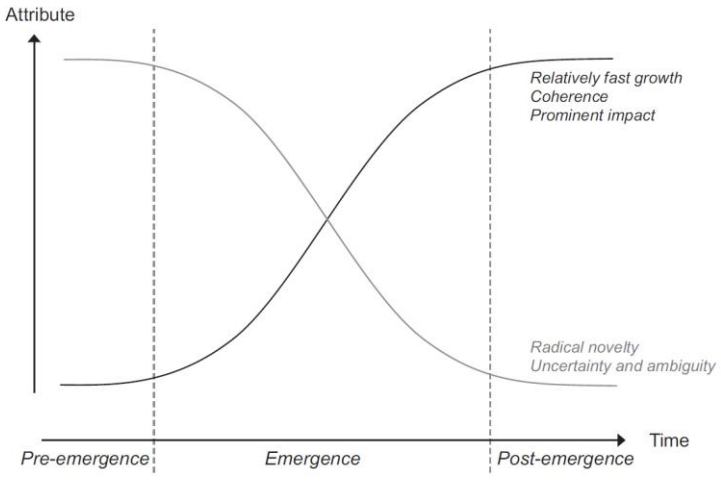

Figure 3: Attributes of trends based on Rotolo et al. (2015)

Radical novelty describes a newness of a technology itself or by using an existing technology in a new application. In the pre-emergence phase novelty is high and decreases as the technology develops (Rotolo et al., 2015).

Fast growth or relatively fast growth in comparison with other technologies, which needs to be conceptualized as what is operationalised in a distinguished dimension (Rotolo et al., 2015).

Technologies must have coherence over time, which means they must have characteristics of a group that sticks together, but also detaches itself from the group as it needs to sustain itself in the process of emerging as a complete technology (Rotolo et al., 2015).

A technology with a prominent impact can have both broad effect across domains and even the entire socio-economic system, as well as significant impact with confined scope (Rotolo et al., 2015). The attributes relatively fast growth, coherence and prominent impact are pre-emergence on a low attribute level, increase fast as the technology emerges and stays in a high attribute level as the technology is fully emerged.

The most significant impact of an emerging technology will be in the future, as it is still in development. Therefore, the emerging process includes uncertainties. Emerging technologies may be subject to ambiguity, as proposed applications may still be unclear, influential, or even conflictive. Affecting parties may have different views of values or meanings that underlie the technology, which may lead to a variety of possible outcomes. As radical novelty, uncertainty and ambiguity are high at the beginning of technology emergence and decrease with emergence, remaining at a lower attribute level once fully developed (Rotolo et al., 2015).

3.3 Disruptive innovation

Christenson (1995) introduced the term disruptive technologies and defined as "(…) a technology that changes the bases of competition by changing the performance metrics along which firms compete." (Bower & Christenson, 1995; Danneels, 2004). In the following years the term merged with the term disruptive innovations and has been used synonymously. As this suggests, the term and the theory have evolved as researchers have used it in different contexts and in different ways (Si & Chen, 2020). This resulted in four differed perspectives which Si and Chen (2020) have analysed and summarized in one comprehensive definition, based on a literature review to create. The resulted definitions will be described in the following, as this is the most recent definitions in the literature.

The first perspective is that a disruptive innovation is based on four activities: 1. disruptive business model innovation, 2. disruptive technology innovation, 3. disruptive product innovation, and 4. disruptive strategic innovation. The second perspective is that disruptive innovation is a developing process. The third is that disruptive innovation can only be defined after their disruptive effect they are making, like in performance improvement or an innovation

which greatly changes whole industries (Si & Chen, 2020). Si and Chen (2020) concluded that the main characteristics of different disruptive innovations are that it is a process, that its initial targets are a low-end market or an emerging market, that the innovation is initially inferior to what has already been implemented, that it does not evolve along existing path dependencies, and that the innovation evolves until it fully meets consumers' needs.

This results in the following adapted definitions, which accounts for the development of the theory within the academical use:

"An innovation process in which technologies, products or services are initially inferior than those provided by incumbents in the attributes that mainstream consumers value, but these technologies, products or services can attract and satisfy the consumers in low-end or new markets with advantages in performance attributes (such as being cheap, simple, or convenient) that these consumers value but which at the same time are neglected by mainstream markets. Over time, through incremental improvement of technology or process, a disruptive innovation gradually satisfies the needs of mainstream consumers, so as to attain certain market share from or even replace incumbents in mainstream markets" (Si & Chen, 2020).

3.4 Side to side of emerging technologies and disruptive innovation

The concepts of emerging innovation and disruptive innovation are frequently used synonymously, although they have different conceptual backgrounds and can be used in different contexts (Si & Chen, 2020). Disruptive innovations are used in strategic, and management papers, while emerging technologies are used in a broader context (Si & Chen, 2020). In scientific studies, for example for AI or big data, both theories are used as a theoretical background, as both technologies have characteristics of both theories. (Li, Porter, & Suominen, 2018). This ambiguous use is problematic, as it is confusing and undermines both theories on the same time (Yu & Hang, 2010; 2011). This is understandable as both concepts seem quite similar as disruptive innovation is defined as change in the competition of companies based of changing performances and emerging technologies have a radical and prominent impact on the business side, which could lead to a competitive advantage (Li et al., 2018). Both concepts have similar characteristics like novelty, high impacts, mature technology is overthrown by new technology, which causes discontinuity in the market, uncertainty relating to new technologies.

Although there are these similarities, the principal contrast lies in the fact that emerging technologies are still in the early stages of establishment. These technologies are either in a developmental phase or in the initial phases of commercialization (United States Congress, 1995). Therefor the concept of emerging technology is used for foresight papers, which assess

future scenarios with this technology. Disruptive innovations on the other hand have already disrupted the market, and therefore the concept is used in a retrospective way.

3.5 Usages of the theories in this thesis

This thesis assesses among other things, how the use of digital technologies at farm level in the EU will influence the farm performance of SMF in the next five years. New technologies such as AI, blockchain, and robotics are already used in different industries, but not so much in the already highly developed EU agriculture. Reasons are the high price of digitalization technologies on farm machinery, lacking trust in data exchange, compatibility issues among different platforms and machinery, lacking awareness of the benefits of digitalization.

Since this thesis looks at possible futures, by definition the concept of emerging technologies would apply. This concept is mostly used for foresight papers, particularly given that the state of these technologies is not yet as established in the agri-food sector as in other industries such as healthcare or automotive.

However, as it is not a single technology that is assessed for this thesis, but all digital technologies, their use would create a digital ecosystem in the EU agri-food sector, which could lead to the distribution of the whole industry.

4 SCENARIO DIMENSIONS

In this chapter, the scenario dimensions, the level of IT integration of the farms and the sustainability demand of the consumers, are defined and a current state is given, as well as the arguments for the choice of the dimensions. The dimensions together are the setting in which the SMF develop in the scenarios in five years from now. This framework for this thesis is visualized as a scenario matrix, in which the four scenarios take place. To analyse the environment of the dimensions and develop assumptions and conditions on how the dimensions might develop in the future, a PEST analysis for each dimension is conducted.

4.1 IT integration on farm level- Definition and current state

IT integration level describes the degree of how high the IT applications are interconnected on farm level (Wolfert et al., 2023). This level can vary, at the low end is the use of standalone apps. Then there are farm information systems, chain information systems, and at the highest level a system of systems where many stakeholders in a business ecosystem use data platforms or a complete data system (Wolfert et al., 2021; Wolfert et al., 2023). The IT integration is a fundamental necessity to implement a European data economy.

There is no explicit literature on how the IT integration of EU farms is currently. Similar measurements can be use or adoption rates of digital innovations or technologies. These are described as still being low rare on average (European Union, 2019; Finger et al., 2019; Walter et al., 2017). Another measurement of IT integration could be the adoption rate of precision farming technologies. In comparison with other countries with highly developed agricultural practice such as the United States, Australia, and South America the EU is very low in their IT integration on farm level, this is seen as the precision agriculture in these countries is significantly higher than in the EU (Lowenberg-DeBoer & Erickson, 2019). Regardless of the type of production the usage of forecast models, applications, and online communication and trade platforms, these digital technologies have the greatest adaption rates, with up to 38% in Germany (Gabriel & Gandorfer, 2023). These tools are typically free or very affordable and have an easy access. The acceptance rate of complex digital technologies, meaning innovations which are difficult to understand, such as NIR-sensors, variable-rate applications and soil sensor systems is low among Bavarian farmers (Gabriel & Gandorfer, 2023). Reasons for this is smaller farm size, but also the farms in the region are often operated by part-time farmers, which results in less motivation, capital and time to learn and invest in specific equipment (Gabriel & Gandorfer, 2023). Other reasons for low adaption rates of digital technologies are uncertainty of the benefits of the adaption, missing skillsets by the farmer, and high investment costs

upfront (Garske et al., 2021). Further is the digital infrastructure for the adoption often just deficient, such as internet coverage (Garske et al., 2021).

The highest adoption rates of digital technologies in crop farming are digital field records, automatic steering systems, and satellite data created maps in Germany (Gabriel & Gandorfer, 2023). Since these adaption rates ranged from 21-14% it can be stated that the technologies are still emerging, and the IT integration is rather low. In Germany, digital technologies that simplify the work or increase the yield have become established, but not in order to obtain positive environmental effects (Gabriel & Gandorfer, 2023).

Leading digital technology in European livestock farming, are farm management systems, barn cameras, and animal behaviour sensors (Borchers & Bewley, 2015). The implementation of robotics, such as automatic milking systems, has experienced a global surge, mainly in the Netherlands, France, and Scandinavia leading in Europe (DeKoning, 2010). Reasons for the adoption are attain greater flexibility for the workforce as well as increasing animal welfare (Straete et al., 2017; Vik et al., 2019).

Even though the adaption of digital technologies is low and more complex technologies are missing acceptance, when a particular technology's relative advantage becomes clear, small-scale farmers have more reason to digitize, experts foresee (Gabriel & Gandorfer, 2023). Therefore, if a quick return on investment of a digital technology can be accomplished or the need for a technical shift is reinforced externally, such as changing regulatory frameworks for agricultural production, adoption rates of specific technologies may climb sharply in the future. Although Bavarian farmers can hardly be considered highly digitalized, Gabriel & Gandorfers (2023) results showed that Bavarian farmers planning to adopt technology like barn robotics, section control, variable-rate applications, and maps derived from satellite data at a pace of 15-20% during the next five years.

Overall, the IT integration level is fragmented in the EU, depending on the country and agribusinesses systems. But it can be stated that overall SMF in the EU have a lower IT integration in comparison to other countries like the US and Australia, where farms are characteristically larger (Gabriel & Gandorfer, 2023). Reasons are smaller farms, lacking in digital infrastructure, and high investment costs (Garske et al., 2021). But farmers begin to see the benefits of digitalization and are planning to invest in the technologies in the coming five years.

4.2 Sustainability demand of EU consumers - Definition and current state

Consumer demand for sustainability refers to consumers' desire for products and services that are environmentally friendly, socially responsible, and economically viable. EU Consumers responded to concerns about environmental and social issues of industrialized agriculture by consumer-based food movements, such as slow food and farmers market, local food, community-supported agriculture, ecolabels and fair trade (Isenhour, 2011).

Sustainable agriculture production means that they are produced without degrading the soil and other environmental products, so that they can be farmed in the same way in the future (Hobbs et al., 2008). This could be an organic farming practice, a regenerative farming practice or even a conventional farming practice that takes sustainability into account at every stage of production (Manshanden et al., 2023; Velten et al., 2015). Therefore, locally produced conventional agricultural products can also be a suitable sustainable option for consumers. Transparency and appropriate food labelling is a much needed tool to communicate the environmental and social benefits of a product to the consumer (Brown et al., 2020; Lam et al., 2020). In this demand, digitalisation can help to verify and prove the real value of a product to the consumer, and farmers can price their products accordingly (Wolfert & Isakhanyan, 2022).

The EU believes that organic farming is the more sustainable farming method and has set a target in its Farm to Fork strategy that at least 25% of the EU's agricultural land should be farmed organically by 2030 (European Commission, 2022; Kowalska & Bieniek, 2022). Therefore, organic farming will be further promoted to farmers through an action plan that also aims to increase demand for organic products by ensuring consumer confidence, increasing demand through campaigns and green public procurement (European Commission, 2020).

The demand for organic produce is drastically increasing in the EU and is expecting to grow 9,4% each year (Kowalska & Bieniek, 2022). The retail sales of organic agricultural products in Europe are highest in Germany and France, with around 15.9 and 12.7 billion Euro, respectively (Shahbandeh, 2023). Germany has the largest organic market, but Switzerland and Denmark have the greatest per capita consumption rates (Shahbandeh, 2023). Around 104 Euro are spent per person on average in the European Union. In terms of organic retail sales, Denmark leads the pack as of 2021, followed by Austria and Luxembourg (European Parliament, 2018). European consumers tend to buy organic goods to support regional businesses, for health reasons, and to prevent away from pesticides and other sprays, among other things (European Commission, 2023; Shahbandeh, 2023). Despite these motivations,

consumers are very price sensitive regarding food. The majority of respondents said they would probably spend an extra 5% for organic food. However, just 14% of respondents said they would be willing to pay more than 10% more for organic goods (European Parliament, 2018).

Depending on which measure for sustainability regenerative, seasonable, or locally produced food can be also classified as sustainable. But since these production types don't follow an EU definition, the market share and demand cannot easily be quantified as with the organic production (Manshanden et al., 2023). While the general sustainability awareness and following the demand is rather high in the EU in comparison, the consumer is still price sensitive for their food, and opt for cheaper option, when other prices increase (Madre & Devuyst, 2016; Nechaev et al., 2018). This was for example the case with the invasion of Russia in the Ukraine, which lead to an increase in energy prices, which followed a decrease demand in organic food (Rehder, 2023). Overall has the demand for local food products significantly increased (Aprile et al., 2016). Individuals which are aware of environmental issues and have adopted green behaviours are more likely to buy locally produced food than others (Bimbo et al., 2021). Further factors are age, education, job security are connected to local purchases (Bimbo et al., 2021). Living in small communities and buying organic are predictors for local consumption (Bimbo et al., 2021).

The results from (Röös et al., 2022)suggest in their scenario analysis, that the planted implementation high organic production niveous are not enough to reach sustainability and environment targets of the EU. Their results show that large-scale implementation of agroecological practices don't improve but could worsen the environment, if the demand of the EU consumers not also changes for more sustainable agriculture produce (Röös et al., 2022). It showed that to reach EU policy targets it is necessary not only to implement organic farm practises are needed but also drastic dietary change and waste reduction from consumer side are necessary (Röös et al., 2022). Therefore, the consumers demand is a necessary variable to address when the EU wants to reach their climate and environmental targets. To increase the demand for organic or sustainable farm produce green marketing has become a useful tool (Aceleanu, 2016).

4.3 Digitalisation's impact on food value chain and arguments for the choice of scenario dimensions

The transfer of big data in agriculture promises to increase efficiency, transparency, quality and sustainability (Belaud et al., 2019; Garske et al., 2021). The first step towards achieving a data ecosystem for food is for farms to digitise their processes so that data can be collected, analysed, and used (Wolfert et al., 2023). In the process of digitalisation of farms, it is not so much the individual technology that is disruptive, but the consequences of the EU-wide use of digital technology could be enormous (Dolfsma et al., 2021). With the use of all kinds of data, the entire food supply chain would have to change and consequently be disrupted. The linear value chain would evolve into a data ecosystem (Wolfert et al., 2023), in which all stakeholders are interconnected. As the level of digitalisation of farms can be measured by IT integration, the level of IT integration in EU agriculture is a crucial dimension to assess the potential future of EU agriculture in terms of the potential data economy for the food industry. The future assessment of the level of IT integration is interesting for several reasons, the development is uncertain. For this thesis technological and social uncertainties are interesting to assess.

The digital technology sector in agriculture is still emerging, resulting in technological uncertainties and a lack of established handling practices. There is currently no common digital technology in the sector or no single data exchange platform where all data is shared and processed. As a result of the many different players in the agricultural and IT sectors, different technologies are emerging for this market, which in the practical life of farmers leads to a lack of compatibility between digital technologies, sensors and agricultural machinery (Klerkx et al., 2019). This situation leads to uncertainty about how digital technology might evolve and adapt to the rapidly changing environment in the agricultural sector.

In addition to technological uncertainty, the social aspects of digital technologies should not be underestimated. Ultimately, farmers will decide whether to adapt to the digital technologies. As the adoption of digital technologies in the EU and especially in the SMF is rather low compared to other developed countries such as the US, New Zealand or Australia (Gabriel & Gandorfer, 2023), it is uncertain how the adoption might change. Several factors could influence the willingness to adapt, such as education level and trust in data sharing, (Klerkx et al., 2019). Due to the high age and different education levels of European SMF, it is a rather heterogeneous group, which brings uncertainty about how farmers will adapt in the future (Klerkx et al., 2019).

The other critical dimension for the performance of SMF operations is the sustainability demands of consumers. As consumers increasingly prioritize sustainability and ethical

considerations, the food industry must respond by offering environmentally friendly and socially responsible products. This section examines the challenges and opportunities in aligning the food value chain with the growing sustainability demands of consumers. An increase in consumer demand for sustainability would be indicated by an increase in willingness to pay for such a product, as well as an increase in awareness and supply of sustainable products. The future development of consumers demand of sustainability is highly uncertain, and therefore interesting to research in a scenario analysis. The demand has been slow but steady increase in the last two decades, but with short-term demand slumps in demand due to increased living costs (Rehder, 2023). Change in demand can be explained by high price volatility in food and as consumers are normally price sensible, but this is not the case for more expensive sustainable products, where prices are more elastic (Aigner et al., 2019)

Other changing factors are how accessible the products are and how they are marketed. Examples can be how discounters are more advertising and selling organic food, which leads to an overall higher sells number and therefore demand for sustainable food (Katt & Meixner, 2020). Further are social factors which could influence the sustainably demand, such as changing awareness for food production, sustainability, environment effects and health. Also, the overall education for sustainable foods might be changing.

Both dimensions have a significant impact on agriculture productivity, as digitalization can enhance productivity and sustainability, while consumers demand could have an indirect impact on the sustainability of agriculture.

The understanding of the interplay of the dynamic of digitalization and consumers demand can become critical to the economic viability of the agriculture sector, as higher IT integration level can lead to cost savings, increased competitiveness, while high consumer demand for sustainable and high-quality product can create market opportunities. The dimensions therefore can directly influence the farm performance of SMF. This scenario analysis is therefore a valuable tool for the risk assessment and strategy adjustment of such farms.

4.4 Scenario Matrix

The combination of the described dimension leads to following scenario matrix, which will be the framework for the following scenario analysis.

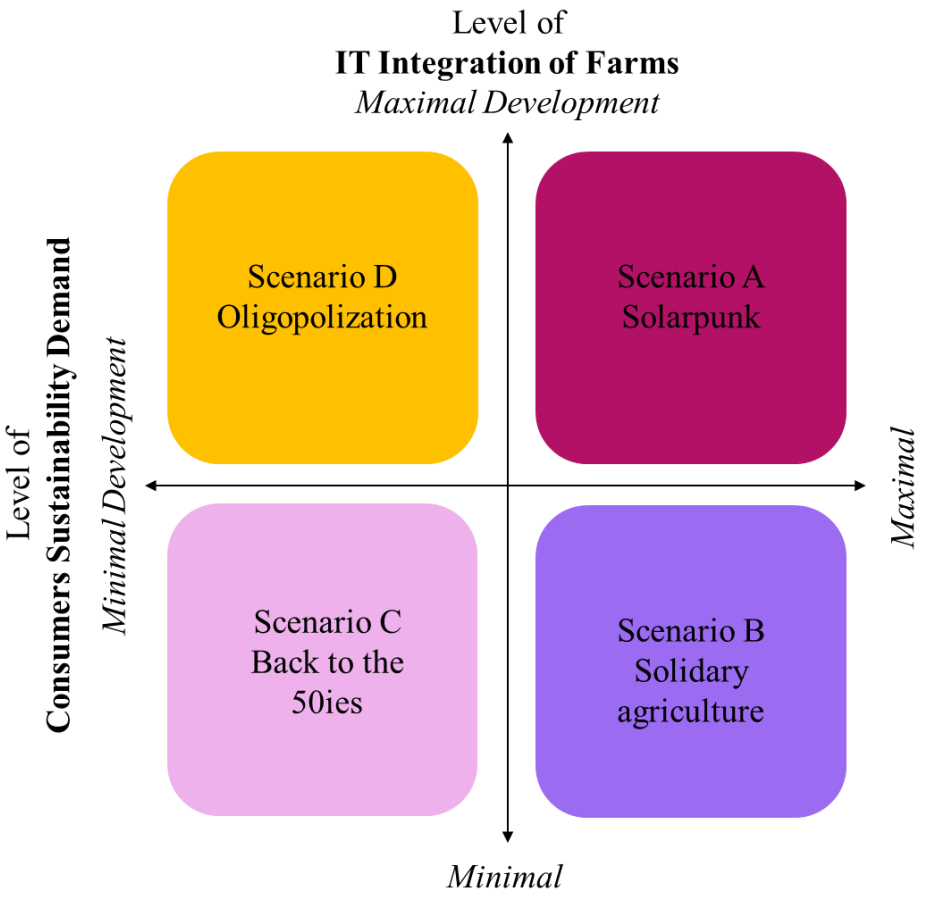

Figure 4: Scenario matrix of IT integration level and consumers sustainability demand

Source: Own visualization, based on own data

In the scenario matrix it can be observed that in scenario A farms and society reached maximal development in IT integration on farm level and maximal level of consumers sustainability demand. In scenario B the IT integration is minimal, while the consumers demand for sustainability is high. In scenario C both dimensions are minimal. In scenario D the sustainability demand is minimal, while the IT integration has maximal developed in the next five years. IT integration on farm level is the positive development "High IT integration with data ownership for the farms", the negative development would be "Low IT integration with low data security on the farms". On the dimension consumer sustainability demand, the positive development is "increased sustainability demand of consumers" and the negative development is "decreased sustainability demand of consumers". This way each scenario each of the four scenarios get a concise description, with various developments within the scenarios.

4.5 Scenario dimension PEST-analysis

Based on this scenario matrix a political, economic, sociological, and technological – analysis (PEST-analysis) is conducted to gain understanding which conditions can have a high influence of the dimensions level. A PEST analysis is used to scan a business environment, it is necessary, to define the scenarios beforehand (Carruthers, 2009). To gain a better understanding of how different levels of each dimension can be reached, a PEST-analysis of both IT integration level and consumer digitalization demand is conducted, to analyse the external environment and therefore the conditions in which SMF operates. This analysis serves to enhance the insight into the contextual background against which scenario development occurs and to derive assumptions and conditions, how the scenarios could develop.

4.5.1 PEST-analysis - IT integration on EU farms

The IT integration on farm level is driven by the influence of political, economic, sociological, and technological factors which are described in the following. The analysis can help determine to which level IT integration can be expected within the next five years.

Politic

EU policies have a major impact on the level of IT integration on EU SMF as they influence production with CAP, Green deal, Farm to Fork strategies and other policy interventions (Alons, 2017; European Commission, 2019; European Commission, 2020).

EU policies are responsible for subsidies for digitalization on farms and sustainable practices to reach a circular and sustainable food system (Hartley et al., 2020). Policies are needed to provide EU-wide internet coverage and a general working data infrastructure platform (Gabriel & Gandorfer, 2023). These subsidies need to be high and accessible to all farmers to reach a high level of IT integration. For digital investments, SMF need financial support, such as affordable loans. Inversely, low measures, such as not high enough subsidies or with low accessibility, expansive loans, or no further digital support, may influence farmers not to further increase the farm IT integration and widens the gap between the EU and better digitalized countries. But the EU funding landscape is highly fragmented and complex, a wide range of financial tools are available, but due to the complexity not as accessible (Verbeek et al., 2019).

Data sharing policies and data security policies also influence the level of IT integration (Garske et al., 2021). The farmer needs the right for their data ownership in a workable way (Garske et al., 2021). That is, the policy cannot be overprotective that there is no incentive for data sharing

(Garske et al., 2021). Therefore, data security policies can have a positive or negative impact on IT integration.

Economic

In a general good economic situation, where inflation, taxes, unemployment rates and interest rates are low, it should be easier for SMF to invest in digital technologies and increase the level of IT integration. Also, low labour availability could incentivize farmers to automate their farm. Vice versa, an economic crisis in which inflation, taxation and unemployment rates are high can reduce investment in digital technologies and have a negative impact on IT integration (Garske et al., 2021).

Sociological

Sociological factors which influence the IT integration level are the demography and education of the farmers (Gabriel & Gandorfer, 2023). Further their values, like trust levels, regarding digitalization and technology and innovational change can influence the IT integration positive or negative (Wiseman et al., 2019). Also, their income level and the awareness for the benefit of digital innovation is a factor (Gabriel & Gandorfer, 2023). Further the fairness perception of data sharing and digitalization innovations are meaningful. Also the risk-aversion in investing of farmers a rather high, due to the demand of high safe standards, and strong competition in the field (Verbeek et al., 2019). Also the agri-food sector is seen as conservative, in investing in new technologies (Verbeek et al., 2019). These factors can influence the IT dimensions positively or negatively.

Technology

For high IT integration, technology development and research must be founded, and executed, new products and processes must be developed and integrated into the existing digitalisation system (Verhoef et al., 2021). The IT infrastructure needs to be improved, such as internet coverage. For low IT integration, as it is now, no further development is needed. Also, the impact of the technology might be influential, to the adaption. Farmers prefer incremental rather than disruptive innovation, since they highly rely on tried and testes technologies (Verbeek et al., 2019).

4.5.2 PEST analysis - Consumers sustainability demand

The PEST analysis reveals possible political, economic, sociological, and technological conditions for changing the consumers demand for sustainable food produce.

Politic

Politics can incentivize consumers to environmentally friendly shopping behaviour by promoting awareness and education about the benefits of sustainable food consumption, as well as the environmental impact of different food choices, through public campaigns and educational programs (WBAE - Scientific Advisory Board on Agricultural Policy, Food and Consumer, 2020).

Also, with education politics can increase awareness for environmental and sustainability issues, and how consumers can contribute to it (Pe'er et al., 2020). Furthermore, policy can increase the transparency for sustainable produced food via labels and advertisement (Brown et al., 2020) way consumers sustainability demand can be increased from political side. On the other side, when this is not applied to the consumers, demand is not further political incentives and might stagnate.

Economic

In a good economic situation consumers have money to spend and can more easily afford more expensive sustainable food. Job security and low inflation, taxation, and interest rates, as well as dept level help to increase the consumer's demand. This is since high income increases the demand for organic food (Nechaev et al., 2018). Further sustainable food options need to be available and accessible (Kennedy & Givens, 2019). On the other hand, when the economic situation is rather bad, with high unemployment level, high inflation, taxation, interest and dept rates it decreases the consumers demand for more expensive sustainable food options (Aprile et al., 2016).

Sociological

On a sociological level, the factors of demographics, education, values, security, and lifestyle are important to consider on how the demand for sustainable production can be influenced. As of now, the demand is mostly driven by middle-aged women with high education and a secure income level (Aprile et al., 2016)These women are also aware of environmental issues. Another factor is that married persons also have an increased demand for sustainable food. Therefore,

an increase in demand can be predicted as women become more educated, earn more, and become more responsible for spending, whether in families or as single households.

To further increase demand, it would be necessary to market sustainable products more to men and less educated demographics. In addition, sustainable food practices and shopping can be taught to increase awareness and the impact of food choices (Rustam et al., 2020). A decrease in demand could occur if environmental awareness decreases, income decreases, or environmental education decreases, due to different reasons.

Technology

On the technology side, increasing transparency through increased digital data collection and sharing, which is then translated into labels or QR codes, can increase consumer demand for sustainability (EIT Food, 2022). This could happen through new processes and technologies or technology transfer from different industries.

4.5.3 Literature research on influencing factors of dimensions

The snowballing literature research on factors which influence the matrix dimensions IT integration level on farms and consumers sustainability demand resulted in 16 factors which are applied to four categories': Social and technology factors which influence the digitalization of farms and social and technology factors which influence the consumer sustainability demand. The factors are listed below:

Categories	**Factor**	**Source**
Digitalization – technology	Compatibility of machinery, data, and digital platforms	(Sadjadi & Fernández, 2023), (Chaterji et al., 2021), (Lin et al., 2016 - 2016)
Digitalization – technology	Access to digital platform for data sharing	(Sadjadi & Fernández, 2023)
Digitalization – technology	Access to digital services	(Sadjadi & Fernández, 2023)
Digitalization – technology	Compatibility of data platforms and machinery	(Saiz-Rubio & Rovira-Más, 2020), (Thomasson et al., 2019)
Digitalization – technology	Internet coverage	(Sadjadi & Fernández, 2023)
Digitalization – technology	Internet access	(Sadjadi & Fernández, 2023), (Gargallo-Castel et al., 2010)

Digitalization - social	Education level of farmers	(Sadjadi & Fernández, 2023), (Chaterji et al., 2021)
Digitalization - social	Willingness to adapt digitalization technology	(Sadjadi & Fernández, 2023)
Digitalization - social	Trust in data sharing technology	(Sadjadi & Fernández, 2023)
Digitalization - social	Attitude towards digital agribusiness	(Sadjadi & Fernández, 2023)
Sustainability demand-technology	Availability of sustainable farm produce	(Kostadinova, 2016)
Sustainability demand-technology	Ecolabeling of sustainable farm produce	(Kostadinova, 2016)
Sustainability demand-technology	Product value and quality of sustainable farm produce	(Kostadinova, 2016)
Sustainability demand-technology	Retail environment of sustainable farm produce	(Kostadinova, 2016)
Sustainability demand - social	Willingness to pay more for sustainable farm produce	(Wei et al., 2018)
Sustainability demand - social	Level of concern regarding environment	(Wei et al., 2018)
Sustainability demand - social	Level of awareness regarding sustainability	(Galbreth & Ghosh, 2013)
Sustainability demand - social	Attitude towards sustainable products	(Matharu et al., 2021)

Table 1: Influencing factor overview

Source: own literature research

This list of influencing factors is later used in the Delphi study as well in the following scenarios. The influencing factors and the results of the previous PEST analysis is used to outline the following possible scenario, as well as assumptions drawn from empirical literature, common knowledge, and the authors interpretation.

4.5.4 Scenario A- High IT integration and high sustainability demand- Solarpunk

In scenario A the level of IT integration at farm level is high, meaning that all relevant factors of agricultural production are digitally measured, all data is collected and stored, analysed, and used by AI to make data-based recommendations. Digitalization is exceeding as farmers adapted 20% more digitalization technologies, such as barn robotics, variable rate application and satellite data (Gabriel and Gandorfer, 2023). Preferred technologies are user-friendly automatic solutions which reduces the overall workload (Gabriel and Gandorfer, 2023). The data-based recommendations are following economic and sustainability standards. Farmers' trust in data-sharing technologies is high, as they will not suffer negative consequences and will only benefit from sharing their data with traders and consumers. Farmers are financially incentivised to share their data, as all economic and sustainability conditions are met thanks to AI.

Also, in scenario A the level of consumer sustainability demand is high. The high investment costs for the farmers in these technologies are financed by the high sustainability demand of the consumer, who is willing to pay more for sustainably produced products. The consumer is willing to pay for a data membership in the local agriculture and food platform to compare agricultural products based on quality, sustainability and regionality. With increased transparency in the food value chain, consumers are regaining trust in the food industry. Supermarkets and food distributors lose their relevance as the farmer markets directly to the consumer via the digital platform.

Figure 5: Solarpunk universe in a studio Ghibli style by concept artist Jessica Woulfe

Source: https://www.artstation.com/artwork/9NJ28q

This scenario could potentially lead to a solarpunk future where humanity overcomes the ecological crises of living beyond its needs and resources. In the solarpunk scenario, humanity manages to live in harmony with nature through the use of technology.

The performance of SMF increases dramatically as demand for their products increases, as does the infrastructure to market their products and technologies that reduce their costs in the long term.

4.5.5 Scenario B- Low IT integration and high sustainability demand- Solidary agriculture

In Scenario B, increased concern for health and the environment leads consumers to buy high quality local food, and they are directly connected in communities to their supplying farms (Bimbo et al., 2021). Concerns are rising due to the impacts of climate change and the increasing number of natural disasters (Singh & Purohit, 2014), and sustainability awareness rises. After a sense of powerlessness (Kennedy & Givens, 2019) has spread among EU citizens, the movement of solidaric agriculture marketing is positioning itself positively, as a way to have a positive impact in the world, and produce sustainable food in a community. This movement leads to a high increase in solidaric agriculture communities all over the EU. The communities develop a diverse, decentralised, and short agri-food chain, in which food is produced sustainable and locally. SMF directly benefit from this development. As the work of the farmers increases in appreciation, and citizens re-educated themselves in farm practise such as permaculture, regenerative agriculture, and agroforestry.

Figure 6: Break of the field works of the solidary agriculture by concept artist Jessica Woulfe

Source: https://www.artstation.com/artwork/xJ45XR

Newly acquired knowledge is used to help and work with farmers. As a result of the rise in labour force, there is no requirement for technology to decrease it, and farmers have opted not to invest in further digital advancements, except for using IT for weather forecasting and direct communication with their communities. Farm profits do not directly increase because fewer high-value crops and livestock are produced. But with solidarity farming, the financial risk is spread through the communities, resulting in a lower psychological burden on the farmers.

4.5.6 Scenario C- Low IT integration and minimal sustainability demand- Back to the 50^{ies}

With both IT integration and the sustainability customer demand being at their lowest levels, trust in data sharing technologies has significantly declined. This is because shared data is no longer under the control of the farmer and can be exploited by any corporation in any manner deemed appropriate. Due to rapid increasing housing and energy prices, consumers just don't have the income to spare for high quality groceries. This results in a demand drop for expensive organic and regional products and consumers look for cheaper food options.

Figure 7: Farmer cultivates his field with a simple tractor

Source: https://www.dailydemocrat.com/2021/05/24/facing-a-drought-californias-farmers-make-hard-choices/

Farmers struggle from the price pressures on the market, input factors become very expensive, demand for high value such as sustainable and regional vegetables, meat, or eggs are not in demand. Farm performance for SMF drastically declines as marketing activities are not effective.

4.5.7 Scenario D- High IT integration and minimal sustainability demand- Oligopolization

In this scenario its assumed that consumers are price driven and therefore have little motivation to buy high quality and sustainable food. Since the demand is low, organic, and other sustainable practices are decreasing, which effects SMF immediately. The number of small stakeholder farms declines, as large-scale farms buy their land and invest in high digitalization, as high processed food is in demand, with little natural variation. Large farms use the increasing scale effects of producing in increasingly larger scales, are forcing any competition out of the market, and the oligopolization of EU agriculture is in dispute.

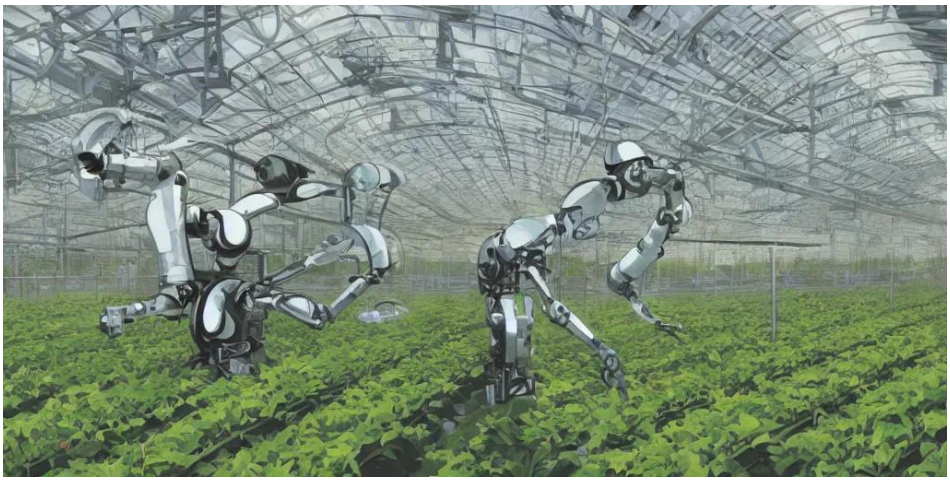

Figure 8: Futuristic automated vegetables farm by Gregory Manchess, John Picacio and Brom

Source: https://search.krea.ai/prompt/448e670c-f738-42b1-b08e-832fbe7cfc19

At the same time, agri-food corporates are gaining drastic profits from the specialised digital and platform products, which are needed for the digital compatibility of different agriculture processes. The use of data is unclear and not targeted to specific visions such as sustainability and rural development.

SMF run out of business, as the market pressure is too big, even though they digitalized, they cannot use the scaling effects as big farms, and as they cannot marketing high quality and sustainable food there is not niche left for them. They sell to the next bigger farm and have to encourage the development even further.

5 METHODS

The following chapter describes the research design, and the framework of the Delphi study. This is followed by the detailed description of all steps of the data collection and analysis to assess possible future scenarios.

5.1 Research design

The research design is an exploratory predictive Delphi study that combines qualitative and quantitative approaches to anticipate potential and predict future scenarios for EU agriculture in the interplay of digitalization and changing consumers demand regarding sustainability, by using multiple iterations of data collection on experts' assessments and an expert focus group. A Delphi study is used to collect experts' opinions on a specific topic, with yet limited research on to reach a consensus in an uncertain forecast. By using anonymous surveys, the group influence is minimized, and multiple iterations are used to compress the experts opinion, based on previous rounds (Berlage, 2020). The results are further discussed in an online focus group, where the experts develop influence diagrams to forecast plausible future scenarios and discuss their opinions. The research focuses on the dimensions IT integration level on EU farm operations and the sustainability demand of EU consumers and aims to shed light on how the interaction between IT integration on farms and the evolving consumer sustainability preferences within the EU might influence the farm performance of SMF.

The primary data collection method is expert surveys and expert focus groups, using an interrogative design. The selection of participants was based on contacts made at the PhenoRob Career Fair on the 8th of May, organized by the chair group *PhenoRob - Robotics and Phenotyping for sustainable plant production* at the University of Bonn, personal contacts of the author, and contacts on the social media platform LinkedIn. The reached panel of experts, represent various fields including agriculture, technology, sustainability, in industry, research and consultancy. A detailed description of the panel can be found in Table 2: Attending experts on the focus group 27.06 and Table 3: 2. Attending experts on the focus group 04.07.

The research design can be classified as an ex post facto design, as the researcher does not control or manipulate variables (Blumberg et al., 2014). The study aims to report and anticipate potential future developments based on expert opinion and current trends. The predictive study analyses how the farm performance of SMF will be influenced in the future along the dimensions of the level of IT integration at the EU farm level and the sustainability demand of EU consumers. The two dimensions are the independent variables whereas the average farm

performance is the dependent variable. The study uses a cross-sectional approach, where data is collected at a single point in time, with each of two expert groups (Blumberg et al., 2014). The research is conducted under field conditions, as online surveys and online expert focus groups are administered to experts in real-world settings.

5.2 Research Framework Delphi study and focus group

The research framework of the Delphi study consists of six steps, alternating between data collection and data analysis. Part of the Delphi study is an expert focus group, this combination offers diverse perspective of a range of experts, a real time interaction which offers in-depth exploration as well as clarification of contradictions of the experts' opinions. Further immediate feedback is given, and qualitative insights can be archived. Additionally, this combination offers time efficiency, as the expert focus group condenses multiple survey rounds as well as it improved consensus. Increased validity could be achieved by cross-referencing and validating the results of the survey with the discussions of the experts in real time. In the first iteration, a literature review is conducted to explore possible key drivers, trends, and uncertainties relevant to the research topic. This step involves gathering information from previous studies to find technical and social factors which influence the matrix dimensions.

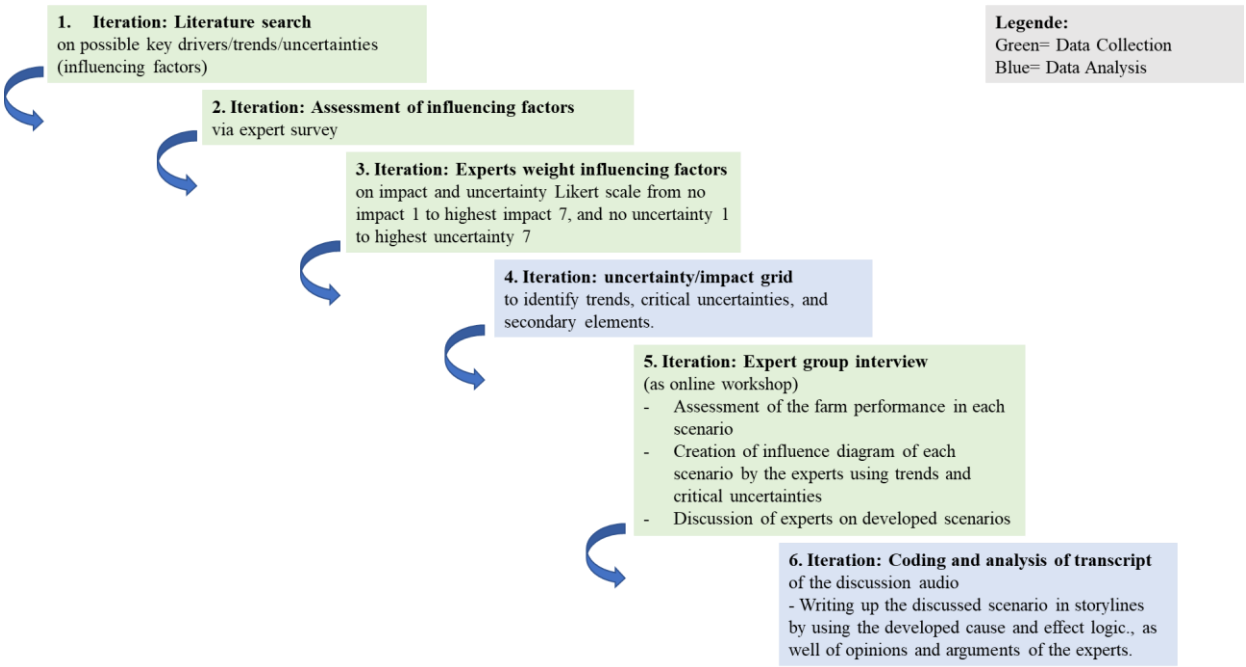

Figure 9: Research framework Delphi Study

Source: own data

The literature review results in a list of social and technological factors influencing the dimensions IT integration level on farms and consumers sustainability demand, the factors are

listed in chapter 3.7.3 Literature research on influencing factors of dimensions and are used in chapter 3.7.4 – 3.7.7 in which possible scenarios are described based on assumptions, from literature and the authors expectations based on the conditions mentioned in the PEST analysis previous.

In the third iteration, the identified influencing factors are assessed by the experts via an online survey, considering their perceived impact and uncertainties on the dimensions under examination, the complete questionnaires can be viewed in appendix II. QUESTIONNAIRES OF ONLINE SURVEYS.

In the next step of data analysis, the assessed factors are applied to an uncertainty/impact grid according to their ranking of the experts. Factors high in impact are categorized into trends, actors which have a high impact and uncertainty are categorized as critical conditions, while other factors scoring relatively low are common conditions.

In the uncertainty/impact grid it becomes clear which forces have the biggest potential of influencing the future performance of SMF. These will be used by the expert in the focus group discussion to develop individually influence diagrams, which will explain how the different scenarios will be reached within the next five years.

The created influence diagrams follow a cause-and-effect logic. The focus groups are recorded and transcribed, so that the scenario development can be retraced. Based on the results, the scenarios will be written up in a storyline which matches the logic of the influence diagram and the answer to the questions of the two dimensions which co-developed in the scenarios. The experts' opinions are synthesized to describe different possible scenarios. To do so, their opinions are systematically collected and aggregated for each scenario. To further gain depth and accuracy of the expert's insight, contrasting opinions analysed on how the arguments for them are made and how accurate they are as well the argument are weighted based on literature and the experience of the expert.

5.3 Data collection and analysis

In the following chapter the data collection for this thesis is described in detail. To collect data, a literature search on secondary data is conducted, resulted in influencing factors which are than rated by experts in a survey, followed by a group expert discussion, in which the influencing factors, among others are discussed.

5.3.1 Literature search on influencing factors

The literature search for this study was conducted to comprehensively explore the influencing factors, which are trends, uncertainties, and driver of certain developments, that shape the dimensions of sustainability demand and IT integration levels on farms. The goal was to identify and synthesize existing research, theories, and empirical findings that provide insights into the factors affecting these dimensions within the agricultural context.

A systematic literature review was tried to apply with the following sampling search string ALL= ((Trend OR Uncertainty OR Driver) AND Agriculture AND European AND Digitalization AND Sustainability) on the database Web of Since, core collection. Since only one paper could be identified and although through robust test with other search combinations and databases no further results were found. Therefore, the literature search was extended non systematically with the following search terms *Trend, Uncertainty, Force, Driver, Agriculture, Agri, Food, European, Digitalization, IT Integration, sustainability, performance, data, data economy* in different combinations as well as a snow balling yielding results from the literature search. Search strings with IT integration level and consumers sustainability demand resulted in no qualified results when combined, therefore operationalisation of these concepts is done of the over topic of digitalization and sustainability. The literature search was conducted on the database Web of Since, core collection, ScienceDirect and Scopus and from mid-May till Mid-June (12.05-22.06.2023). As this literature research was not conducted as a systematically review, with the described process it was aimed to be as inclusive and exhaustive as possible.

Literature was selected first based on fitting title, which would indicate that factors were used to assess the digitalization of EU farms or the consumers sustainability demand. Further the abstract was checked on relevant data. All empirical literature on IT integration level needed to be collected within EU farms. Sustainability demand was not only papers on agricultural produce but also a t-shirt retail paper, that assessed the choice making nudge of consumer sustainability demand (Galbreth & Ghosh, 2013).

Literature was analysed by reading through the whole paper and marking influencing factors in the text or in their given analysis of the respective papers. The found influencing factors where than listed, and only social and technical factors were selected to fit the research question.

5.3.2 Online survey on participation and demographics

To assess of the expert will participate one what date and to collect both their demographic data as well as their expertise a short online survey was conducted. This was necessary for

scheduling the different experts as well as make sure a certain level of diversity and expertise is given. The survey questionnaire is attached in the appendix II. QUESTIONNAIRES OF ONLINE SURVEYS.

The online survey resulted in the following two tables, which describe the characteristics of the experts:

Table 2: Attending experts on the focus group 27.06

Expert	Field of experience	Professional position	Occupation	Name of the company or organisation	Organisation type	Years of experience in	Age group	Gender	Nationality
Expert # 1	Agriculture; Digitalisation; Sustainability;	Project Manager	Research Manager	CLAAS E-Systems GmbH	Industry	30+ years in agriculture research	55-64	Man	German
Expert # 2	Agriculture; Economics; Politics;	Employee	Analyst/ Consultant	AFRY Management Consulting	Consultancy	10+ years in practical farming on family farm	25-34	Woman	German
Expert # 3	Agriculture; Sustainability; Economics;	Employee	Trainee in sustainability management	VERAVIS	Consultancy	5+ years in practical farming, +apprenticeship	25-34	Man	German
Expert # 4	Agriculture; Sustainability;	Researcher	PhD researcher	Wageningen University and Research	Academics	2 years research	25-34	Woman	German

Table 3: Attending experts on the focus group 04.07

Expert	Field of experience	Professional position	Occupation	Name of the company or organisation	Organisation type	Years of experience in	Age group	Gender	Nationality
Expert # 5	Sustainability; Agriculture; Digitalisation;	Team Manager	CEO	farming revolution GmbH	Start-up	6 years farmers as direct clients	25-34	Man	German
Expert # 6	Agriculture; Sustainability;	Project Manager	Project Manager Business and Biodiversity	Global Nature Fund	NGO	10+ years in practical farming on family farm	25-34	Man	German

The panel of experts that attended the Delphi study consists of six agriculture experts. The sample group is German and rather young; therefore, it can be stated that this research represents the German viewpoint of the younger generation on the future of the EU agriculture. Below are the results of the demographic survey of the experts,

All experts stated that they are experts in agriculture, additionally in and or sustainability, digitalization, economics, or politics, when they could give multiple answers.

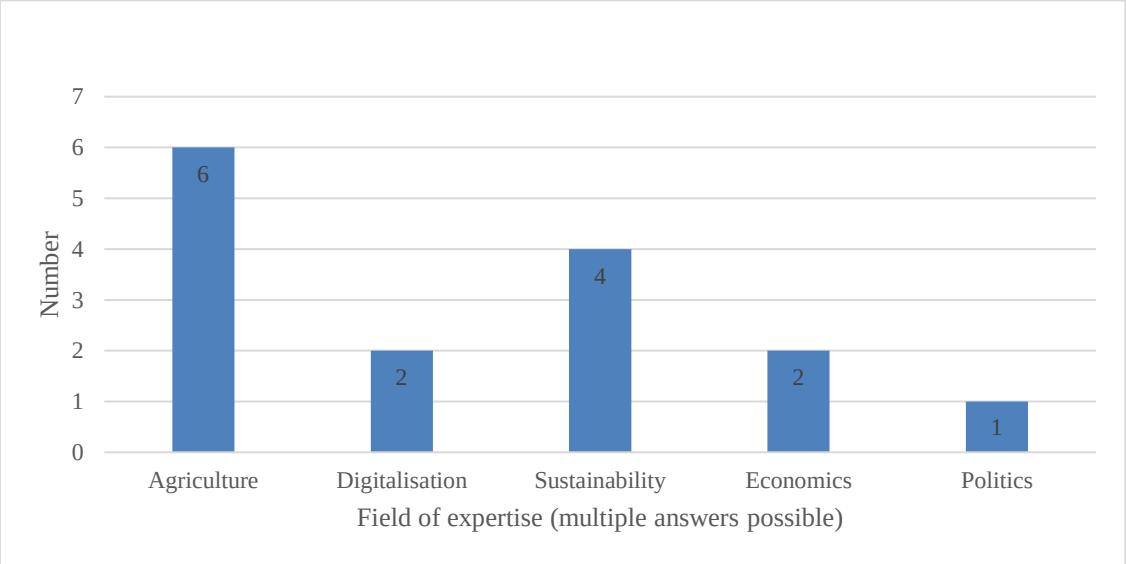

Figure 10: Field of expertise of participating experts

Source: own data

Two of the six participants are women, the rest are men. Most of the participants are in the age group from 25-34, with just one man in the age group of 55-64.

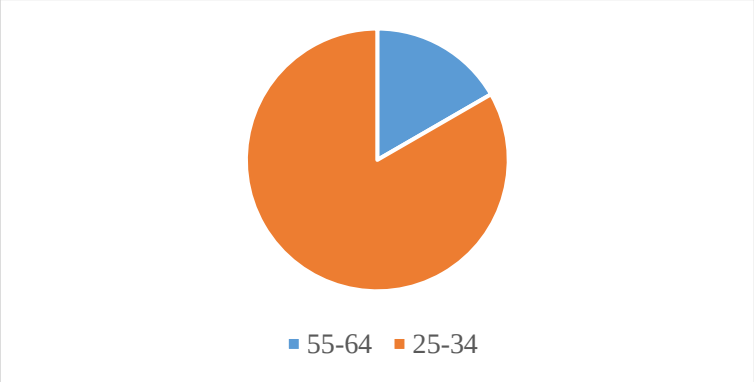

Figure 11: Age groups of participating experts

Source: own data

The expert group is homogenous in their expertise, age, and nationality. But there are very different viewpoints due to the types of organization they work with.

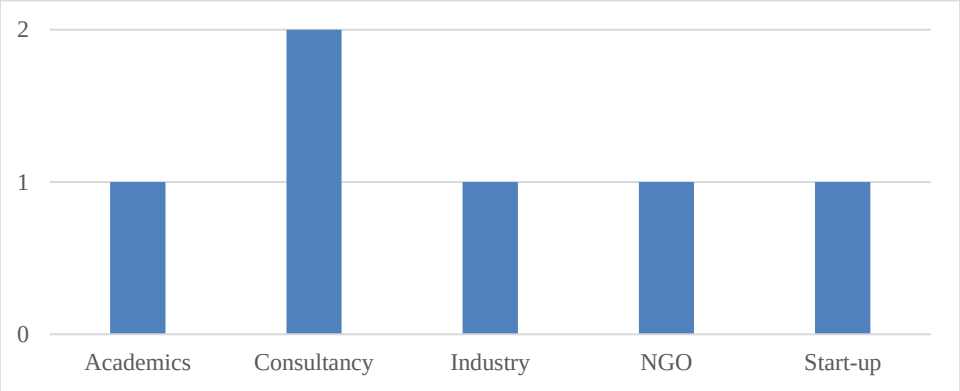

Figure 12: Organization types of participating experts

Source: own data

They all relate to agriculture but within different organization types. All answers of the demographic survey can be seen in a detailed table in the appendix.

5.3.3 Online survey on influencing factors

To build scenarios, relevant trend and uncertainties needs to be analysed (Schwenker & Wulf, 2013; van 't Klooster & van Asselt, 2006). To further assess which factors from the literature search, have the highest uncertainty and impact, they are assessed by exerts based on the quantitative survey. The experts are asked to assess each factor according to their uncertainty and impact on each of the dimension's digitalization and consumers sustainability demand on the farm performance on SMF in EU within the next five years. Both social and technological factors were assessed according on their uncertainty and impact level on both dimensions, on a 7-step Likert scale from no impact or uncertainty to highest impact or uncertainty. The online survey was conducted on Microsoft forms and the link to the survey was send out a week before the respectively online expert group discussion. The survey questionnaire is attached in the appendix **II. Questionnaires of online surveys.**

The Likert scale was translated from no impact or uncertainty equals 1 to 7 for highest impact or uncertainty, to calculate the average. Since the six highest average values of impact and uncertainty together are selected as further used influence factors in the Delphi study, as trends or critical conditions. All factors are placed in the uncertainty and impact grid, due to their expert's assessment of average impact and uncertainty.

5.3.4 Impact/ Uncertainty grid

The quantitative data from the previous survey is used to conduct an impact/uncertainty grid, in which the influencing factors are categorized in common conditions with low impact, at the bottom on the graph, trends which have high impact but rather lower uncertainty, and critical conditions, which have both high impact and high uncertainty (Schwenker & Wulf, 2013).

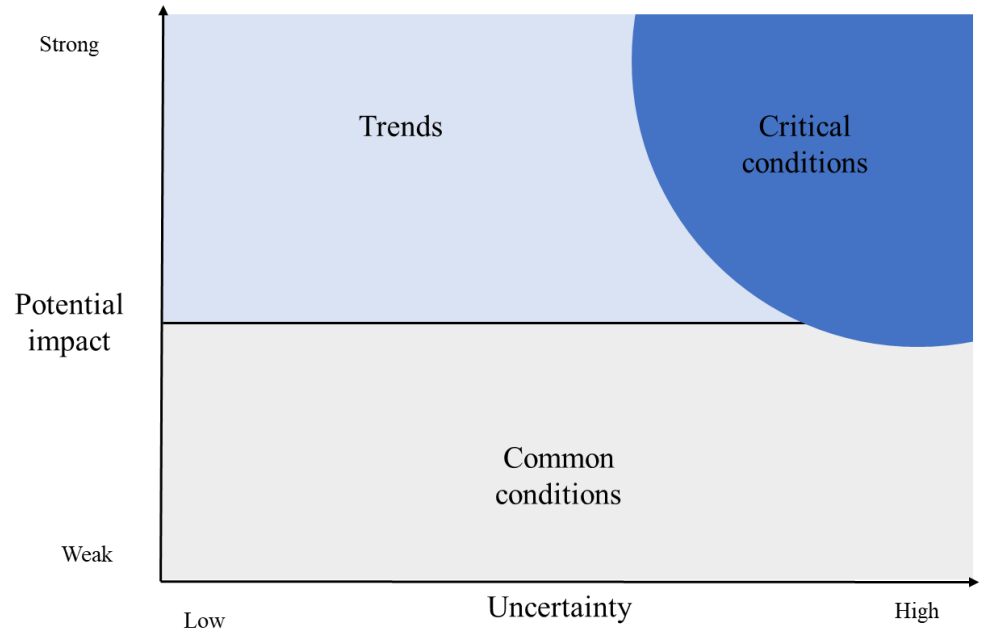

Figure 13: Impact/Uncertainty grid adapted from Schwenker, Wulf (2013)

Source: Wolf (2013)

The impact/uncertainty grid is used to identify the trends and critical conditions and to exclude the common conditions to get a manageable number of factors to develop the influence diagrams. Since trends and critical conditions have high potential to influence the dimensions within the next five years (Schwenker & Wulf, 2013) they are used by the experts to develop the influencing diagrams. Whereas common conditions will be available for the experts to use in the influence diagrams as well, but they are asked to first make sure to use the critical conditions. The common conditions can be used to further explain the development of the scenarios and underpin their argumentations. The first group of experts answered the second survey completely before the group discussion; therefore, the data could be used to create the uncertainty impact grid, which resulted in the following graph:

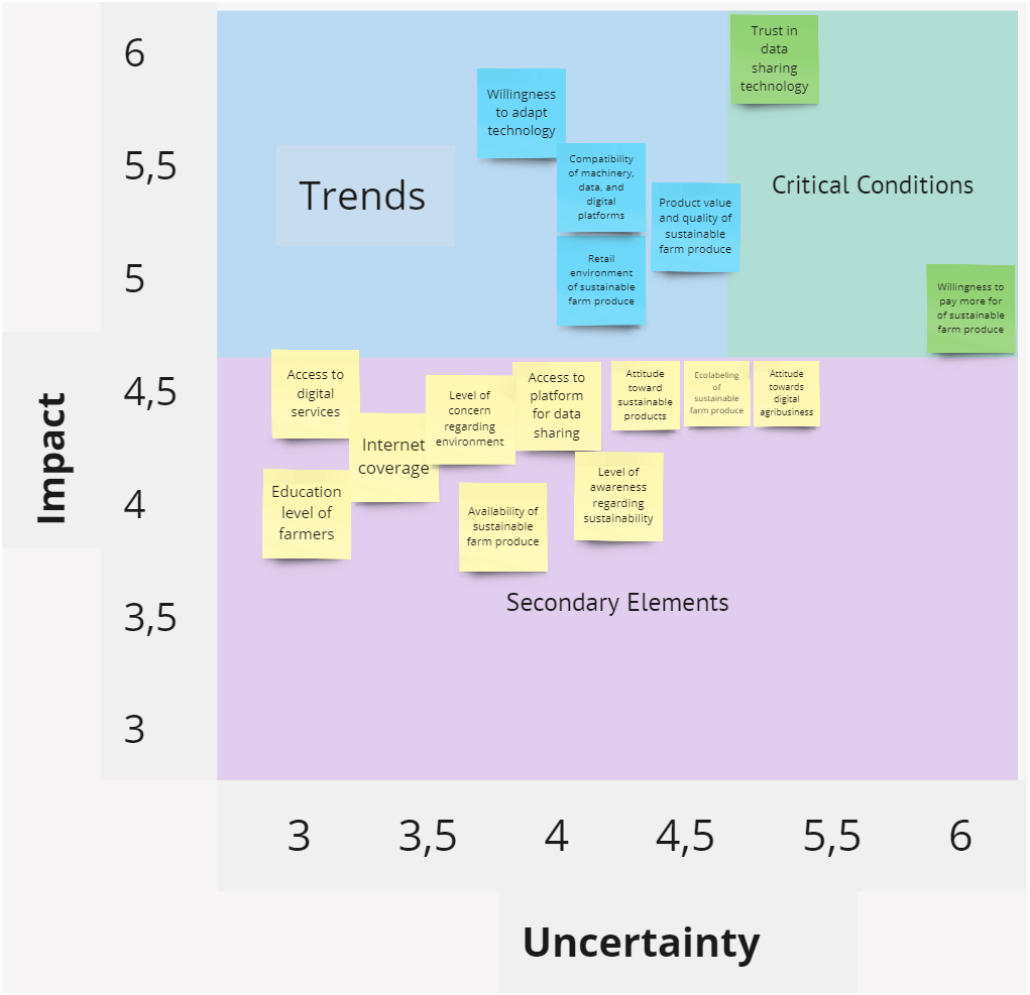

Figure 14: Results of the impact/uncertainty grid

Source: Own visualisation on miro, based on own data

Due where the factors are positioned in the uncertainty/impact diagram it resulted those four trends (*Willingness to adapt digital technology, Compatibility of machinery, Data and digital platforms, Retail environment of sustainable farm produce, Product value* and *quality of sustainable farm produce*), as well as two critical conditions are (*Trust in data sharing technology* and *Willingness to pay more for sustainable farm produce*) are further analysed. These identified trends and critical conditions were further used by the experts to create the influence diagrams, and the remaining common conditions were mainly left out but could be used by the experts, when it was applicable to their influence diagram.

Since not all experts of the second group did the survey, the same results of the first group survey, meaning the same impact/ uncertainty grid from the first group were used also in the second group discussion. In this way the same factors were discussed, and the developed influence diagrams can be compared.

5.3.5 Expert group discussion

Due to scheduling experts, two expert group discussions were conducted. The group discussion took place in an online workshop atmosphere, using the online whiteboard tool miro. Both discussions were audio recorded and later transcribed. The expert group meetings took place on the 27.06.2023 with four experts and 04.07.2023 with two experts. For the later discussion, two other experts were registered who could not attend spontaneously. Two test runs were conducted, to make sure the participants would understand the workshop, reduce technical issues, and to practice the moderation and time management. The expert group discussion took about 90 minutes and had the same miro board with the same activities each time. The activities are an icebreaker to get to know each other and to get to know the controls of miro, the assessment of the farm performance of EU SMF in all scenarios, the development and discussion of influence diagrams for each scenario by each expert. In the following each activity is detailed described as well as the task instructions which were given to the experts.

Introduction of the research and the workshops agenda

First the workshop facilitator, which is also the author of this thesis introduced themself and described shortly the tasks of the group discussion and the agenda.

Introduction to the miro board

Due to feedback from the training workshop rounds, an introduction to the miro board as online whiteboard with its functionalities seemed necessary. Therefor all major functions were described and visualized with videos, as well as a field was given, where the experts could try out the functions. The exact functions were moving around, zooming in and out, make comments, following the facilitator, writing sticky notes, and using arrows.

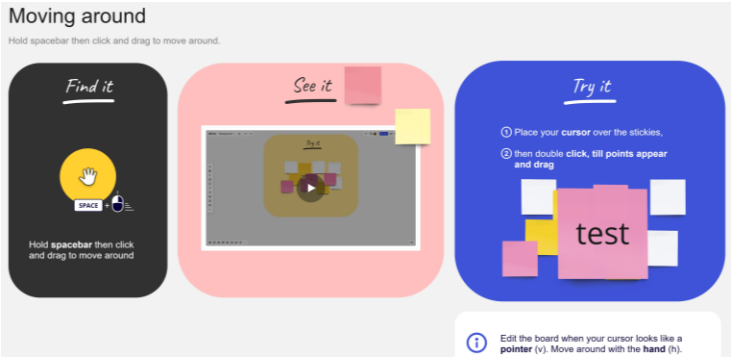

Figure 15: Example of miro board testing for the experts

Source: Own visualisation on miro

The exact task instructions that were given by the facilitator:

"For today's meeting, I thought it would be good for us to try out the Miro board. Here are the most common commands. Please feel free to try them out, click on the videos and familiarise yourself with the tools."

Icebreaker for the experts

Third step was an icebreaker for the experts, with the two functions that the experts get to work on the miro board and use the functions they just learnt and as well as get to know each other better with an introduction round.

Figure 16: Icebreaker and introduction round of the experts

Source: Own visualisation on miro

Each experts got a designated space to answer questions and introduce themselves on the board. The exact task description from the facilitator was: "Now that we've all seen how this works, we're ready for the first exercise, where everyone will introduce themselves and answer one of the questions given. I would like to spend a few minutes getting to know you. Choose a board below and write something about yourself. Use the arrows and other stickers provided. You can drag one of the questions and answer it on your board. Then we'll take a gallery walk to find out more about you. Please start, there is no right or wrong, I gave an example, but I had more time. Add what you would like to share from your side. You have 3 minutes."

Objectives of the expert group discussion

In the next step the objective of the expert group discussion as well as the background of the research was described in detail. The scenario matrix with the dimensions is displayed as well as the definitions of the dimensions.

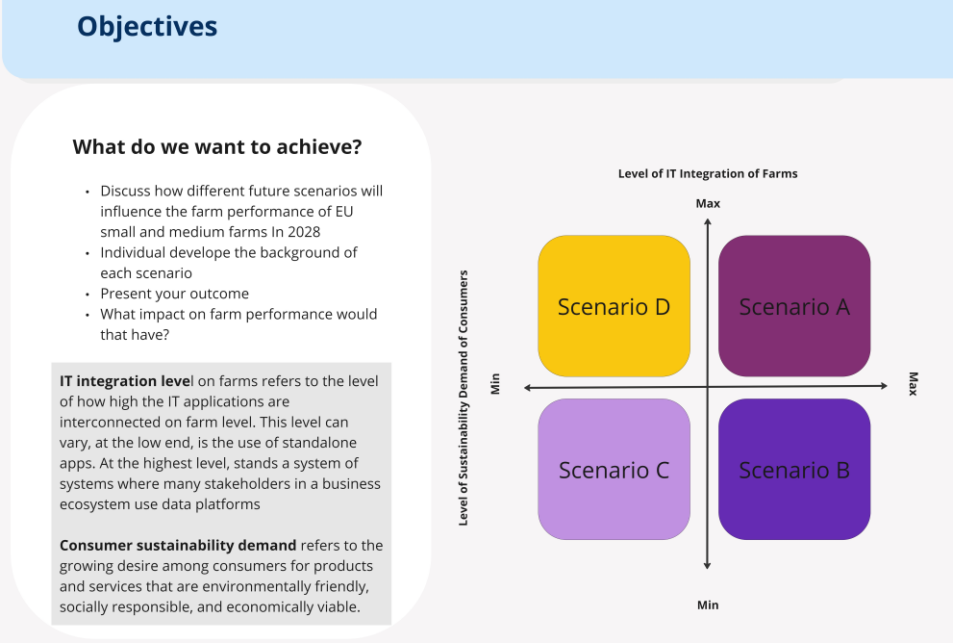

Figure 17: Screenshot miro board, objectives, and dimension definition

Source: Own visualisation on miro

This step secures that all experts talk about the same objectives and know what the aim of the group discussion is. The visualisation of the scenario matrix helps to understand what is behind each scenario.

Instruction and assessment of the farm performance

In the next step the experts were asked to assess the farm performance in each scenario by click and drop one of five different arrow stickers on each scenario in the matrix.

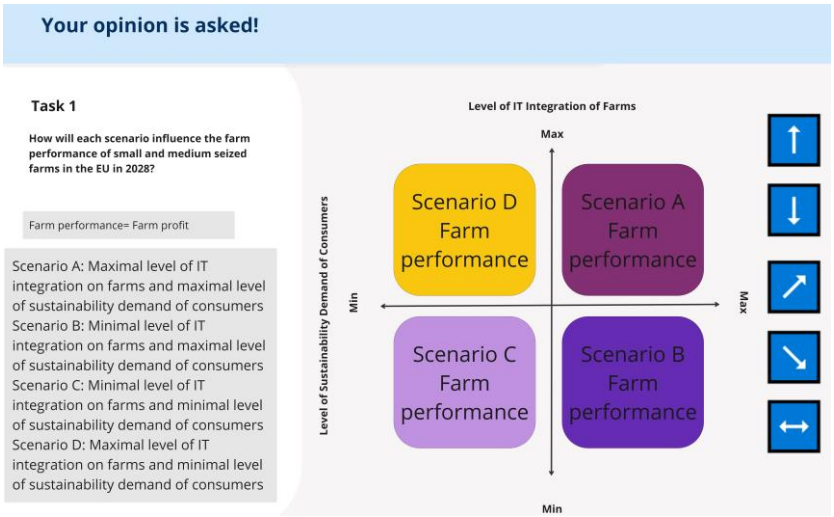

Figure 18: Screenshot miro board, farm performance assessment task

Source: Own visualisation on miro

The different arrows that are used assessed to each scenario is seen on the right side of the figure. The experts were asked by the facilitator: “How will each scenario influence the farm performance of SMF in the EU in 2028? Please assess this in your own boxes, which are down with your names on. Use the arrow stickers for comparable results”. For clarity the dimensions level of each scenario is described.

Presentation of the survey results

After the experts assessed the farm performance in the different scenarios, the survey of the expert’s assessment on the influencing factors regarding uncertainty and impact level are presented by the facilitator. In each workshop the results were found worthy of discussions by the experts.

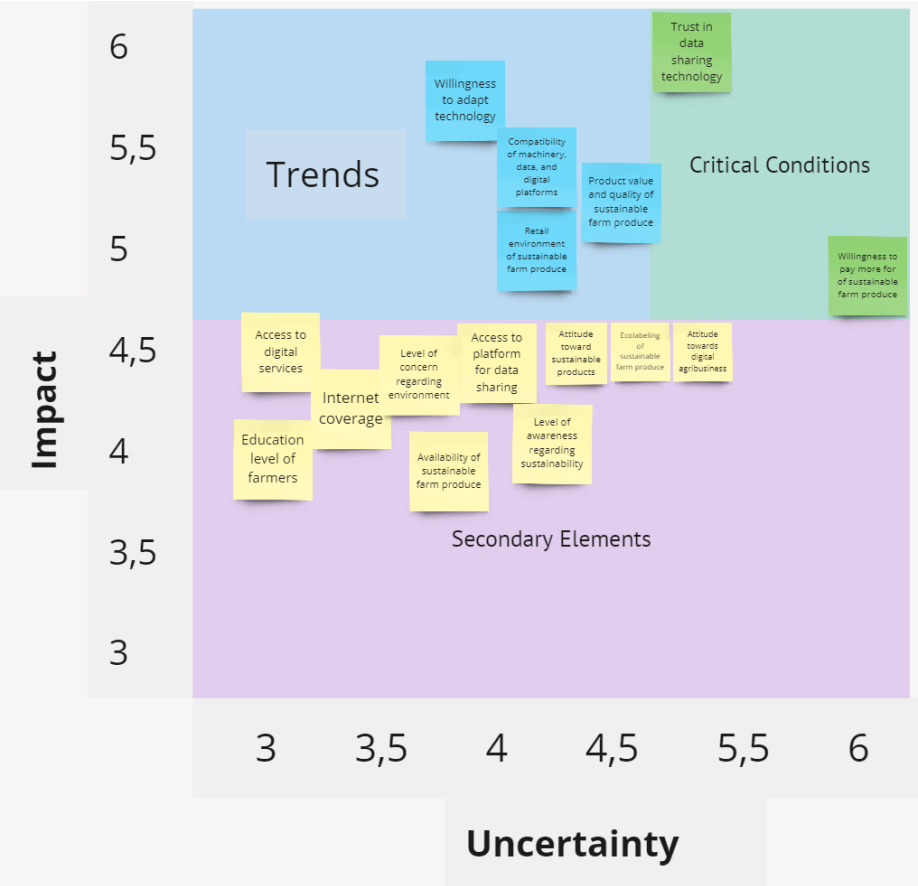

Figure 19: Results of the impact/uncertainty grid

Source: Own visualisation on miro, based on own data

The analysis of the results is then presented, as factors with high impact and high uncertainty are classified as critical conditions, while factors with lower uncertainty but comparable high impact are classified as trends. Factors with low impact are classified as common conditions, which are excluded due to the low impact they are expected to have in the future.

5.3.6 Influence diagram

The influence diagram is the story behind each scenario in the matrix. The influence diagram describes how the scenarios will develop and what development is needed for each scenario to take place. To create one for a scenario, experts are asked to visually relate the critical conditions and trends and indicate their potential impact on each other along the five-year time dimension.

In the workshop the facilitator explains the experts how they have to conduct the four influence diagrams for the scenarios. The task of the experts is it to determine the relationship of the critical conditions and trends and assess how they influence each other. To do so they were presented first with a definition of an influence diagram, task instructions and with an example influence diagram. To not bias the experts, no defined verbal examples were made.

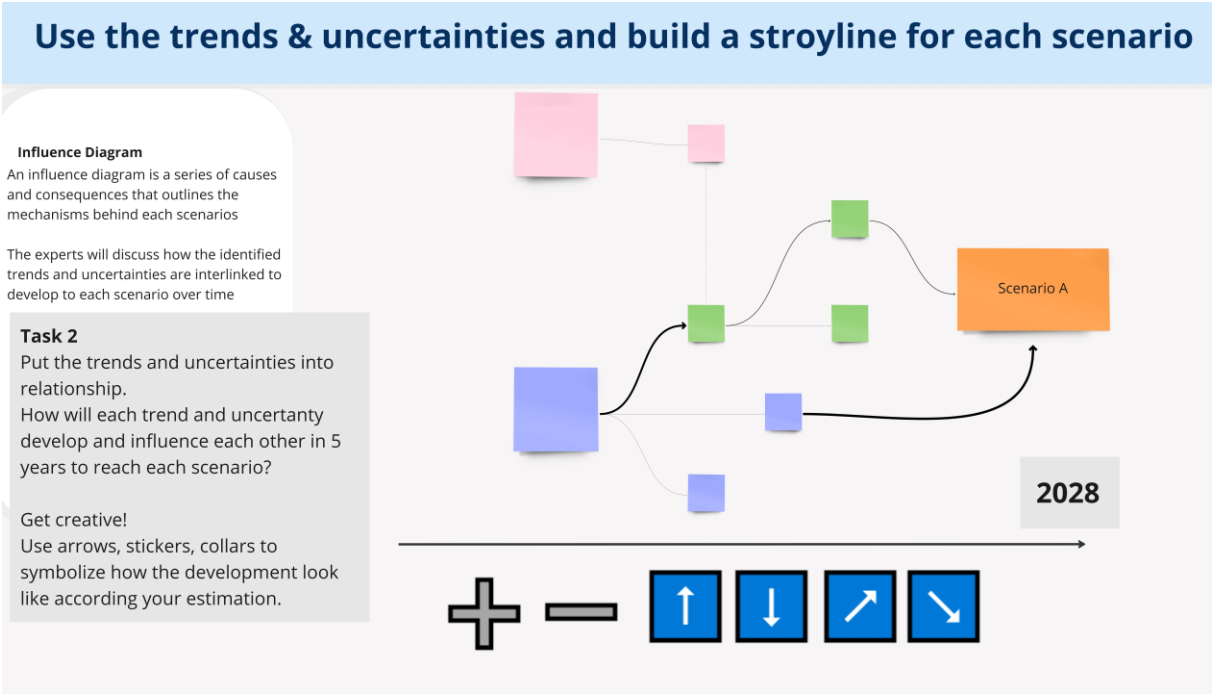

Figure 20: Screenshot miro board, description of influence diagrams

Source: Own visualisation on miro

The facilitator gave these instructions:

“We can move on then to how you're going to do the influence factors influence diagram. So here you see you have those little notes. So first an influenced diagram is a series of causes and consequences that outline the mechanisms behind each scenario. So, as we said, we have the scenarios A, B, C, D. And now your task is it in each you have four influence diagrams. You put the trends and uncertainties in and put them into relationship and you're going to tell me how each trend and scenario uncertainty develop and influence each other’s within the next

five years. So, this is why there is the timeline to 2028. So, you are allowed to get creative, use errors, use stickers, use whatever you like. You can comment on those."

After the broad idea of influence diagrams was clear, the participants were asked to go to the whiteboard part where they are supposed to work on. Additionally, more detailed description of the task was given:

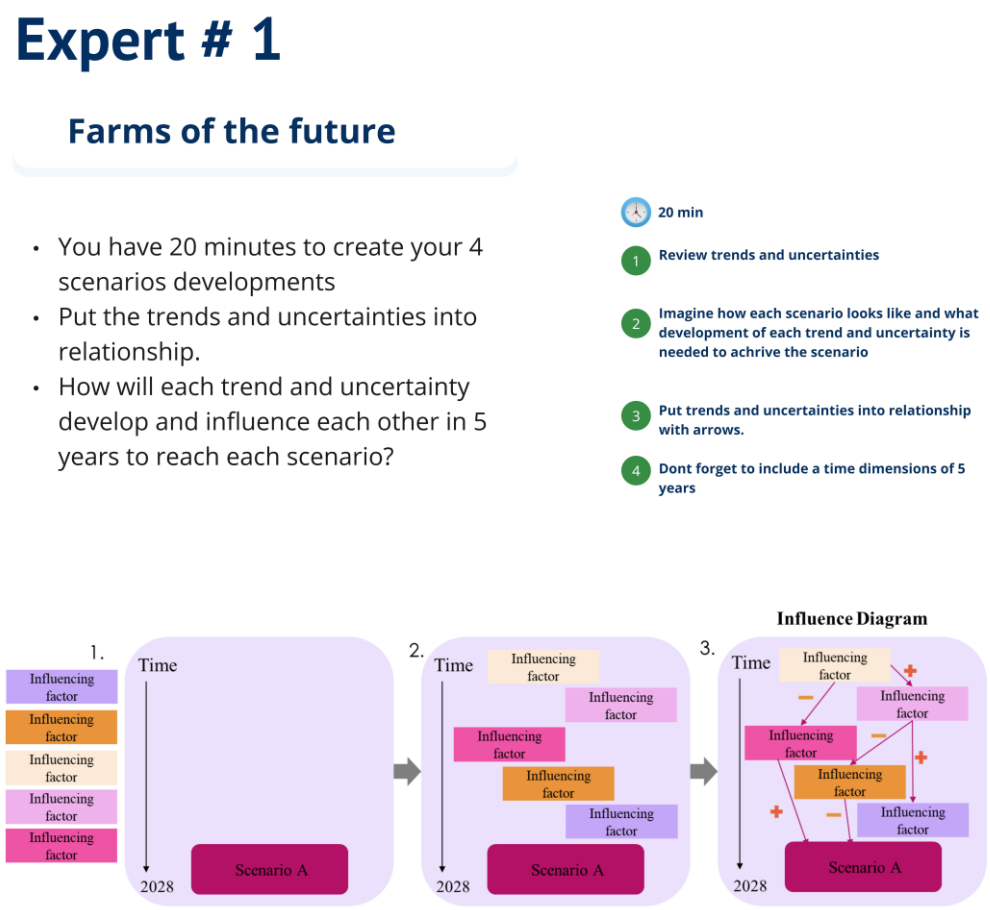

Figure 21: Screenshot miro board, task description of influence diagrams

Source: Own visualisation on miro

The facilitator explained where to move next and explained the influence task further:

"I guess we just can go over to experts #1 board here. There is a bit of a more detailed explanation."

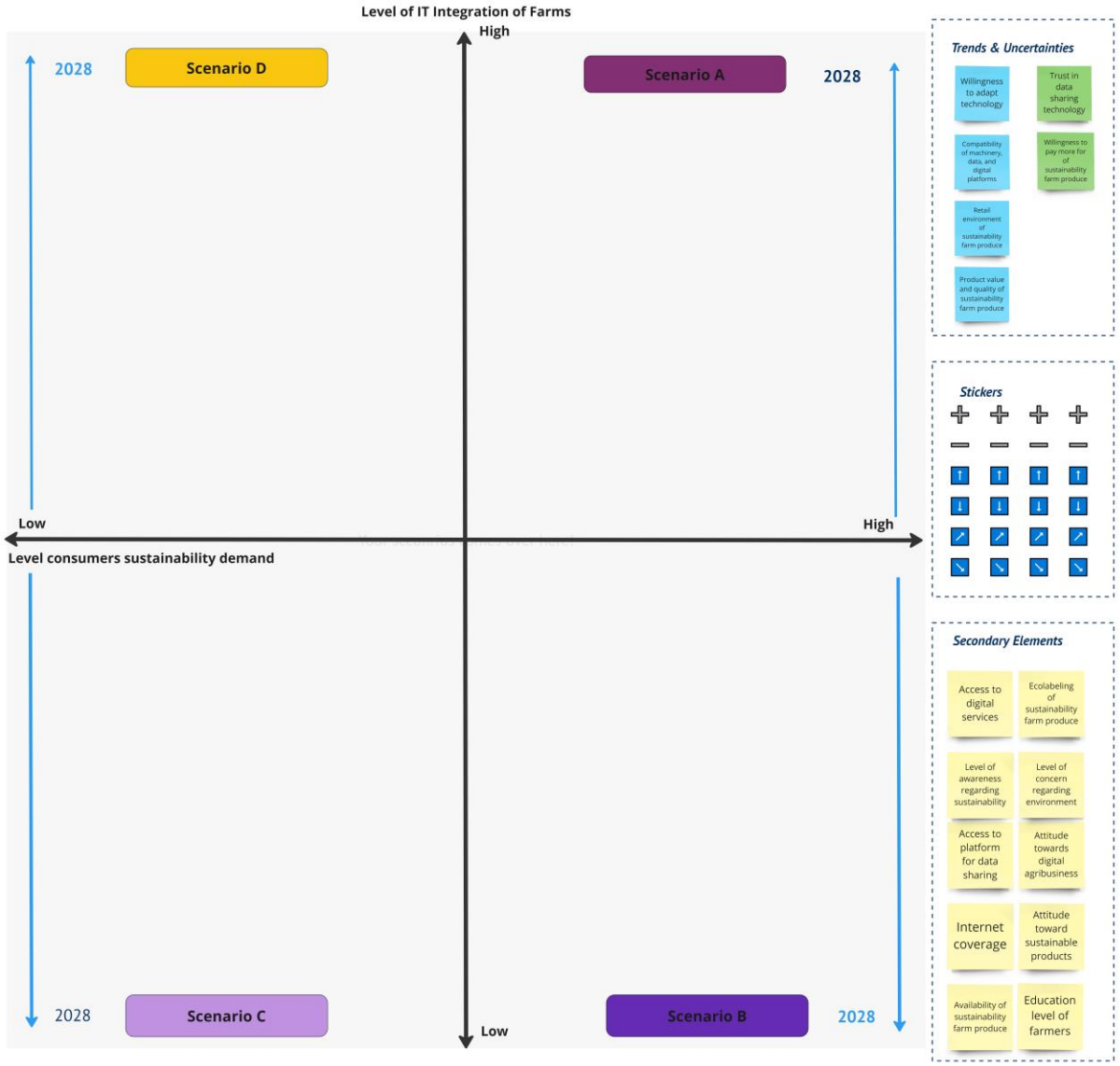

Figure 22: Screenshot miro board, expert's workspace for the influence diagrams

Source: Own visualisation on miro

Next to the task description is the space, where the experts are asked to work in. Each expert had their own workspace to work on and they were given following instructions:

"You see your board where you're going to work on. So, you are asked to do four inference diagrams for each scenario you have been given. On the left side, the trends and uncertainties going to bring you all back to me. So, the blue stickers are the trends we assess. The greens once are the critical conditions, and you ask to put them into relationship within this five-year timeline. So, you are just pulling them here back and putting them into relationship with each other. You can use the errors from the left toolbar here. You just put them somewhere and put those factors in the sticky notes into relationship with each other, with arrows and stickers." The experts were given six minutes to complete one influence diagram. After each influence diagram was conducted one of the experts presented their diagram and gave arguments why they think it would develop that way. Each diagram was

open for discussion. In the first workshop each expert presented one influence diagram, where in the second workshop both experts explained all their diagrams."

Experts establish cause-effect connections between the factors. For each factor, they identify its potential impacts on other factors and how changes in one variable might lead to changes in others. This is done simultaneously by all experts, around six minutes for each influence diagram, one for each scenario. They used the miro board, to drag and drop the key factors and arrows which indicates the direction of influence. The diagram is organized on a timeline to illustrate the time development to reach the scenario within the next five years. Experts assign the strength of the influence with an arrow sticker next to the factors, based on their expertise. Some expert's choice to visualize this differently, by connecting the factors with different kinds of lines, some with dotted lines, for stronger or weaker relationships.

Each expert presented at least one of their developed influence diagrams and were discussed after, to generate potential feedback. Following the expert group discussion, the influence diagrams are presented to the expert group via mail for validation and refinement.

5.3.7 Coding and analysis of transcripts

In order to be able to analyse the transcripts of the expert group discussions in an efficient way, the document lines were numbered, and the documents were subdivided according to the titles of the respective activities discussed by the experts. In addition, in the transcripts all experts were anonymised and numbered so that it was possible to trace which expert had which expertise, by still staying anonymously. Each transcript was deductively coded with the 16 influence factors as codes and the corresponding scenarios discussed by the experts. The arguments used by the experts to support their opinions were coded inductively. These codes are used as power quotes to describe the opinions on how the experts assess how the scenarios will develop over the next five years. The coded transcripts can be founded in the appendix IV.

5.3.8 Writing of the scenarios

Based on the dimensions of the scenario matrix, the conditions from the PEST analysis, the assumptions based on literature from the assumption scenarios, the impact/uncertainty grid, the influence diagrams of the experts and their arguments for their opinion, the four scenarios are developed by factoring a more positive and negative development, from the perspective of SMF. As the scenario framework with the dimensions are already given, with different level of IT integration and consumer sustainability demand, how the factors from influence diagrams

develop in each scenario, based on the experts´ assessment is used to write characterizable narrative description of the scenarios.

The narrative scenario writing follows four steps:

1. Scenario introduction, which sets the stage for the scenarios in which the needed conditions of politics, economics, social and technology are described to reach each scenario. This includes the baseline conditions of the PEST analysis for each dimension.
2. In each scenario the development of agriculture machinery producer and digital service companies, general development of SMF in the EU, retailer, EU citizens, and an example of SMF is described to reach s storyline.
3. This is established in a five-year timeline.
4. Characterization of the critical conditions and trends in each scenario, and how they developed over time to reach the scenario, based on the influence diagrams of the exerts.
5. Based on the characteristics of the scenario, each scenario is given a descriptive title, which is memorable and easy to understand what is behind each scenario.

5.3.9 Analysis of the farm performance assessment

The experts were asked to assess how the farm performance will develop in each scenario, by putting arrows in the scenario matrix, which reflect the development of the farm performance, on the online white board. The expert could choose from five different arrows, which can interpret as significant increase, steady increase, farm performance stagnates, steady decrease and significant decrease. The experts had a couple of minutes to decide, how to assess the farm performance development for each scenario and after the results were shortly discussed.

6 RESULTS

In this chapter the results of the Delphi study are presented, which are the influence diagrams of the experts for each scenario, the scenario storyline for SMF in five years, and the expert's assessment of the farm performance in each scenario.

The results of the influence diagrams highlight the consensus and the disagreements and the according arguments for the expert's assessment of the development of their diagrams. In the second result part, these results are then used to write scenario storylines with the players, Agriculture machinery producer and digital service companies, generally SMF, EU citizens, Retailer, and a fictional example SMF to show how different levels of the matrix dimensions might influence the SMF in the EU. In the third result chapter the influence of each scenario on farm performance will be presented, based on the assessment of the experts.

6.1 Influence diagram of experts from focus groups

Each expert drew four influence diagrams of how each scenario would unfold with the, via survey, selected factors. They put them into relationships to visualize how they influence each other in order to achieve each scenario within the next five years. The visualized data from the influence diagrams, as well as the transcript verbal data, are used to demonstrate the expert's arguments for why certain developments may occur. In addition, the results are interpreted in light of the theoretical background.

6.1.1 Influence diagram - Scenario A

The experts developed individually influence diagrams that describe the development of scenario A, high IT integration on farms and high sustainability demand, and agree that all factors must develop positively in order to reach scenario A. However, there is no clear agreement on which factors influence each other and when they develop positively in the timeframe of the next five years. Most experts see the farm related factors will have a positive influence on each other, which are *Compatibility of machinery, data, and digital platforms*, the *Willingness to adapt digitalization technology*, and *Trust in data sharing technology*, which are circled in red in fig. 21. This can be examined in the influence diagrams of experts #1, #2, #3, and #4. In the influence diagrams from the experts #1to #3 is an explicit separation of farm and consumers factors (*Retail environment, Product value, and Willingness to pay more*) which is than connected by the positive influence of the *Willingness to adapt technology* to the W*illingness to pay more for sustainable farm produce*. The separation is marked with two red circles in fig 23.

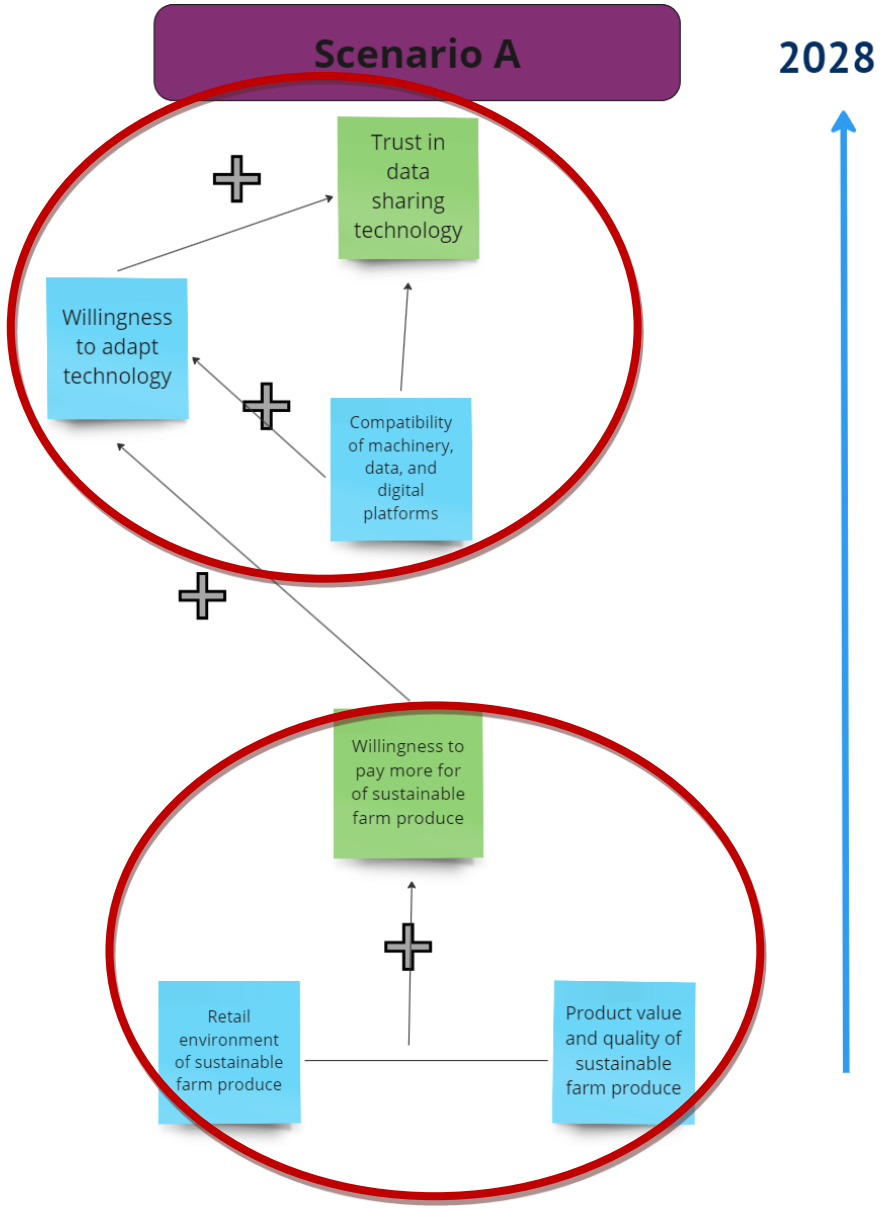

Figure 23: Influence diagram scenario A from expert #3

Source: Screenshot miro board, own data collection

The experts agree that the increased *compatibility of machines, data and digital platforms* positively influences *the willingness to adapt digital technology* by saying: *"So I thought at first* (on the lower left corner) *that we need the compatibility of machinery, data, and digital platforms. And this is followed by the willingness to adapt technology"* (Expert #6, 2. Transcript, line 815-816 and influence diagrams experts #1,2,3).

The farm side faces the consumer and trade side, where the factors *Retail environment of sustainable farm produce*, *Product value and quality of sustainable farm produce* and *Willingness to pay more for sustainable farm produce* influence each other positively: "*And on the right side we need the level of awareness regarding sustainability which needs to increase for the willingness to pay more. And following this so we need more awareness than higher willingness to pay"* (Expert #6, 2. Transcript, line 816-818). This description is seen below in fig. 24.

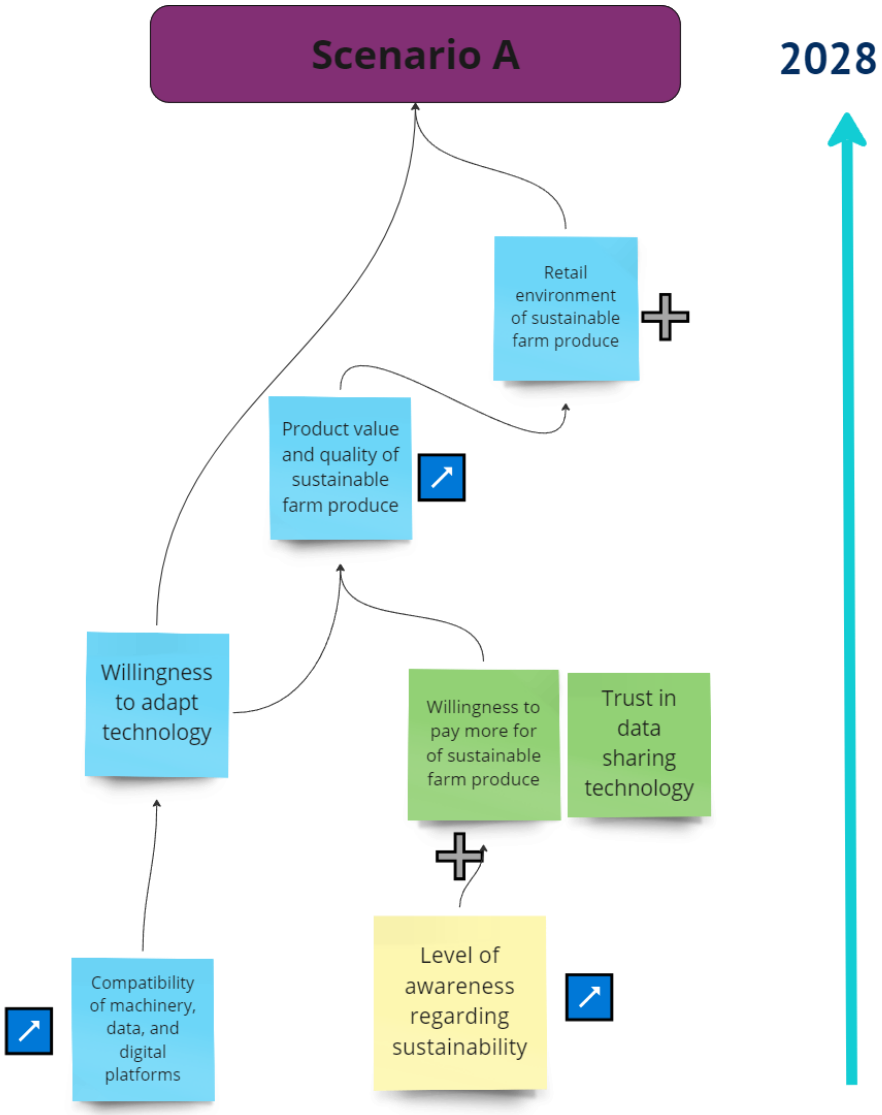

Figure 24: Influence diagram scenario A from expert #6

Source: Screenshot miro board, own data collection

Especially the increase of willingness to pay more for sustainable produce of the consumer side would influence the farm sides willingness to adapt further in digitalization positively as expert #1 states: *"So, (...) this is also in a good situation and also the retail environment of the products. So, this means consumers are willed to pay more for the products. And if consumers are willed to pay more for the product, this has a sort of force feedback to the willingness of the farmer to adopt technologies"* (1. Transcript, ln 574-575). The experts also insinuate that the consumers are in a "good situation", this could also imply a good financial situation, which could be a reason why consumers are willing to pay more for sustainable products. This is in line with the papers, which say that secure and high income influence consumers positively to pay organic produce (Aigner et al., 2019; Kociszewski et al., 2023; Nechaev et al., 2018).

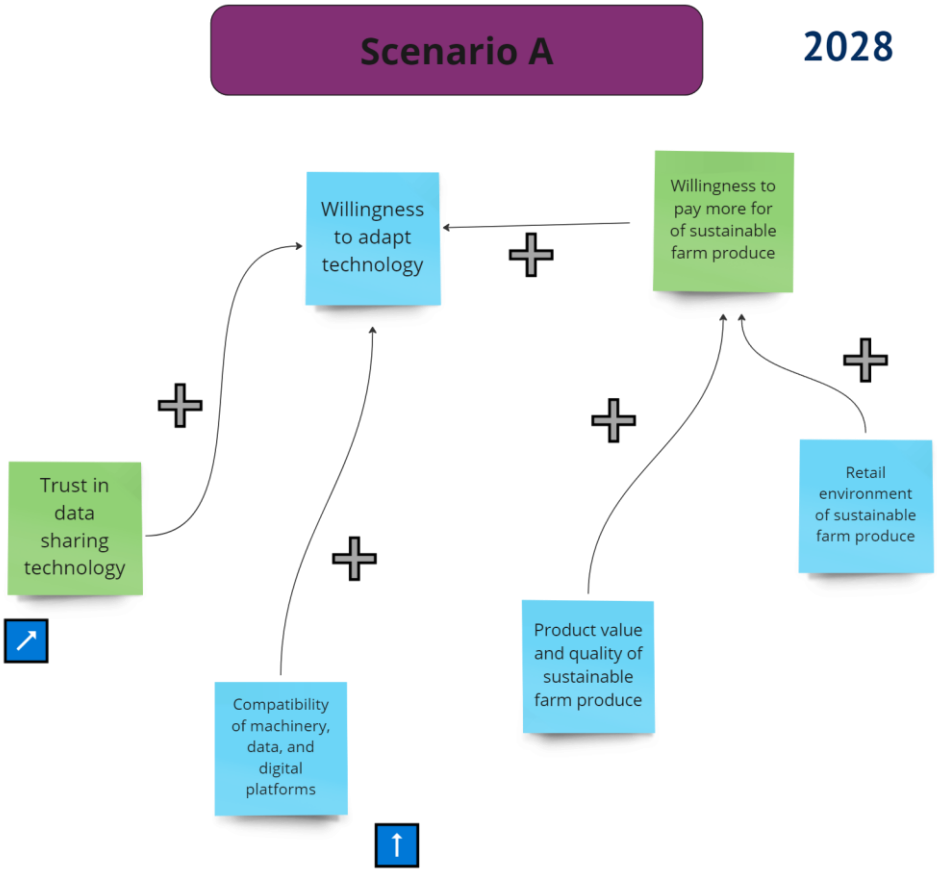

Figure 25: Influence diagram scenario A from expert #1

Source: Screenshot miro board, own data collection

In fig. 25 it shows again, like in the influence diagram of expert #6 that the farm side is influenced by the consumer side, so it can be stated that it is a positively enforcing relationship, as *Willingness to pay more for sustainable farm produce* influences the *Willingness to adapt of digital technologies* positively. This leads to higher *Product value and quality* (1. Expert, 1. Transcript, ln 564-569), which other experts say leads to a higher willingness to pay more for

sustainable farm produce: "*The willingness for the farmer to adopt to this technology is fostered by that and on the other side, the product value and product quality so we are more sustainable"* (1. Expert, 1. Transcript, ln 568-569). This means that the consumers have an explicit power, with their demand to farmers to adopt digital technologies. This direct link, is not explicitly documented in the previous described literature, where the consumer demand for sustainability is rather an indirect link, over food movements (Isenhour, 2011).

Also, expert #5 argues that the consumers need to push the demand to reach scenario A: *"My main idea was that some factors are jointly now affecting the whole business. Right. So that's the level of awareness let's say people are more interested in sustainability and push this. As well, the product value of sustainable farm produce, this is how I kind of read it would be like the value is good. People understand that it has a high value, and it drives demand, which (…) Same about the retail environment. So basically, willingness to pay more and also ecolabeling for me, those are the measures that could happen fast, which drives the demand. And in my opinion, if the demand is there, the farmers will move. If the technology is there and the demand is there, in my opinion, technology is mostly there already"* (2. Transcript, ln 879-886).

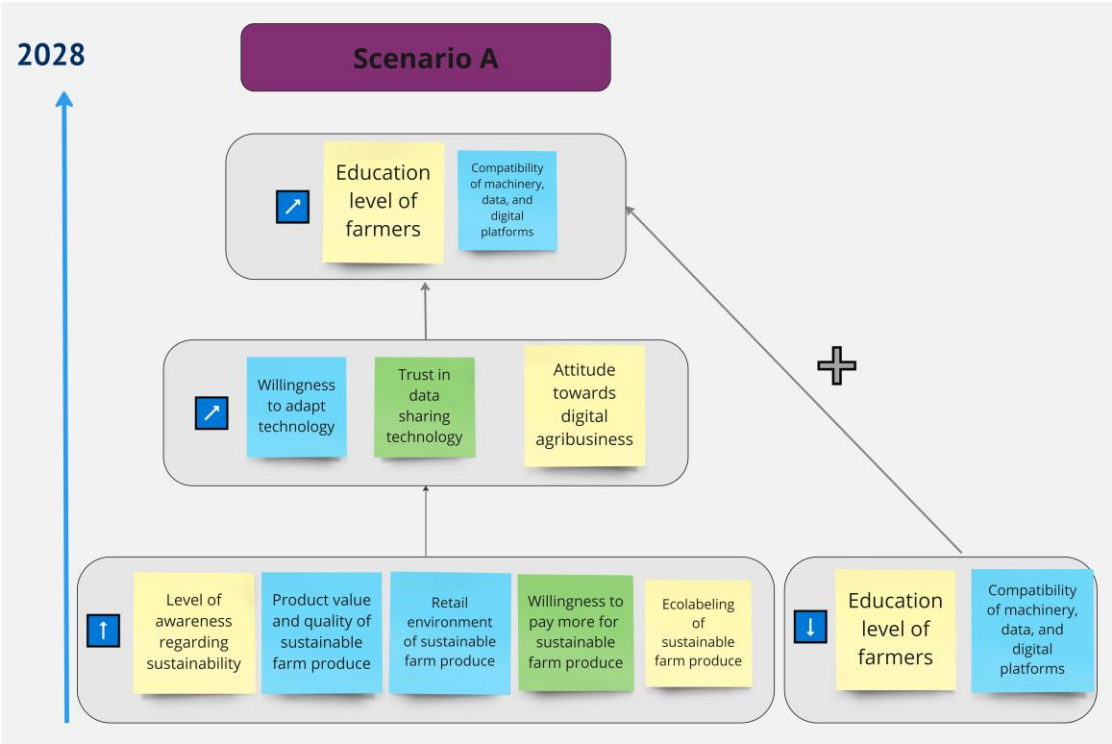

Figure 26: Influence diagram, scenario A from expert #5

Source: Screenshot miro board, own data collection

For expert #5 it is crucial in the first step, that the level of awareness for sustainability needs to be increased, as well as the value for the product (5. Expert, 2. Transcript, ln 879-886): *"People need to understand the higher value of the sustainable product, which would increase the demand for it. Also, the retail environment and ecolabeling needs to be improved. These factors would increase the demand und push the farmers' willingness to adopt digital technologies, as the needed technologies are already on the market"*. The expert #5 explains the second stage in his influence diagram from fig. 24: *"And then this will be like the second stage which I have here in the middle, which is willingness to adapt. Technology will increase because if the farmer sees that he can sell it for more and people will buy the produce, they will adapt the technology, the trust as well. If they see the value in sharing the data, they will also use it. And the attitude towards digital agribusiness, as I said, in my opinion, those distributor companies would have to really change the way they act if they do that. Or maybe other actors come in that are more digital, that will also drive things. And then the last level, I would say I put this on top because (...) I just put those very far away because I don't see this happening fast"* (2. Transcript, ln 890-896). With the higher consumer demand and then higher willingness to adopt digital technologies, this further influences the other farm factors positively. The strongest argument for increased trust in data sharing technologies is that farmers need to see the value in this, then they would also use it (5. Expert, 2. Transcript, ln 890-894). That the benefits to farmers are often not clear and leads to a lack of adoption is in line with Gabriel and Gandorfer (2023).

Further expert #5 states that the factors, *Compatibility of machines* and *Higher education of farmers* are needed to reach scenario A and would follow the previously steps, but he assesses that this development will need at least ten years, as currently the compatibility is not given, and education levels are not high (5. Expert, 2. Transcript, ln 901-905 and 909-910).

The cross-expert conclusion for scenario A is, that there are two groups of farm and consumers demand factors, and in each factor-group the factors influence each other positively. The farm factors are *Compatibility of machinery, data, and digital platforms*, the *Willingness to adapt digitalization technology*, and *Trust in data sharing technology* and the consumer factors are *Retail environment*, *Product value, and Willingness to pay more.* The groups are interconnected by the positive influence of *Willingness to pay more* on the *Willingness to adapt digital technologies*. The experts agree that the consumers demand for sustainability is the active driver, to reach high IT integration levels on farms, as the *Willingness to pay more* becomes in most influence diagram a condition for the farmers to adapt in digital technologies.

6.1.2 Influence diagram - Scenario B

In the influence diagrams for scenario B, with low IT integration and high sustainability demand, consumer side factors influence each other positively and develop so, while farmers factors develop in the opposite direction.

To reach this scenario, the experts agree that the main drivers come from the sustainability side, as the factors *Product value and quality*, *Retail environment* and *Willingness to pay more* are the intrinsic drivers for the consumers and drive the sustainability demand further. Experts #4 explains: *"I think the main driver is on the sustainability side. That's why I have product value which I combine also with how sustainable and especially ecologically sustainable a product is. That's related, I think with a product value that the consumer attaches to the product. So, there's a large drive towards this. So, this is a big driver also the retail environment. So, the retail environment also has an interest in sustainability, not only the producer and the consumer. And the willingness would also be at the start of my diagram. So, I have those three on the same level. So, they're like intrinsic drivers from the consumers, the producers to drive sustainability forward."* The expert sees that sustainability is a food quality characteristic, which also consumers value in this scenario. This is in line with the literature, in which consumer consider sustainability as a quality attribute (Polcyn, 2021)

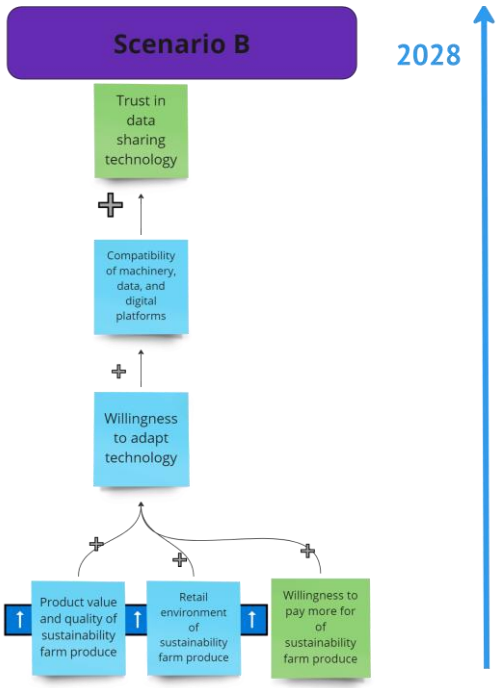

Figure 27: Influence diagram, scenario B from expert #4

Source: Screenshot miro board, own data collection

The expert expects that these trends will drive the *Willingness to adapt* positively, even in this scenario, where the digitalization is low, as this helps to increase sustainability. *"I think those three trends also drive the willingness of the farmer to adapt new technologies which help to achieve more sustainability. But I made small pluses because the scenario is that minimal technology or it is implemented, there is a driver, but it's not so large. And also, with a willingness to adopt technologies comes an improvement in technology that is available"* Expert #4 explains (1. Transcript, ln. 649-652). Experts #1 and #4 also shows in their influence diagram that they think, an increase in *Willingness to pay more*, will positively influence the *Willingness to adapt*, even in a scenario where the IT integration is low (see fig. 28).

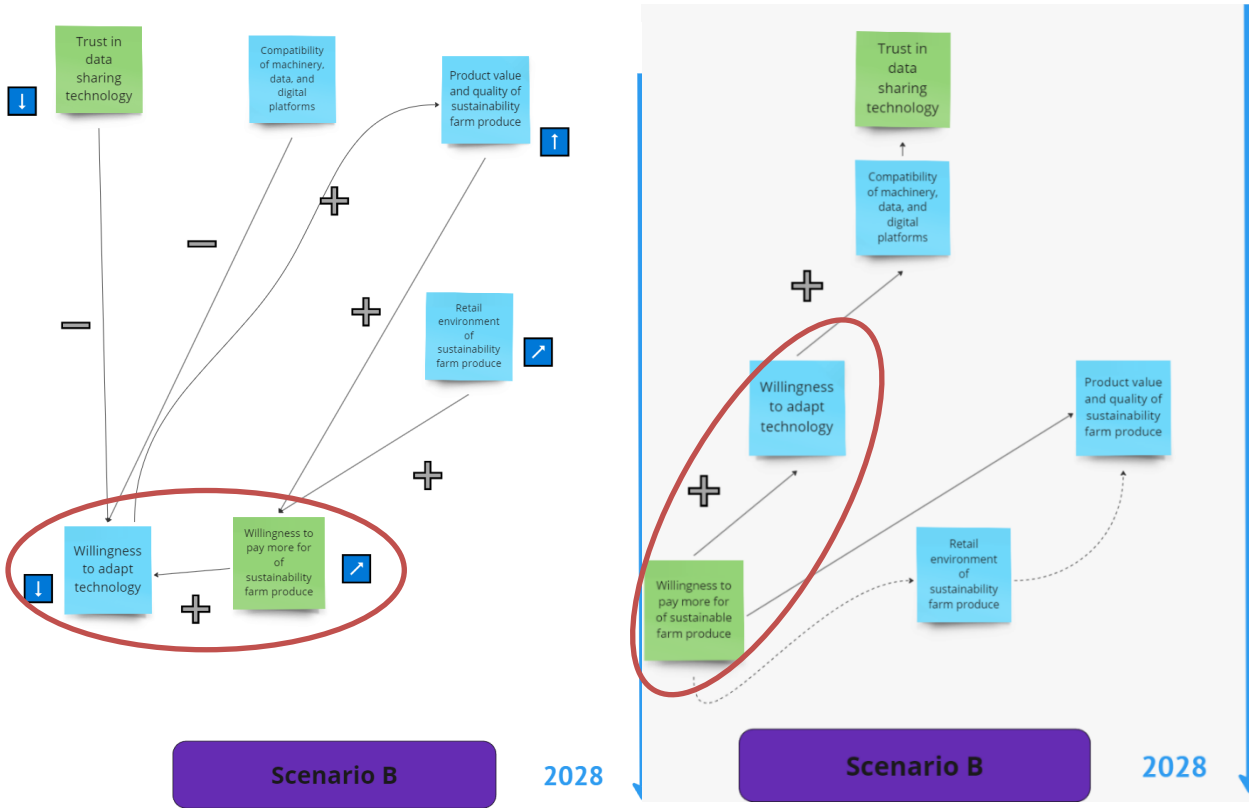

Figure 28: Influence diagram, scenario B from expert #1 and expert #4

Source: Screenshot miro board, own data collection

Expert #4 further describes:" *So, compatibility, for example, and I think once a farmer adopts a technology and sees that it works well, it will also increase the trust in this technology. So, I also see a positive trend there"* (1. Transcript, ln. 652-354). This means that farmers can be convinced to adapt by working technologies, even when the overall trend goes to low IT integration. It is a repeating topic, that technology is adopted by farmers, if its working as

expected, and the benefits are clear communicated. Unclear benefits of digital technologies is a hurdle which for technology adoption which Gabriel & Gandorfer (2023) has also discussed.

The experts from the second focus group, see a more differentiated development between digitalization and sustainability factors.

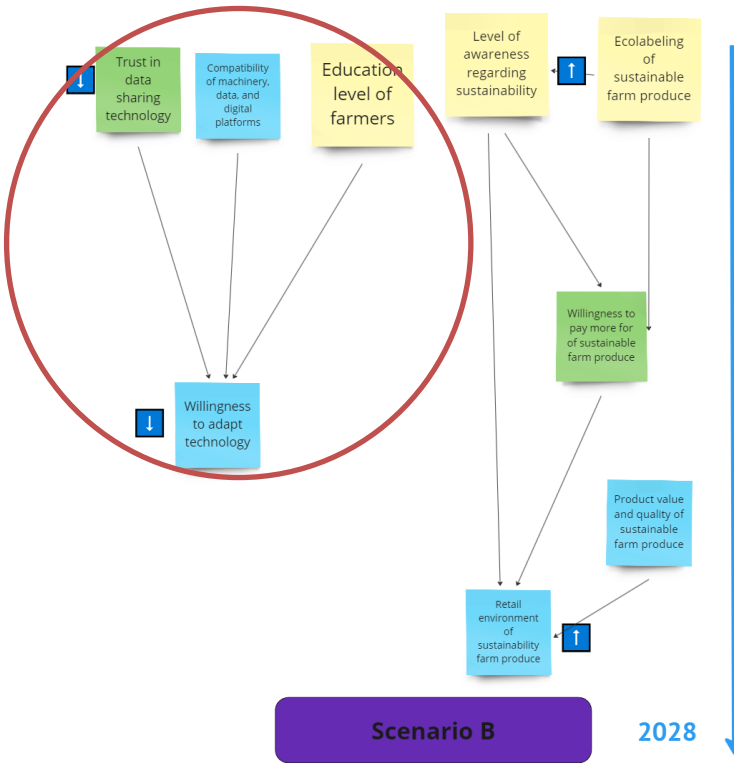

Figure 29: Influence diagram, scenario B from expert #5

Source: Screenshot miro board, own data collection

They describe a negative development on the farm side, market red in fig. 29 and 30, and a positive development on consumer sustainability side, which is nearly not interconnecting at all. Expert #6 describes the increasing demand for sustainability needs to come from education: "*I think I have to shift this here and then we get the environment of the retailers is more sustainable I think might be through organic or something and with this we get to scenario B"* (2. Transcript, ln. 1022-1023).

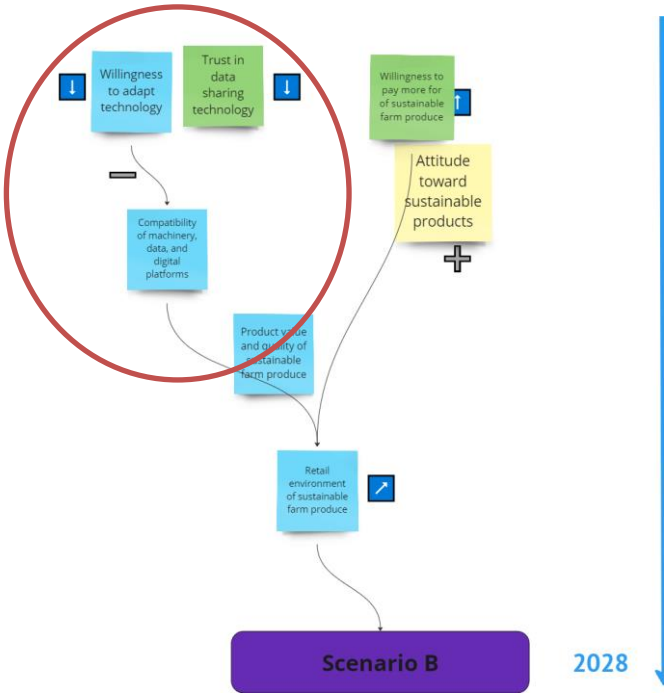

Figure 30: Influence diagram, scenario B from expert #6

Source: Screenshot miro board, own data collection

Facilitator: *"So the retail environment is increasing for that and (...) do you have a reason why the willingness to pay more for sustainability farm produce is increasing? Do you have a reason?"* (2. Transcript, ln. 1027-1028).

Expert #6: *"Yeah could be through education to the consumers. (…) Now so I can use it through governmental I don't know, awareness, full programs."*

Additionally expert #6 sees that sustainability can be reached without IT technologies, and other factors drive the sustainability demand: *"Basically, we get there without technology, or without IT technology at least. I mean, there's many ways to be sustainable, especially if you're a small farm doing more manual things, different types of crops, different types of ways to grow crops and so on. There are many ways to do this without technology, in my opinion. So, I have the level of awareness. The ecolabeling, which are two potential drivers for the willingness to pay more and the willingness to pay more drives demand and in the end will also affect how much sustainable product is there, what's the price of the product. And at the same time, we could have in this scenario, low trust, low compatibility, which definitely is the case at the moment, low education of the farmers, which is also true. And thus, a low willingness to adapt technology."* (2. Transcript, ln. 1048-1055).

In conclusion the expert panel reached the following results for scenario B. The factors related to the farms develop and impact each other negatively, and contrary developed the factors related to the consumers, which improved drastically. Experts agree that the sustainability aspect is the primary driver, with elements such as *Product value and quality*, *Retail environment*, and *Willingness to pay more* acting as intrinsic consumer drivers and increasing demand for sustainability. According to the expert, sustainability is a quality attribute that, in this case, consumers appreciate and are willing to pay for. This result is in line with Polcyn (2021). Additionally, the experts state that alternative agricultural methods can achieve a higher level of sustainability without the use of cutting-edge digital technologies. This is also well researched (Manshanden et al., 2023). However, experts #1 and #3 also indicate that, even in a situation where there is low IT integration, that an increased willingness to pay more for sustainable produce will positively influence the willingness to adapt digital technologies. This implies that, despite the general trend toward low IT integration in the scenario, farmers might still be persuaded to adapt by highly functional and beneficial technologies.

6.1.3 Influence diagram - Scenario C

In scenario C both dimensions have minimal levels of development. Experts agree independently from each other that all factors, regardless of farm or consumer related once, will decrease, and influence each other negatively.

The experts #1, #2, and #5 agree that the *Trust in data sharing technology* and the *Compatibility* decreases, which influences the *Willingness to adapt technology* negatively, see fig. 31. For experts #1, #2, and #6 consequently, the *Product value and quality* decreases.

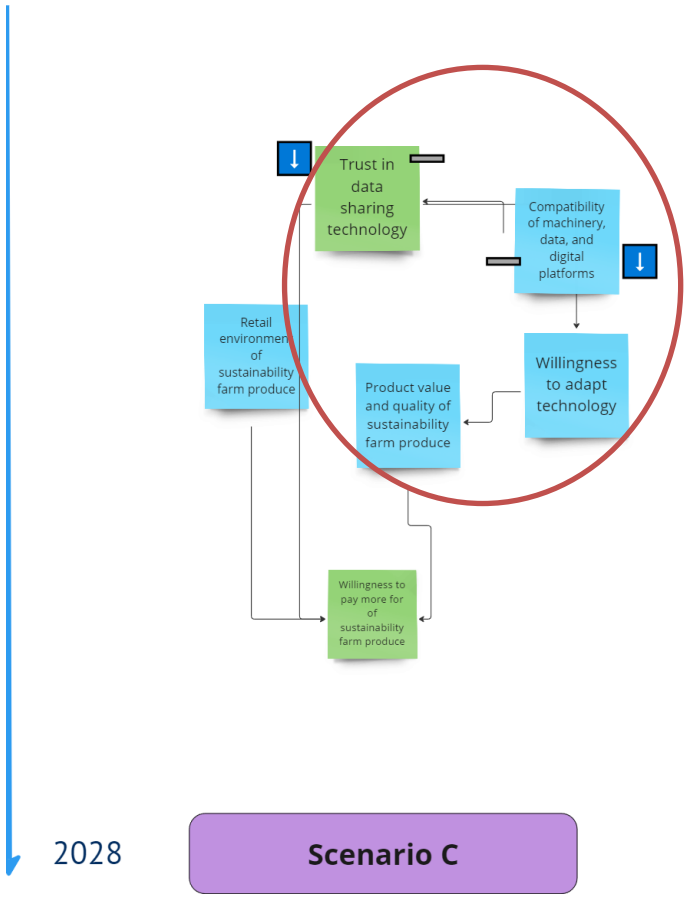

Figure 31: Influence diagram, scenario C from expert #2

Source: Screenshot miro board, own data collection

Also, the experts #1, #2, #4 agree that the decreased *Product value and quality* influences the *Willingness to pay more* of consumers. Additionally, the *Retail environment* worsens for sustainable products, which further decreases consumers' *Willingness to pay more*, according to expert #1, see fig. 32.

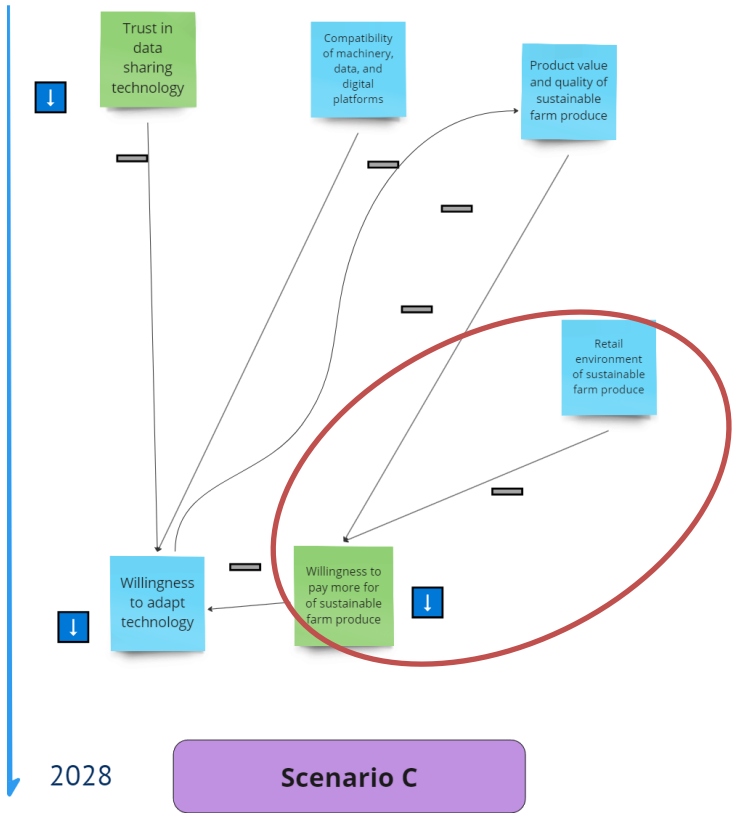

Figure 32: Influence diagram, scenario C from expert #1

Source: Screenshot miro board, own data collection

Expert #5 influence diagram can be again put into different stages. According to expert #5 in the first stage, low education level of farmers and low *Compatibility of machinery with data and digital platforms* is present on farm side. On the consumer side, that the value of *Eco-labelling of sustainable agricultural products* decreases due to decreased transparency, which leads to decreasing the level of *Awareness regarding sustainability*. In the second stage the *Trust in data sharing* has decreased due to the development on farms in the first stage. Similar is the development on the consumer side, where the *Willingness to pay* has decreased.

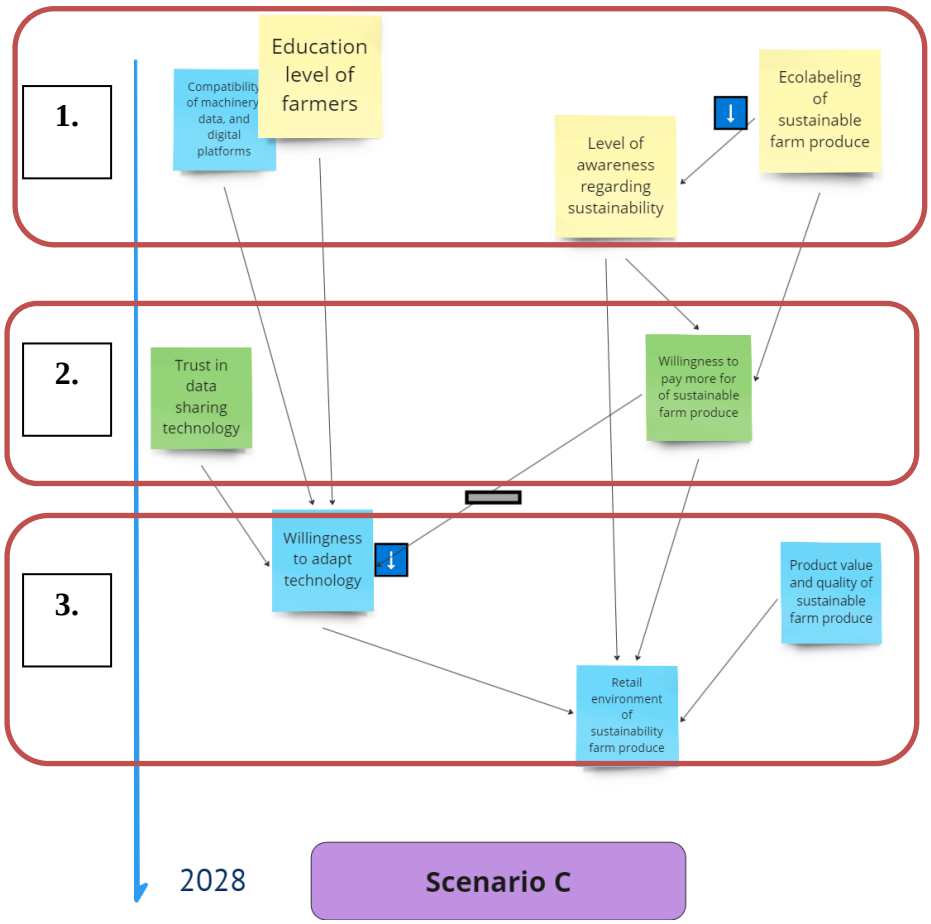

Figure 33: Influence diagram, scenario C from expert #5

Source: Screenshot miro board, own data collection

Expert # 5 states: *"It might be a bit extreme position, but in my opinion, if the technology works and the farmer can clearly see that there is a demand and that it will increase everything, efficiency, productivity and so on, based on the technology and the demand is there, then we'll go up. And in this case, it will go down mostly because the demand is not there. So, demand goes down, willingness is going down and the fact that technology is not there is making it even worse. (...) In my opinion, the main driver is really the demand. If the demand goes down, there's no point in adapting any technology because why would I?"* (2. Transcript, ln 1102-1117). In light of the emerging technology theory, it can be stated that digital technologies are not emerging, in this scenario, as no fast growth or prominent impact of the technologies are visible (Rotolo et al. 2015). The facilitator is asking the experts if there could be other reasons for a low technology adaptation.

Facilitator: *"Because you're saying the demand for sustainability goes down, the technology goes down. But there could be other reasons, right?"* (2. Transcript, ln 1130-1131).

Expert #5: *"For technology going down, the willingness to adapt technology goes down if the demand goes down. If the demand goes down, the prices stay down, people don't buy organic food and so on, then the willingness to adapt technology will also go down from the farmers. I think that's quite a natural thing. And if technology is there or not, that won't matter anymore because the demand is down"* (2. Transcript, ln 1135-1138).

In the third stage it is shown that the development on the farm side of low level of *Trust in data sharing technologies* a decreased *Willingness to adapt digital technologies*. This is also due to the decrease in *Willingness to pay more for sustainable agricultural products*. This is due to the decrease in *Eco-labelling* and *Level of awareness* on the consumer side from the previous stage. Since the *value and quality of the product* has decreased, this is reflected in the *Retail environment*, as it is not much marketed or promoted. It is interesting to note that Expert #5 sees a decrease in *Product value and quality* without any correlation with other factors, while other experts see both the farm side and the demand side in direct correlation.

The facilitator adds a different thought: "*Okay, but we could also think even though sustainable product demand is down, then I can really sell really good conservative whatever product, right. Like my product could be whatever, then maybe I want can…"* (2. Transcript, ln 1141-1143).

Expert #5: *"…Increase, I can increase produce and so on in a non-sustainable fashion. Is that what you're yes. Okay. Yeah. That's actually a good scenario that I didn't even see there. Yeah, so you're completely right. So, this would be the scenario where actually productivity is being increased without sustainability"* (2. Transcript, ln 1147-1149).

Expert #6 adds an important thought, that sustainability is not only dependent on the consumers' demand: *"But only if the farmer thinks he's only producing sustainable for the consumers and not for his farm."*

Facilitator: *"For his own good."*

Expert #6: *"Yeah, for his own good and to produce even foods in the future and the next generation on this land. And so, I think that's also the idea of sustainability. Right? Yeah, I know it alive and not like using all the resources in our generation"* (2. Transcript, ln 1161-1163).

Facilitator: *"Yeah. Most farmers I know, they see themselves as their guards of their lands or their animals. Right. Not just taking advantage of it, but interesting thoughts here. Expert #6, your scenario?"* (2. Transcript, ln 1167-1168).

Expert #6: *"Yeah. So basically, the same. No demand for sustainable products and with this, the farmer doesn't see any advantage investing in technology and this decreases the product value of sustainable farm produce, and this lowers the retail environment of sustainable farm produce"* (2. Transcript, ln 1172-1174).

Expert #6 mostly agrees with expert #5, as he has similar stages:

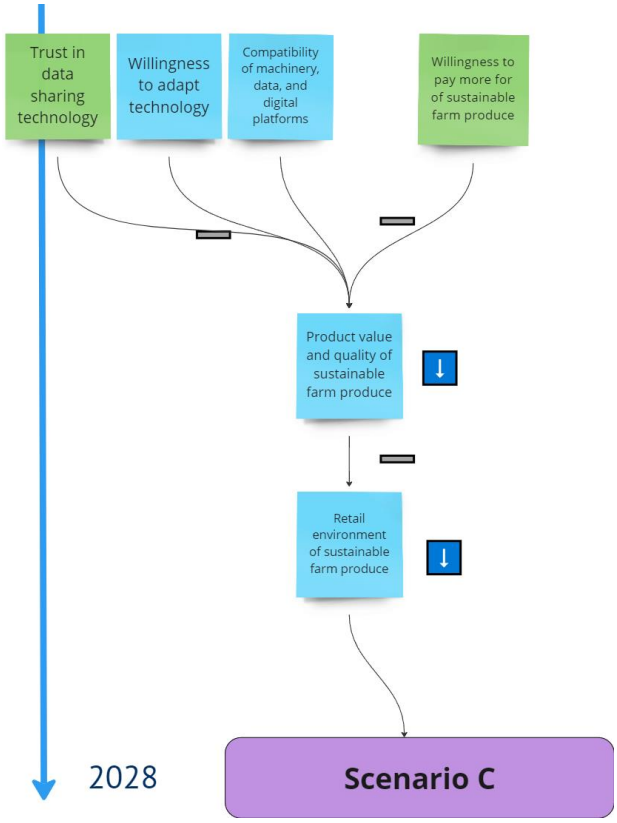

Figure 34: Influence diagram, scenario C from expert #6

Source: Screenshot miro board, own data collection

On the first stage of the farm level the *Trust in data sharing technology*, the *Willingness to adapt* in this and the *Compatibility* is decreasing. One the consumer side, the *Willingness to pay* decreases too. This leads in the second stage to a decreased *Product value and quality of sustainable farm produce* as well as a decrease in the *Retail environment of sustainable farm produce*.

Two thoughts which were mentioned in the discussion, but not in the influence diagrams were interesting. First from Expert #5: Farmers might invest in digital technologies without a thought about sustainability. First the expert thought the demand is the driving factor for it.

Second, expert #6 thinks, farmers might invest in digital technology to increase their sustainability, without the demand of consumers. Which means they might invest in it for their own good, without considering communication it with the consumers.

In scenario C a clear path for the scenario development was visualized by the experts, where most experts agree with: It can be stated that overall, the experts agree in the visualized diagrams, that all factors develop and influence each other negatively. On the farm side particular, low levels of *Trust in technology* and C*ompatibility* diminish the *Willingness to adapt technology* further. This negatively influences the *Product quality*, which the consumers response with decreasing *Willingness to pay more for sustainable products*. This development is magnified by the deterioration of the *Retail environment*. Some of it has to do with *Eco-labelling*, which is more confusing than it is transparent.

However, in the expert discussion the opinions have changed: First the opinion is stated that technology will be adopted, if it is beneficial to the farmer, and the consumer demand drives this development. This is in line with the visualized scenario development above. The farms do not adapt, if the demand for sustainability is not there. When the facilitator asked, if there could be other products the farmer might sell, the experts agreed immediately. They found, it could also happen that the farmers adapt the technology, just to increase efficiency and productivity, which (Gabriel & Gandorfer, 2023). Another reason for farmers to want to increase sustainability for their farms and environmental sake, is support by (Mouratiadou et al., 2023).

6.1.4 Influence diagram - Scenario D

The experts influence diagrams for scenario D show a clear picture of what the experts expect in the development. The technology and farm factors develop positively while the consumers factors decrease.

This is visualized in the diagram of expert #2, who sees an increase in *Trust in data sharing* and *Compatibility*, which positively influences the *Willingness to adapt*, which then leads to an increase in *Product value*. The *Product value* and the *Retail environment* decrease the *Willingness to pay* (see fig. 35).

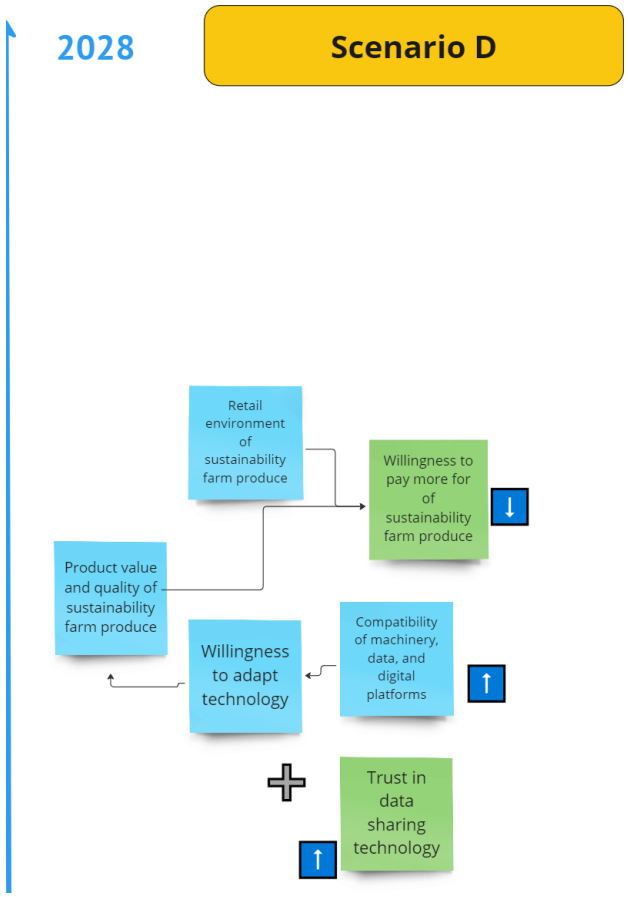

Figure 35: Influence diagram, scenario D from expert #2

Source: Screenshot miro board, own data collection

This is also what expert #3 expects: "*I think if you have a maximum level of IT integration then probably hopefully the compatibility of your machinery, data and digital platforms will be higher. This will probably directly influence the willingness of the farmers to adopt the technology. So that would be at least my experience and it will indirectly also influence the trust in the data sharing technology. That would at least be what I would expect. And yeah, a higher willingness to adopt the technology would probably also interrelate with more trust and data sharing technology. So, the arrow only shows inference from willingness to adopt technology to trust the data"* (1. Transcript, ln 741-747).

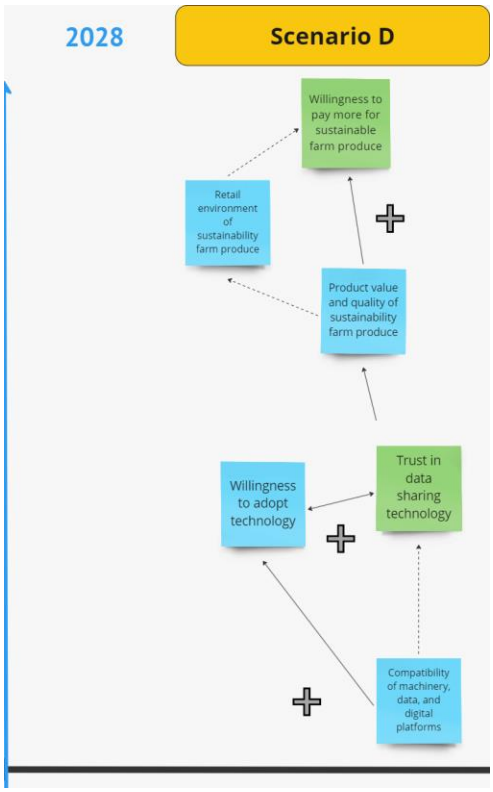

Figure 36: Influence diagram, scenario D from expert #3

Source: Screenshot miro board, own data collection

"And then I think this is a section for itself. So, these three trends are also impacts. Right. And then this will probably impact your product value or at least your quality because I assume if you have more data about for example in your crop production then you can easily optimize or not, let's say more easily optimize your sustainability and also probably the quality of your products. So, this will lead to an optimization of your quality, I guess. Or I assume and the retail environment from me is only an indirect factor because I think this is a factor that also could lead to willingness to pay more for sustainable farm produce. But I think if I'm persuaded of a higher product value and quality of this sustainable farm produce as a consumer, then the retail environment won't be the most important factor for me to buy this more sustainable farm produce. Okay, but in this scenario, this is more indirect factor", expert #3, (1. Transcript, ln 793-800).

Facilitator: *"In the scenario D, the level of sustainability* demand is quite low. Right, or it's on the lowest. But you had the willingness to pay more for sustainability is influenced positively, right, *exactly"* (1. Transcript, 816-817).

Expert #3: *"Yeah. It's the last one, right? The last one would appear in 2028. (...) So, I think*

if you offer the consumer higher product value and quality then this might lead to a higher willingness to pay. So that's the logic that I at" (1. Transcript, 829-830).

Also, expert #6 sees that the overall sustainability is improving, as technology is adapted. He sees in this scenario the consumer might be not the driver but there is an intrinsic motivation: *"So the idea here is even though we don't have, even though the demand for sustainable products is low, I say that we get a retail environment that's more sustainable with higher level of technology. So, I think that it could be the way to get there is that the farmer gets educated about environmental problems and also, I don't know, things of the vision that he wants to improve the land for the next generation, maybe his son who wants to take over the farm or something like this. So, we have high concern about environmental problems. And with this we think he looks for solutions and he finds solutions in technology. Or could be that he finds solutions in technology to produce, to farm his land more sustainable. And with this he adapts with more technology to have more knowledge about the soils and like to decrease inputs"* expert #3, 2. Transcript, ln 1248-1255. The previously described literature don't mentions farmers intrinsic motivation to adapt digital technologies to increase the sustainability, more the hurdle of them, and the motivation is to increase efficiency or lower labour.

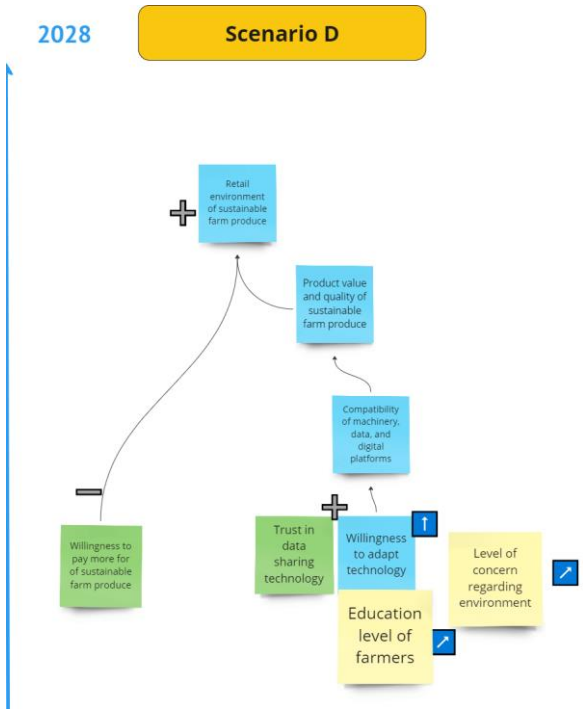

Figure 37: Influence diagram, scenario D from expert #6

Source: Screenshot miro board, own data collection

Expert #6: *"And with this the products get more sustainable because of more knowledge and*

lower inputs or decreased negative inputs. And with this the retail environment is more sustainable in the end, even though we left out the consumer" (2. Transcript, ln 1259-1261).
Facilitator: *"Okay. Yeah. Just by the awareness of the farmer themselves, they are pushing for a sustainable future?"* (2. Transcript, ln 1265).
Expert #6: *"Kind of he thinks he's doing it for himself, the globe and maybe his family."* (2. Transcript, ln 1269).

Expert #5 shows a similar development, but with different reasoning, and a different outcome: *"Basically, here I have like two things that run in parallel, kind of. So, one would be willingness to adapt technology and trust and data sharing technology. So here I'm thinking the farmer basically sees there's no demand for sustainable products, but I'm still going to use technology to produce more and cheaper and increase the attitude toward digital agribusiness. If it works and I save some money there, produce more, so I might as well grow like that. And the compatibility and education, I put them on top because I think that from all those factors, those are the things that take the longest time to move. So, until everything's compatible and farmers are educated, that's really a long way to go. This is the thing that lasts ten years and I think it's driven by technology. And on the other side, basically trend of awareness is going down. People not aware of what is sustainable and whatnot also they're afterwards not willing to pay for the produce because they're not aware. And also, in my more pessimistic scenario than yours, in the end we have cheap non sustainable produce in the supermarkets, but the farmers in the end are still producing more or producing more efficiently"* (2. Transcript, ln 1285-1299).

Facilitator: *"So you have two different lines. But I see like from in your scenario you discussed, like there's this willingness to adapt and like the left side, this also influences right. The produce value rate or quality"* (2. Transcript, ln 1303-1304).

Expert #5: *"Not necessarily the quality, right? Yeah, the product value, but this is product value of sustainable farm produce. Right. I mean in this scenario, for me, this is just a scenario where, I don't know, agriculture in Europe is becoming like in the US. Or in South America, maybe the small farms might be more difficult for them, might better, but they use more technology. Let's say GMO technology, let's say they're more dependent of the distributors, which take control of what they should do, what to put on which field, which chemicals to put, which seeds to put. And in the end the product value might be higher, the efficiency and productivity might be higher, but less sustainable produce."* (2. Transcript, ln 1308-1314).

Facilitator: *"Yeah, what I don't understand is the level of concern regarding environment which is high"* (2. Transcript, ln 1318).
Expert #5: *"Yeah, I put this as a thing that in my opinion it might be high. It probably is high today that people are concerned about the environment, but it doesn't mean that they're aware or that they're willing to pay. So that's why I didn't put any arrow here. I mean, those things, in my opinion, can stay pretty much separate. So, people are concerned, but in the end, they still don't buy organic produce"* (2. Transcript, ln 1322-1325).

Expert #6: *"They know that smoking is bad, but still smoke"* (2. Transcript, ln 1329).

Expert #5: *"And this is why policy has to I mean, we have to educate people and move people to buy the right goods and understand where does it come from, what does it mean, what does organic mean? One organic is not the same as another organic. And those are the kind of things that are still pretty much missing"* (2. Transcript, ln 1333-1335).

Expert #6: *"Or, like that's educating the consumer. But also, we can make an environment where all the products in the store are sustainably produced. And then it's not the consumer bashing because he can only go for sustainable or more sustainable products"* (2. Transcript, ln 1339-1341).

Expert #5: *"Yes, I mean, that would be amazing. You don't have the right to choose them, but this could be driven maybe by technology as well. But I think it's tricky because the technology will always go into the path of least resistance. Right? And unfortunately, it's very cheap to make things unsustainable even with IT solutions. And there's a good way to get a lot of data and manage the field more efficiently, but without being sustainable. And that's something that could happen if the demand is there. I think for a lot of farmers it could be an interesting way to go, which I don't support, but it could go this way. I'm more pessimistic than you"* (2. Transcript, ln 1345-1350).

The cross-expert expectation for scenario D is that first the farm and technology related factors develop positively and influence each other so, while the consumers factors decrease later. As production becomes more digitalized, it becomes more effective and also sustainable, without the demand of consumers. That digital technologies are expected to increase the sustainability in the agri-food industry is argument by many researchers (Garske et al., 2021; MacPherson et al., 2022; Wolfert et al., 2021; Wolfert et al., 2023). The sustainability demand might come later, after the product is already very sustainable. In this scenario the farmers motivation to become more sustainable might be a factor to adopt digital technologies in the first place,

without considering the consumer. Another explanation is that the farm wants to increase farm productivity and ends with less sustainable farm produce. The experts conclude that the consumer needs to be more educated, and a system needs to be in place, where it is easier to choose a sustainable product.

6.2 Scenarios for the EU SMF in 2028

Based on the expert opinions, academical literature, and the authors interpretation the following scenarios A-D describe how EU agriculture could change. Each scenario describes the development of different players. These are agricultural machinery manufacturers and digital service companies, retailers, and EU citizens, and how these developments affect a fictional example farm of Theo and Frida. The digitalization dimension is reflected by how agricultural machinery manufacturers and digital service companies and retailers develop, while the demand for sustainable food is shown within the players of retailer and EU citizens. Since the dependent variable is the farm performance of SMF, the example farm is described on a more personal level, as the farm performance is also interlinked with the personal life of SMF.

The in the following described example farm is fictional and is used as setting for each scenario and will explain how each scenario will affect the farm's performance of Theo and Fridas´ farm is a typically SMF. They have rented ten hectares of arable land where they grow vegetables, keep chickens, and produce the chicken feed for direct marketing as they farm close to suburban structures in the EU. They started their small farm in 2018, both in their 30s. The first two years were financially difficult, with the implementation of the farm and the marketing. For them, the COVID-pandemic was a financial blessing, as many consumers' demands for sustainably produced food, including from local farms, increased. During the pandemic years they also had many volunteers working on their farm. But after the pandemic, and with the Russian invasion of Ukraine, demand fell dramatically due to increased energy prices and inflation. Only one volunteer still helps on a regular basis. On the farm, Frida and Theo are the only full-time employees.

6.2.1 Scenario A - Sustainable growth: SMF thriving in the digital era

In 2028, the EU agricultural landscape has undergone a remarkable transformation, as SMF have adopted high levels of IT integration on their farms and responded to an increased consumer demand for sustainability in agriculture. As a result, a thriving data economy is evolved, in which data is shared among all stakeholders for value creation and increased transparency. This transformation has been influenced by several interrelated factors that have created a synergy resulting in a more efficient, sustainable, and consumer-oriented agricultural sector. This scenario envisions a future in which SMF thrive due to their interconnectedness in a digital ecosystem and a favourable market.

Agriculture machinery producer and digital service companies

The major agricultural machinery manufacturers and digital service companies, based in the EU, have recognized the need for greater compatibility between agricultural machinery, digital technologies, and data platforms, on the farm. Farmers have shown in surveys that the lack of compatibility between different brands of machinery and data collection is a barrier for many farmers and therefore they refuse to invest further in digital equipment. As this lack of capability reduces their overall market share, they standardized their data systems, which simplifies the technology application for the farmer. This created a higher economic and ecological value to the farmers and the cooperation is able to communicate this value. Incremental improvements and technological advances have led to the development of highly compatible machinery and digital platforms that integrate seamlessly. Intelligent tractors, precision planters and automated harvesters are now the norm on European farms. These machines can collect and transmit real-time data to digital platforms, enabling farmers to monitor crop health, optimize irrigation and manage pest control with precision, using only easy-to-use data platforms. Because they are easy to use, they meet the needs of most SMF, giving the technologies a certain market share.

SMF

In the early 2020ths, due to a hype for sustainable and regenerative farming a lot of people have seen their future carriers in farming and leasing land. As a result, many SMF were founded, which serve the higher demand for sustainable food options. They produce locally high-quality foods. These new SMF specialize in high digital equipment and planned this investment in their business plans beforehand. But lower educated farmers in higher age struggle to apply digital technologies. Bigger farms have already successfully adapted to high IT integration levels, and benefit already from economics of scale, which makes them more competitive on the world

market. In order to remain competitive, farmer-cooperatives and agricultural associations will provide workshops and presentations on how to make the application successful, ensuring that all farmers can access and implement IT solutions. The trust in digital technologies is high, as EU law secures farmers data ownership. SMF adopt organic and regenerative farming methods as well as using digital technologies in an efficient way. Farmers across the EU have achieved a high level of IT integration on their farms as they have adopted advanced technologies and are willing to share data. Their willingness to share data is monetary incentivized as consumers demand high levels of transparency throughout the food value chain, and retailers pay for the data to market the products better.

Retailer

Major retailers have seen great potential in the increased demand for sustainable food and started running green marketing campaigns in the early 2020th, partly to sell products at a higher price point. As retailers adapted to the demand for sustainable produce, they dedicate sections of their stores to products with ecolabel and advertising videos, which educated about the sustainable practices, running on tablets. Online platforms also prominently feature sustainable farm produce. The demand is so high that vegetables and egg and diary sustainable options are preferred to the conventional one. The demand is also driven by the high transparency of sustainable products. The consumer is educated in their shopping experience with easy-to-understand labels and videos. Therefore, the retailer offers more of this kind of sustainable and less conventional products. Also, convenience products are more and more offered with sustainable ingredients and packaging.

EU citizens

EU citizens are sensitized with green marketing campaigns for sustainable farm practice, without farmer bashing. School class visits to farms are mandatory for elementary and middle schools. This object is to increase the understanding for farm production and its importance. EU citizens have increased their demand for sustainable farm products as awareness for negative environment issues become more aware. Also, the awareness for the farmers' financial and social situation rises, which leads to an increased willingness to pay for sustainable food. Further food waste is socially avoided. Consumers trust in locally and sustainably produced food has increased dramatically through green marketing campaigns, education of children in schools and the QR code on products to trace the origin and production of food. Additional eco-

labelling has greatly increased transparency for consumers. Consumers are willing to pay more for high quality, sustainable food because they value sustainable farming practices.

Theo and Frida

Theo and Frida strategically adapted their farm business to the increase in demand for their sustainable products. They start to produce in an organic and regenerative manner, but also they want to intensify their production without producing less sustainably. As their land area is constant and cannot be easily expanded, their idea is to produce more efficiently. Therefore, they adopt more and more digital smart solutions. They started to invest in an irrigation system for vegetable production, but it has to be turned on and off manually, which is time consuming and based on visible soil and plant stress characteristics. They decide to use sensors to optimise irrigation, which then accesses when water is needed, and a computer automatically turns on irrigation when needed. This saves labour and water and increases yield by reducing stress on the plants. The data from the irrigation system is stored digitally and analysed. The farmers build on this success and further automate their farm through increased IT integration. Theo and Frida are using the subsidies to invest in smart sensors for precise resource management, data analysis for yield optimisation and automated machinery for efficient farming. They are also looking at automated weeding robots, but with their limited acreage it does not make sense for them to invest. Instead, they decide to rent one and share it with neighbouring farms. They also use data platforms, to share their data and experience with other farmers, but also with the further value chain stakeholders. This increases the market transparency, on which they can make better farming decisions. They are also starting to work with the local supermarket to increase their selling points, as the farm's opening hours are limited. Another marketing opportunity they have found for themselves is to sell their products to kindergartens and primary school caterers. Thanks to this contact, they now offer agricultural workshops for children twice a year.

Theo and Frida's farms have found their niche in the rapidly changing agricultural sector. They specialize in sustainable practices and produce high quality, environmentally friendly products. They market their products through night-time farmers' markets, local shops and online platforms linked to social media. Through their online presentations, they are able to communicate their commitment to sustainability and environmental friendliness.

In this scenario, Theo and Frieda's small farm has used high IT integration and consumer demand for sustainability to become a key player in reshaping the future of agriculture. They

have taken organic food out of the niche and into the mainstream by increasing transparency and using online shops. The result is a thriving business that is able to compete. Their farm performance is high, competitive and, most importantly, able to support their family in a sustainable way.

6.2.2 Scenario B - European agriculture dilemma: Between consumers green demand and digital stagnation

In the scenario "European agriculture dilemma" EU consumers strongly prioritize sustainability, SMF face pressure to adopt eco-friendly practices. Agriculture machinery producers focus on sustainable technologies. Retailers respond by emphasizing ecolabeling and marketing strategies for sustainable produce. However, farms struggle to achieve high levels of IT integration, as they are relying on traditional methods. Therefor no interconnected data economy has evolved. While sustainability goals are met, the farms may experience challenges in optimizing resource use and overall efficiency. The emphasis on eco-friendly practices may overshadow potential technological advancements.

Agriculture machinery producer and digital service companies

Agriculture machinery producers develop machinery which has lesser soil damaging attitudes and further increase sustainability by securing climate damaging emissions in the soil. They work further on machinery, which does more steps on field at once to limit the numbers of drive overs. This reduces gasoline and does not compact the soil as much. Furthermore, electronic machinery is developed. Digital solutions were not high in demand due to lack of connectivity, data security, and low trust levels of the farmers.

SMF

SMF are adapting sustainable farm practices such as regenerative farming and soil covering. As the demand is high for sustainable food, farm stores are very lucrative for SMF. Even though digital farm solutions could improve sustainability, SMF´s struggle to adapt them due to high investment costs.

Retailer

Retailers use the increased awareness for sustainability and market organic and region food prominently. They use the increased willingness to pay more for sustainable food options and set high price targets for these products.

EU citizens

Consumers have a high willingness to pay for sustainable food, as have become highly aware of the environmental impact of their food choices. They want to solve ecological issues and are responsible for the consequences of their consumption. They visit farmers markets or buy directly on farms, as their sustainable diet becomes a priority.

Theo and Frida

Theo and Frida are unsure how to digitalize and automate their farm. They rather stick to traditional farm practices and expand their knowledge about regenerative farming. They use the high demand for regional and sustainable produced food by selling their own produce and from befriended farms in their farm store. They like the interaction with their consumers and get to know their preferences and produce accordingly.

6.2.3 Scenario C- Agriculture's digital standstill: EU SMF and sustainability suffer

The scenario "Agriculture's digital standstill " envisions a European agricultural landscape five years from now that faces significant challenges in embracing digitalization and meeting sustainability goals. Despite the potential for transformative change, the agricultural sector remains trapped in traditional practices. The scenario highlights the effects of insufficient adaptation to emerging technologies in farming and food consumption, as well as the missed opportunities for a more sustainable and technologically advanced agricultural sector in the EU. Due to these circumstances a thriving data economy is not developed.

Agriculture machinery producer and digital service companies

Most agriculture machinery producers focus their main business on traditional non-digital equipment. This is due to low demands in digitalization and big hurdles in the market, as the compatibility between different machinery with different data systems is not given. The existing digital technologies are adapted by big farms, with the necessary investment possibilities. The overall level of digitalization remains low, with interconnectivity only on a farm level. Some individual agricultural machinery manufacturers are working with digital service companies to increase the digitalization of their machinery. As there are only a small number of large agricultural machines, each company wants to create a competitive advantage through its own innovation in order to gain greater market share and profits than its direct competitors. As a result, brands are becoming more specialized and less compatible. Agricultural machinery manufacturers and digital service companies are working on more specialized robots that will further automate field work to reduce labour and input factors. Such technologies are very

costly because they are just emerging on the market. Different brands of robots don't work with existing machinery and therefore don't exchange data, so in most farms the machinery and the robots work separately. These high-priced technologies are used by large farms that have the financial resources to establish such technologies. These farms also benefit from economies of scale. However, due to the competitive nature of the supplier, and therefore having connectivity issues with other brands, farmers are reluctant to invest.

SMF

Overall, SMF are struggling financially as demand for sustainable products declines while inputs such as labour and fertilizer become more expensive. As a result, SMF lack access to digital tools and have not adopted digital farming practices. Many farmers have traditional farming backgrounds and have not received digital education. Even if SMF are interested in digitalization of their farms and increase their IT integration level, they face difficulties, like slow internet, missing internet coverage, and limited access to digital tools. Most SMF are unable to invest in robots and other digital technologies for their farms because they lack financial resources due to the hardships of recent years. More and more SMF are quitting their jobs, selling their land and equipment, and finding other jobs. SMF have made limited progress in the process of generating higher IT integration levels. This deepens the gap between SMF and big farms, which are successful using more and more digital technologies. More and more SMF stop their production and sell the land and equipment’s to big farms.

Retailers

Retailers prioritize conventional products, and sustainable products are sold separately on different shelves. Ecolabelling is insufficient as the consumers are confused with different labels. This issue is not improved in the last five years. Retailers raise the price of sustainable products in order to increase their profit margin, which further reduces demand for the products. Retailers also resent organic produce because it is often not as visually appealing and goes bad quicker as conventionally produced food and defects this with the farms. As this continues to happen, they stop contracting with organic farms, as the demand for these products is decreasing. Organic and local farms lose a major selling point. Due to increasing issues with the visual quality of organic and local foods and lack in demand, retailers have decreased their sustainable food offerings. They continued to focus on food innovation such as lab-grown food, conventional food, and convenience food.

EU citizens

Due to the overall high cost of living, the demand for sustainable food is declining. Consumers are no longer shopping at farms or farmers' markets and are instead turning to cheaper options at discount stores. As a result, most of the direct selling farm shops are closing, and the consumer does not seem to be concerned about it. Some consumers are aware that other products have a better environmental impact, but consumers are increasingly price conscious, and convenience driven. Even informed consumers are no longer willing to pay higher prices due to increased costs of living and constant incomes. As retailers decreased the amount of organic food they offer, consumers buy less and less organic food.

Theo and Frida

Theo and Frida don't recover well from the lower demand of previous years. As they have not been able to break-even on most of their initial investments, they are unable to invest further in innovation. They use simple weather forecasting apps and some digital planning tools to get an overview of their current and past crop status. As the demand for their products is decreasing and their farm shop remains empty, they are thinking of producing more crops instead of vegetables, which they could sell on the land trade or futures market. Theo and Frida are interested in investing in digital technologies, to decrease labour and input factor costs. But they are afraid of how their data could be used and sold to, by the technology provider. Also, they are not aware of any subsides or beneficial loans, so they don’t have the financial resources anyway. They are frustrated, as they have problems to sell their product and cannot pay themselves a salary. The farm is making depts, with no vision how the situation could improve. In the next season Theo and Frida can no longer live on the low income from their farm. Heartbroken, they decide to cancel the farm lease and sell their equipment while they look for other jobs outside of farming. They leave the farm with high debts and in a worse emotional and physical state than before they started the farm. They wonder what they did wrong to make their business fail, but other friendly farmers gave up before them.

6.2.4 Scenario D- Digital harvest in a sustainable desert: Indifferent farmers

In scenario “Digital harvest in a sustainable desert” SMF become highly digitalized and interconnected, and a functioning data economy is implanted. This has happened without a high demand for sustainability from the consumer side. The scenario is characterized by modern digital supported agriculture practices and a silent population regarding sustainability and environmental issues.

Agriculture machinery producer and digital service companies

Agriculture machinery producers invest and develop in cutting edge digital machinery and services as the demand for advanced agriculture technologies is skyrocketing. The market for digital machinery is growing, like no other agricultural technology sector. The sector is booming also because of EU regulations for animal welfare and the decrease in pesticides and fertilizer. Farmers are incentive to invest in smart solutions for their environmental issues.

SMF

With GMOs banned, pesticide and fertilizer use strictly limited and audited, farmers have little choice but to digitalize their farming operations to manage and reduce environmental risks. Due to these regulations, they invest heavily in digital machines, which results in a reduction in the use of input factors.

Retailer

The supermarket offers are not changing much, retailers predominantly stock conventional products, as the demand for sustainable options obtains low. Ecolabeling stays untransparent and sustainable options are comparatively expensive to conventional products.

EU citizens

EU citizens are annoyed with sustainability, as the issues are not resolving itself. The consumer is confused with the ecolabeling and unsure of the impact of their shopping behaviour. The consumers don’t want to feel judged for their consumption and take responsibility. Additionally, marketing for sustainability becomes more and more a green washing marketing tool, whereas the consumer feels fooled. The consumer becomes more and more desensitized for sustainability issues and is more convenient and price driven, as it is more comfortable for them. Stringent regulations on input factors increase the sustainability of conventionally produced food, adding value to the product without the consumer noticing.

Theo and Frida

Theo and Frida invest in different digital technologies to increase efficiency in there farming and are sharing their data on an EU platform to better plan and adapt to the market earlier. As organic or local marketing is not effective, they don't bother to certificate as organic to save the money and invest it further in digital technologies. They sell their products to supermarkets and don't sell it directly in farm stores as it is time consuming, and the demand is low. They did implement a website to inform consumers, caterers, and supermarkets, but do not use it as a selling point. They focus on increasing the visual quality and efficiency of their farm, and don't bother in educating consumers. Their farm is highly automated and mostly needs supervision and strategic decision-making, therefor hard manual work is non-existing. Since fertilizer and pesticide use is reduced, as well as medication use for their livestock, they increased the environmental, social, and economic sustainability on their farm, without aiming for it. Their farm performance is slow and steady increasing.

6.3 Assessment of the farm performance in the scenarios

The experts were asked how each scenario will influence the farm performance of SMF in the EU in 2028. They were given five arrow stickers to choose from and were asked to place them on each scenario in the matrix. This can be seen in fig. 38. The arrows can be interpreted as farm performance rises strongly, rises moderately, stays the same, decreases moderately, and decreases strongly.

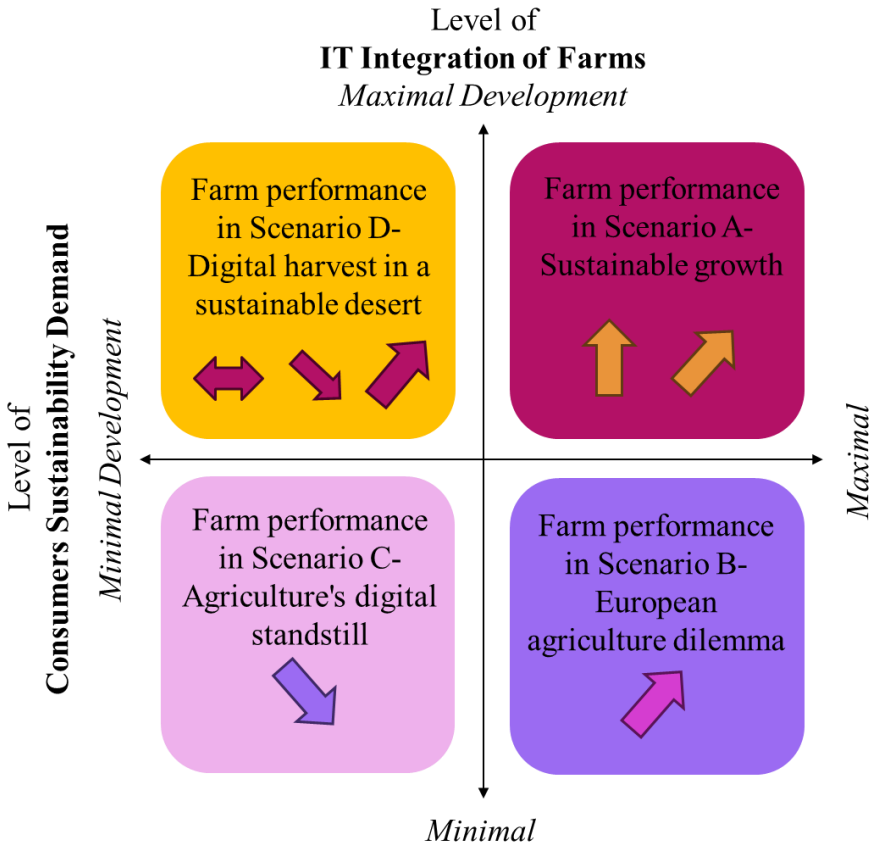

Figure 38: Scenario matrix with experts' assessment of the farm performance in each scenario

Source: own data collection

The experts come to consensus that in scenario A "Sustainable growth", in which IT integration level and consumers sustainability demand both are high, the farm performance of SMF will rise significantly. Similar is the assessment for scenario B "European agriculture dilemma", in which the IT integration is low, but the sustainability demand is high, the experts agree that the farm performance will stay at least the same and has a good potential of rise, since no expert assesses a farm performance decrease. In scenario C the collective assesses that the farm

performance will decrease if both IT integration and sustainability demand is low. The experts did not agree on how the farm performance will be developing in scenario D, in which the IT integration is high, but the consumer´s sustainability demand is low. The one senior expert assesses that the farm performance decreases moderately, while most of the young experts expect a moderate rise. No expert expected a strong decline in farm performance in either of the scenarios.

6.3.1 Scenario A- Experts' assessment of SMF farm performance

All experts agree that in case of scenario A "SMF thriving in the digital era" the farm performance of SMF expects the highest and most significant increase of all scenarios. The experts named serval reasons and considerations for the improvement of the farm performance.

Figure 39: Experts´ farm performance assessment for scenario Sustainable growth

Source: own data collection

First, high IT integration on farm level leads to reduced input amounts, such as pesticide and fertilizer, as digital tools can optimize the resource utilization and therefore lower the overall production cost, which would improve the farms performance. Expert #6: "*I think also with high I hope like with high IT integration that we can have like lower inputs for irrigation system, spraying. Maybe also not thought this through minimum tillage or stuff like this, but also, I think so then we can have low inputs which I assume will make it sustainable but also make it transparent to the consumer"* (2. Transcript, ln 250-253). Second, higher digitalization can increase the evidence of good sustainable practice of SMF, which is in high demand among consumers (Lam et al., 2020). Also, with increased transparency in sustainable farming practice can build trust of consumers, which further increases the consumers' demand. Expert #6: *"So, I think with the high performance of IT integration that we can give like that; we have a lot of indicators to prove that the product is sustainable. So, we have the high demand and with the high technology, we can prove we can have many indicators from the field through the product that the consumer can know it when he's buying it in store"* (2. Transcript, ln 238-241). But

expert #5 argues that higher transparency also may not be sufficient to change consumers behaviour, without a translation in an easy-to-understand label. (Expert #5: *"They (the consumers) think organic is good, but they don't know what organic means. Really. If you ask them on the street, what does organic actually mean? Most people don't know. And if you give them more, IT transparency. I don't even know if they care so much. Right. It's like it has to be a simple label. And I have a little bit of a question mark. I'm sure it drives things, but I'm let's say not that optimistic about it. As you were. That's why I didn't put the big arrow"* (2. Transcript, ln 285-287). Third, in this scenario sustainable farm produce is in demand, and SMF often specializes in sustainable farm produce. These farms would have an advantage as they can sell directly to consumers and achieve higher profit margins, due to the perceived value of sustainability (Expert #5, ln 273-281).

Even though there are three convincing arguments for high farm performance two experts independently from each other said that the farm size needs to be considered. The farm performance of SMF may not be as high in this scenario as for bigger farms which could use better scale up effects of the digitalization (Expert #5, ln 316-319): "*I really think for me the big question is who's going to benefit from it more? If you think small medium farms, if really all farms are more interconnected, the small farm going to benefit or the big one, right? And we'll see about that. Just my impression is now that larger farms will benefit more from this than smaller farms."* This is also added by expert #1 in the first focus group, he agrees that in this scenario the conditions for SMF are good but also states bigger farms should be considered: *"Yes. So, if the farmer can fulfil that* (sustainable production), *so the demands are manifold. And in case we have a high level of IT integration in the specific farm, we would be able to follow that. So that's my arrow up, maybe with a tendency to just put that here with a tendency towards this. Because there's always, I don't know how much we do have to consider the other farms, those bigger than we discuss here. But basically, it's a quite good environment for the farm to develop"* (1. Transcript ln 255-259). This means if bigger farms have the same good conditions, they can use digitalization better in comparison with SMF. This development might increase the competitiveness on the market for all farmers in the EU. Therefore, the development of a data economy could widen the gap between SMF and big farms, but also further widens the gap between developed and developing countries.

6.3.2 Scenario B- Experts' assessment of SMF farm performance

Scenario B "European agriculture dilemma: Between consumers green demand and digital stagnation" the experts expect a steady increase in farm performance for SMF in the EU in the

next five years, even though not as a high increase like in scenario A- “SMF thriving in the digital era”.

Figure 40: Experts´ farm performance assessment for scenario European agriculture dilemma

Source: own data collection

Expert #5: *“For me it's more or less the same arrow I put* (as in scenario A). *So maybe a little lower. A little bit lower. But I think in general, small and medium farms will benefit for sure from sustainability demand. That's something that the smaller ones benefit from, and so it will increase for sure”* (2. Transcript, ln 328-330). Reasons could be derived from the arguments from scenarios A. Consumers demand increase the farm performance, but input cost cannot be reduced without the digital technologies, which leads to a farm performance increase, but just not as high as if the IT integration is high.

6.3.3 Scenario C- Experts’ assessment of SMF farm performance

In the scenario C- “Agriculture's digital standstill: EU SMF and sustainability suffer” the experts in the first focus group agreed that a decrease or even a significant decrease in farm performance is to be expected.

Figure 41: Experts´ farm performance assessment for scenario Agriculture's digital standstill

Source: own data collection

In the second focus group the #5 expert convinced expert #6 that the farm performance might stays the same, as no IT integration decline could be pictured and if the sustainability demand is low, GMO technologies could be implemented and SMF could become international competitive:

Expert #5: *"I would say it's low* (IT integration). *That's why okay. I was not picturing, really a decline in IT integration. I have a hard time thinking how this would happen. So, I was more thinking like, okay, there's no development, or almost no development. And then that was my thought. If things stay as they are, maybe actually right now, if you look at the demand for sustainability, I mean, you might know this better. But also, my feeling is that it's not really growing much or rather declining at the moment. That's one scenario where I would say not much changes for the farmers and stays"* (2. Transcript, ln, 366-371).

Facilitator: *"Okay. Expert #6's, your farm performance goes down."*

Expert #6: *"Yeah, initially, I thought it would go down, but now, as it will be. As it is now, I think that nothing will change. So, it's like it stays"* (2. Transcript, ln, 379-380).

Expert #5: *"Farmers will keep on using the technology if it works. I think that's the main thing. (...) And actually, now that I think about it, I was not really picturing this decrease in sustainability, but what this could mean, it could mean something like GMOs are authorized in the EU, full Roundup ready, kind of seeds and stuff like this. And in terms of depends how you define performance. Right. But performance might actually go up for the farmers. I mean, it might be easier, more competitive internationally. It's not something that we want as a society. But I think for the farmer it might even be a better situation in terms of just his business and the competitiveness on the international level"* (2. Transcript, ln, 398-404).

Expert #6: *"Yeah, I think what we leave out here, we have the sustainability demand. I mean, we leave out policies. I mean, policies can drive all this. Then in 2028 we have a new CAP. So, with new regulations and maybe more subsidies for even more biodiversity friendly farming practices and also demand can be generated from the government, especially like organic goods, stuff like this, when we only focus on consumers demand on sustainability. Yeah, I always have in mind that policy can have a big influence and drive changes, force changes"* (2. Transcript, ln, 412-417).

Since the GMO regulation in the EU are very strict, it cannot easily expect that the political will change this fast in the next five years and will rather more develop in creating a more environmentally sustainable farming system. This was also insinuated by expert #6, that the sustainability demand will be also driven by policy. Therefore the author weight that in scenario C the logical conclusion is that the farm performance decreases and weights the assessment of expert #1-4 higher than the assumption of expert #5.

6.3.4 Scenario D- Experts' assessment of SMF farm performance

The biggest variation in the farm performance is found for scenario D- "Digital harvest in a sustainable desert: Indifferent farmers". Expert #1 asset a decline in farm performance, expert #2 a significant increase in farm performance, and for #3 farm performance will stagnate. While experts #4 till #6 expect an increase in farm performance for SMF, because with a high IT integration level, the sustainability goals could be meet, without the consumer demand.

Figure 42: Experts´ farm performance assessment for scenario Digital harvest in a sustainable desert

Source: own data collection

Expert #4 explains it like this: *"Because I was thinking it sounds like IT* (High IT Integration) *should have the goal to make the farm economically more feasible or more sustainable. So, I think it's the inherent goal of the technology that is implemented to result in more sustainability and higher profits. So maybe you meet the demand of the* (Sustainability) *consumers without even aiming for it. But if you want to, or if you apply more IT, but you're not even aware of the consumer demand, it sounds like you're a bit confused about why would you even implement the it. So, you might just go with a market trend without really having a strategy for your farm. And if you have no idea why you do what you do, it might mean that you don't have really no change. Really. But if you apply the IT because you know it has benefits, you also have a positive impact on the sustainability demand of consumers because you meet the demand even if it's not your main goal.*

Here is implied that you need to adapt digital technologies, (following the trend, without a strategy), to stay competitive in the market. And by applying digital technologies, to increase efficiency, an increase of sustainability could happen without aiming for it. The author agrees that if the IT integration is high on SMF, even without a high sustainability demand, the farm performance should develop positively, due to increased efficiency of farm inputs. But it needs to be considered, how fast a high IT integration on SMF can realistically be implemented.

7 DISCUSSION

The scenario analysis presented in this master's thesis provides valuable insights into the potential future trajectories of SMF in the EU on how different levels of IT integration level on farms and consumers sustainability demand has an influence on the farm performance in the next five years. To do so, a Delphi study with two expert focus groups were conducted. The research led to the scenario A - *Sustainable growth* in which the farm performance will increase for SMF, scenario B - *European agriculture dilemma* in which also a positive farm performance development is assessed, but SMF turn to traditional farm practices. In scenario C - *Agriculture's digital standstill* the farm performance decreases, and in scenario D - *Digital harvest in a sustainable desert* the farm performance is expected to stay the same or to increase.

The most striking result is that no development on the IT integration and a decrease in demand for sustainable food, is a high risk for SMF, to lose the competitiveness and conditions to exist in the market.

The following discussion compares the literature and the assumption scenarios with the expert-based scenarios, assess each scenario on their level to reach a data economy and how emerged digital technologies are, and critically examines the implications of each scenario, and suggests recommendations for policymakers and stakeholders in the agri-food industry and discusses the limitations and assumptions of this master thesis.

7.1 Comparison of literature and assumption scenarios with expert-based scenarios

Assumption scenarios are literature based so it is a comparison from literature and the results of the thesis.

7.1.1 Scenario A - High IT integration and high sustainability demand

The assumption scenario S*olarpunk* and scenario *Sustainable growth* are very similar. Both scenarios are developing positively, as the general conditions for SMF are good. All used factors develop good and influence each other positively. Both scenarios come to the conclusion that farm performance is improving significantly. But the assumption scenario describes developing in a short period of time to develop into the early steps of a utopia, which is named solarpunk. Solarpunk is an idea of a movement, in which humans live in balance in nature by using technology in a sufficient manner and using all resources in a sustainable manner. The expert scenario *Sustainable growth* is more realistic, and is not promising a utopian future, while still being a very positive one for SMF, as the farm performance is expected to increase

the highest of all scenarios. The driver for this development is the sustainability demand of consumers, as the high willingness to pay for sustainable farm produce directly influences the farms to increase their IT integration levels.

This scenario has multiple similarities to the scenarios from Ehlers et al. (2022), in which different level of digitalisation are the dimensions of the scenario matrix, to fine policy gaps and recommend according to strategies. They left out the consumers sustainability demand, or any sustainability issue. Their level is the environment of digitalisation, between unconducive, with low acceptance and innovation rates and conducive, high acceptance and innovation rates (Ehlers et al., 2022). The other dimensions how homogeneous or heterogeneous the development of digitalisation is. In scenario A *Sustainable growth,* the development of digitalisation is also positively impacted by the cooperation of agriculture manufacturers and digital services companies, while the acceptance of the farmers for digital technologies are high. This would be in line with their scenario "Autonomous Technology", where also data openness and much data sharing is a condition (Ehlers et al., 2022).

7.1.2 Scenario B - Low IT integration and high sustainability demand

In the assumption scenario *Solidary agriculture* named reasons for the increased demand are health and environmental concerns, climate change, which increase sustainability awareness. These reasons are not explicitly named by the experts but can still be underlying reasons for future increase in sustainability demand, as these are reason for food movements in the past (Isenhour, 2011). Further in the assumption scenario the solidaric agriculture movement led to a bigger connection with the farms and low digital technology applications, as with increase workforce the investment is not needed. This is not covered by the experts, and therefore not in the scenario *European agriculture dilemma*. But they also see that regenerative practices can be a reason to improve soil, sustainability, and yields, without technology applications. In the assumption scenario, the farm performance stays the same, without significant change. This is not how the experts assessed the scenario, for them the farm performance will increase steadily, with the increased sustainability demand. This scenario is mostly in line with the scenario Ligh Digitalisation from Ehlers et al. (2022), in which the willingness to share data is low, farmers have great farming skills, and innovation rates are low. Ehlers et al. (2022) also mentions great equality for farmers, which is not coarse data resolution, which is not explicitly mentioned in the influence diagram B or the scenario *European agriculture dilemma* but fits in the overall picture.

7.1.3 Scenario C - Low IT integration and minimal sustainability demand

In the assumption scenario *Back to the 50^{ies,}* the IT- integration stagnates as the trust in data sharing technology drastically decreases, due to data ownership struggles, and the consumers demand is declining due to increased living expenses. In this scenario the farm performances are negatively affected, and SMF struggle. This possible development is in line with the expert-based scenario *Agriculture's digital standstill.* In this scenario SMF use traditional farm practices and haven't developed much. With low consumer demand for sustainability the farm performance is declining, to the point where it is no longer economical to continue the farm activity and sell land equipment to bigger farms. The scenario *Agriculture's digital standstill* has similarities with the scenario "Digital revolution" from Ehlers et al. (2022), in which the willingness to share data, digital literacy, innovation rates, and farm skills are low. In "Digital revolution" The government owns the data and is very powerful, as it provides and controls the digital infrastructure, which is not the case for *Agriculture's digital standstill*, where the low sustainability demand of consumers is troublesome to the SMF.

7.1.4 Scenario D - High IT integration and minimal sustainability demand

The assumption scenario *Oligopolization* describes how SMF cannot cope under market pressure any longer, and have to sell their land, to bigger farms. These big farms than can invest in cutting edge technology and can use scale-up effects for an improved performance. In this scenario, SMF obviously lose farm performance to a point, where a sustainable economic practice is no longer possible. This is not the case in the expert-based scenario *Digital harvest in a sustainable desert*, in which SMF become highly digitalized, as they are pushed from EU regulations. It is expected with increase in efficiency, the farm performance slightly increases, and the production becomes more sustainable, without the consumers demanding for it. The scenario *Digital harvest in a sustainable desert*, has similarities to Ehlers et al. (2022) scenario "Digital Food Business", in which innovation and acceptance rates are high, and detailed data for food issues is available. In this scenario, it is concerning that the data is closed, and farmers have low quality. As SMF have already a burden to compete in the market, this situation could become worse, without policy frameworks, which help SMF receive fairness in a data economy.

7.2 Assessment of scenarios based on their evolution towards data economy and emerging technology level

In scenario B *European agriculture dilemma* and C *Agriculture's digital standstill*, a highly interlinked data economy in the agri-food sector is not possible, due to the limited IT integration

levels of EU farms. Even though a data economy is not developing, in scenario B, SMF are still expected to increase their farm performance, as the sustainability demand is high. This is based on the assumption that SMF produce the more sustainable perceived products, such as organic and local produce. But without the sustainability demand and no data economy, as in scenario C, the situation states very similar on how it is today, but with further decreased farm performance, SMF cannot longer participate in the market.

On the other hand, in scenarios A *Sustainable growth* and D *Digital harvest in a sustainable desert* a data economy has evolved, as data is collected, stored, analysed, and is used to generate value to the farmers. The attributes of radical novelty and uncertainty of digital technologies, which are nowadays high, are in scenario A and D low, and they had a prominent impact on SMF, are expected to be coherent and relatively fast growing among SMF. In conclusion, digital technologies are emerging technologies in scenario A and D, following Rotolos et al. (2015) definition. In both scenarios the farm performance is expected to rise.

A disruptive character had the low level of consumers sustainability demand. As with the combination of low IT integration level, in scenario C SMF lose their competitive advantage and changes the performance metrics both for SMF and large farms. In scenario D low sustainability demand also disrupts the way SMF market their produce, as they no longer sell to consumers directly and give up their direct contacts to them. In this scenario, they prefer to sell exclusively to supermarkets.

7.3 Implications and recommendations for stakeholders

In this chapter implication and recommendations based on the scenario results are made for SMF, machinery producer, EU citizens, and EU politics.

7.3.1 Implications and recommendation for SMF

Besides environmental and economic risks SMF also faces the dramatic risk of a change in consumer's demand. On the basis of the results of the scenarios, farmers are advised to influence consumer demand in the best possible way. Several ways are possible. SMF can sell their produce directly to consumers for example via farm stores, in this way SMF can pay pass modern procurement chains (Rivera et al. 2020). Further they should advertise their work, commitment and sustainability goals and vision to their customer. This would lead to value based advertisement. This can be done via homepage, social media and mouth to mouth propaganda, television presence or newsletter articles. As this is also a lot of work, they could also consider hiring a social media expert to maintain or run their social media platform, or

even an enthusiastic volunteer. This recommendation is in line with Poulton et al. (2010) strategy, to leverage cheap or even free labour to use local context knowledge to enter existing markets. Also, farmers should consider in direct contact and marketing strategies to learning the preferences of the consumers and targeting them accordingly. Consumers will just keep buying their products when their needs are met. A niche could be opening due to local preferences. With this shift from producing commodities to more specialized products, the resilience of SMF could increase, following Vetta (2007). Besides to influence the consumer demand as positive as possible, they should consider investing in digital technology, which can help reduce input factors, such as work force, fertilizer, pesticides, and feed. This can help decrease costs and increase sustainability to their farm.

Following the result in scenario A- *Sustainable growth*, if the SMF can reach high level of consumers sustainability demand and IT integration levels on their farms, they can expect an increase of farm performance. To reach high sustainability demand a marketing strategy, which target woman with high income could be helpful. Products and services, such as the delivery of veggie boxes, should be convenient as possible, then also high price premiums can be realized.

The literature has described a strategy for SMF, to create a Win-win situation for consumers and farmers, by creating food hubs (Berti & Mulligan, 2016), instead of solidaric agriculture. This could be an applicable strategy for SMF in the scenario *European agriculture dilemma*. By creating food hubs, with a number of SMF, the scale up is not the responsibility of only one farm, but an ecosystem for SMF is created. Produce is delivered directly to the consumer, without the supermarkets as the middlemen. This way SMF not price takers but price negotiates, as they deliver value based products to the consumers (Berti & Mulligan, 2016).

This could be also an applicable strategy in scenario A, as the sustainability demand of consumers is high. Here, due to the high IT Integration level on the SMF, e food hubs could be created, which use data transparency on websites to communicate with consumers the product availability, payments, and sustainability value of the produce (Berti & Mulligan, 2016).

7.3.2 Implications and recommendations for EU citizens

Low demand for sustainable farm produce can have significant implications for the EU citizens. Products that are not in demand will be no longer produced. With a further decrease for local and sustainable produced food, EU citizens could find themselves in a situation where they cannot buy such food in an accessible way. This could mean sustainable products, but also valuable arable ecosystems could get lost along the way. Additionally, if farmers are not paid

for their work and know-how and they stop working, the special land experience and knowledge could get lost. EU SMF provide citizens with environmental and social public goods ("Provision of public goods through agriculture in the European Union", 2009), which could be endangered if the scenarios with low sustainability demand become reality. While on the other hand if the demand of EU citizens is increasing, like in scenario A *Sustainable growth* and B *European agriculture dilemma* thriving communities could evolve to promote a sustainable society, in which SMF are financially recovering growing and sustainability issues can be locally solved.

For the privileged reader, who has the ability and opportunity to support SMF, please do buy your groceries as much as possible at local farms. But the recommendation just to buy more sustainable and local food products to increase sustainability runs short, as not all citizens have the privilege to do so. But individuals can organise themselves, vote for a sustainable future and food system, and influence policy and cooperations to take actions.

7.3.3 Implications and recommendations for EU policy

In the following the implications of low and high levels of the dimensions for the EU politic is discussed as well as recommendations are given based on the implications from the scenarios.

First the implications of different levels of consumer demand for sustainability are discussed and recommendations are given. This is followed by the implication and recommendations for the IT integration levels of EU farms.

The EU not only need to increase the demand for sustainable agricultural products from SMF, if the EU does not want to continue to risk a significant amount of SMF. But the EU also needs to create political and redistributive solutions to achieve real sustainability. Although consumer demand has increased in the last decades since the rise of alternative food movements, this can be interpreted as a shift of responsibility to the consumer (Isenhour, 2011). The expectation of such market-oriented solutions can significantly deteriorate environmental and climate problems, reflecting the growing influence of neoliberal environmental governance (Isenhour, 2011). Instead, structural barriers need to be overcome to bring about significant change, as consumer responsibility excludes those without access or financial means to purchase sustainable food, creates social hierarchies, and fails to provide the political and redistributive solutions needed to archive sustainability. The consumer cannot be let alone in the responsibility to reach sustainability, and politicize their grocery shopping and leave this decision to certain social groups, which can afford to buy sustainable and local produce

(Isenhour, 2011). Therefor collective and political actions are recommended. To reach a sustainable circular economy, it is necessary that the whole system must change without leaving the responsibility to the consumer (Hartley et al., 2020). The EU can help create a circular economy, by developing a data economy in agri-food (Hartley et al., 2020). This could be a necessary step to create a sustainable food system, in which not only privileged consumers, eat in a sustainable and healthy way (Wilk, 2004). First steps are taking by the political initiative like the Farm to fork strategy to create a sustainable food system, but more actions need to be done.

What consumers could help, based on the expert's assessment, is a standardized and understandable ecolabel, which increases transability of the production of food. It can be a great tool to educate consumers and help them to make an informed decision in their food choices (Brown et al., 2020). Further an understandable label, can improve consumers trust in the agri-food sector. An example for an easy to understand label is the new regional label for Germany, „Gutes aus deutscher Landwirtschaft" in English "Good products from German agriculture", which comes with easy requirements: The food must have been produced in Germany (Michelberger, 2023). A understandable and standardized ecolabel, could be a good solution towards an increased demand towards sustainability and reach increased awareness of the production of food (Brown et al., 2020). But since the concept of sustainability is abstract and divers, as well as food systems and production schemes are complex, it is a mayor challenge to label sustainable foods accordingly (Brown et al., 2020). Further green marketing and educating EU citizens could increase awareness for sustainability and increase the willingness to pay (Wei et al., 2018).

Policy to enhance digitalization on farm levels are highly necessary, if the agri-food sector should stay competitive in the world market. Numerous sectors have already disrupted due to digitalization, but the EU agriculture appears to be lagging behind other significant industries (Luyckx & Reins, 2022). An explanation is that the EU agriculture is based on a complex system, which is mostly operated by comparatively small enterprises (Luyckx & Reins, 2022). No political support could lead to low productivity levels and the sector stays traditional. On the other hand, political support could target unfairly mainly large farm, which can widen the gap between different farm sizes further (Garske et al., 2021). Therefor it is recommended to target SMF directly to help investing in digital technologies, to decrease the risk of unfair market situations. Also digital technology should be affordable or accessible for SMF, and not only to large farms (Garske et al., 2021; Luyckx & Reins, 2022). Further data ownership needs

to be protected, so that the risk averse farmers do not need to fear, loss of control over their collected data.

The EU needs to make it possible to invest for SMF in digital technologies if they are willing to meet sustainability targets in agriculture and let a data economy for food evolve. Even though there are many factors which influence the adoption of digital technologies negatively on farm level, like risk aversion, conservatism, aversion to IT-based innovation, the biggest hurdle, especially for SMF, obtaining financial possibilities (Verbeek et al., 2019). The EU funding landscape is highly fragmented and complex, which leads to low accessibility to financial instruments (Verbeek et al., 2019). The application for various financial opportunities needs to be simplified and the conditions need to be more transparent communicated. But before investment possibilities, a legal framework is necessary to incentives the investment. The framework needed to clarify product liability questions, farmers need a guarantee to their data protection and security (Garske et al., 2021). There is a need for EU wide data standards and basic digital infrastructure, which is also covering 100% rural areas (Garske et al., 2021). A requirement that big data or data economy is a tool to reach sustainability targets is, that legal framework archive the inclusion of SMF, to reach fairness and distribution of benefits and access of digital tools (Luyckx & Reins, 2022).

7.4 Limitations, assumptions, and critical reflection

A limitation of the research design is that just social and technological factors where used, to assess the economic situation of SMF, and other factors were dismissed. For future research political, economic and law factors should be considered. One of the biggest assumptions used in this thesis, both from the author and the expert is that SMF produce sustainable farm produce, which is a generalization. Furthermore, the results are based on the only six experts' opinion. To generate a higher validity of the generalization of the results, they are interpreted in light of theories and recent papers.

There were some limitations in the execution of the focus groups. Only the results of four out of six expert surveys could be used to select the influencing factors. This is because just one expert of the second focus group answered in time. Therefor it was decided to use the same factors as in the first focus group, this way the results of both focus group could be compared and described in the same way. For future research it is recommended to hand out the surveys earlier, so that the results of all experts can be included, not only the once of the first focus

group. In the second focus group, with only two participants, there was a lot more discussion, which made more arguments and backgrounds clear. Therefore, more arguments from these experts could be used in the results. This could lead to the results being skewed slightly more towards the opinion of these experts. The facilitator did not moderate differently than in the first focus group, as each step was moderated in the same way, as all instructions were read out and the moderator stuck very closely to the script. However, it may be that because there were only two lively participants with different views, the need for discussion was greater. As a result, the focus group lasted longer, and more insights could be drawn from the discussion. To not let individual experts influence the results to much, the author weighed the arguments, in light of the literature when needed. The author therefore recommends holding several smaller focus groups and possibly interviewing the experts with different views several times or discussing the results from the first focus group in a large group. But even here there is a high risk that one expert will dominate the discussion. The written scenarios should be discussed again with the experts, for them to discuss them and have another iteration to be sure that is their opinion. This is missed due to time constrains of a master thesis. Instead, the scenarios were sent to the experts to read and for them to give them an opportunity to give feedback on them, which was without an answer.

8 CONCLUSION

The prospects and effects of digitisation in the agri-food sector and sustainability demand for SMF is uncertain. To prepare agricultural stakeholders, in particular SMF in the EU, this master thesis developed four scenarios, which addresses the uncertainties and challengers which come with different levels of digitalisation and sustainability demand. The research has demonstrated that the further development either of digitalisation of the agri-food sector or an increased consumer sustainability demand is condition for SMF last in the market, as they already face financial hardships. The Delphi study has advanced our understanding on how different level of IT integration and consumers sustainability demand influences the farm performance of EU SMF. Policymakers should consider increasing sustainability demand though green marketing, education, and understandable ecolabels. Further to increase the IT integration on farms, political framework for data sharing and data platforms are necessary. Data security needs to be protected, so there are incentives to share farmers data. Further SMF need to specially facilitate to invest in digital technologies. This is important not to risk further decline in the numbers of SMF, due to unfair market conditions. The findings are mostly supporting existing literature and contribute the unique viewpoint from technology development of digitalisation and consumers side on SMF. Moreover, the strategy recommendation for SMF to create and work in food hubs, should be further researched, how these can be implemented and supported by the EU politic. Additionally future research could explore the same scope, but using not social and technology factors, but politic and economic once. This future research could broaden and deepen the understanding of how SMF will be influenced in future.

APPENDIX

I. PERSONAL DECLARATION

Personal Declaration

I hereby affirm that I have prepared the present master thesis self-dependently, and without the use of any other tools, than the ones indicated. All parts of the text, having been taken over verbatim or analogously from published or not published scripts, are indicated as such. The [paper/ thesis] hasn't yet been submitted in the same or similar form, or in extracts within the context of another examination.

Pulheim, 29.11.2023

_____

Student's signature

II. QUESTIONNAIRES OF ONLINE SURVEYS

II.1 Online survey for expert participation and demographic data

Please register your participation

... to the expert discussion on the future of SMF in the EU

1. Please enter your name (This is needed in case that I need to inform you regarding your participation)

Open answer

2. Please enter your email address (This is needed in case that I need to inform you regarding your participation)

Open answer

3. Will you participate at the online expert discussion?

- Yes, I will participate at the 27.06. at 7 p.m.
- Yes, I will participate at the 04.07. at 7 p.m.
- No, but another expert within our organisation/business is willing to participate instead of me
- No, unfortunately I can not attend

4. Please enter the name of the person participating instead of you

Open answer

5. Please enter the email of the person participating instead of you

Open answer

6. What is your field of experience (multiple answers possible)

- Agriculture
- Digitalisation
- Sustainability
- Sociology
- Economics
- Politics
- Other

7. What is your professional position?

Project Manager

- Team Manager
- Supervisor
- Researcher
- Engineering
- Employee
- Student
- Open answer

8. Please enter the name of your occupation

Open answer

9. Please enter the name of the company or organisation you are working for

Open answer

10. What age group do you belong to:

- 18-24
- 25-34
- 35-44
- 45-54
- 55-64

11. Please enter your gender

- Woman
- Man
- Non-binary
- Prefer not to say

12. Thank you, for your answers. Any other feedback you would like to share?

Open answer

II.2 Online survey for expert assessment of influencing factors

Please rate the following factors according to their impact and uncertainty within the next 5 years.

1. Please rate the following factors according to their impact on the IT integration level of EU small and medium farms within the next 5 years.

(More than one item can be ranked as having the "highest impact".)

Background:

IT integration level on farms refers to the level of how high the IT applications are interconnected on farm level. This level can vary, at the low end, is the use of standalone apps. At the highest level, stands a system of systems where many stakeholders in a business ecosystem use data platform.

	No Impact	Very low Impact	Low Impact	Medium Impact	High Impact	Very High Impact	Highest Impact
Compatibility of machinery, data, and digital platforms	○	○	○	○	○	○	○
Access to digital platform for data sharing	○	○	○	○	○	○	○
Access to digital services	○	○	○	○	○	○	○
Internet coverage	○	○	○	○	○	○	○
Education level of farmers	○	○	○	○	○	○	○
Willingness to adapt technology	○	○	○	○	○	○	○
Trust in data sharing technology	○	○	○	○	○	○	○
Attitude towards digital agribusiness	○	○	○	○	○	○	○

2. Please rate the following factors according to their **uncertainty** on the **IT integration level** of EU small and medium farms within the next 5 years.

(More than one item can be ranked as having the "highest uncertainty".)
Background:
IT integration level on farms refers to the level of how high the IT applications are interconnected on farm level. This level can vary, at the low end, is the use of standalone apps. At the highest level, stands a system of systems where many stakeholders in a business ecosystem use data platform.

	No Uncertainty	Very low Uncertainty	Low Uncertainty	Medium Uncertainty	High Uncertainty	Very High Uncertainty	Highest Uncertainty
Compatibility of machinery, data, and digital platforms	○	○	○	○	○	○	◉
Access to digital platform for data sharing	○	○	○	○	○	○	○
Access to digital services	○	○	○	○	○	○	○
Internet coverage	○	○	○	○	○	○	○
Education level of farmers	○	○	○	○	○	○	○
Willingness to adapt technology	○	○	○	○	○	○	○
Trust in data sharing technology	○	○	○	○	○	○	○
Attitude towards digital agribusiness	○	○	○	○	○	○	○

3. Please rate the following factors according to their **impact** on the **Consumer sustainability demand** of EU small and medium farms within the next 5 years.

(More than one item can be ranked as having the "highest impact".)
Background:
Consumer sustainability demand refers to the growing desire among consumers for products and services that are environmentally friendly, socially responsible, and economically viable.

	No Impact	Very low Impact	Low Impact	Medium Impact	High Impact	Very High Impact	Highest Impact
Availability of sustainable farm produce	○	○	○	○	○	○	○
Ecolabeling of sustainable farm produce	○	○	○	○	○	○	○
Product value and quality of sustainable farm produce	○	○	○	○	○	○	○
Retail environment of sustainable farm produce	○	○	○	○	○	○	○
Willingness to pay more for of sustainable farm produce	○	○	○	○	○	○	○
Level of concern regarding environment	○	○	○	○	○	○	○
Level of awareness regarding sustainability	○	○	○	○	○	○	○
Attitude toward sustainable products	○	○	○	○	○	○	○

4. Please rate the following factors according to their **uncertainty** on the **Consumer sustainability demand** of EU small and medium farms within the next 5 years.

(More than one item can be ranked as having the "highest uncertainty".)
Background:
Consumer sustainability demand refers to the growing desire among consumers for products and services that are environmentally friendly, socially responsible, and economically viable.

	No Uncertainty	Very low Uncertainty	Low Uncertainty	Medium Uncertainty	High Uncertainty	Very High Uncertainty	Highest Uncertainty
Availability of sustainable farm produce	○	○	○	○	○	○	○
Ecolabeling of sustainable farm produce	○	○	○	○	○	○	○
Product value and quality of sustainable farm produce	○	○	○	○	○	○	○
Retail environment of sustainable farm produce	○	○	○	○	○	○	○
Willingness to pay more for of sustainable farm produce	○	○	○	○	○	○	○

	No Uncertainty	Very low Uncertainty	Low Uncertainty	Medium Uncertainty	High Uncertainty	Very High Uncertainty	Highest Uncertainty
Level of concern regarding environment	○	○	○	○	○	○	○
Level of awareness regarding sustainability	○	○	○	○	○	○	○
Attitude toward sustainable products	○	○	○	○	○	○	○

III. EXPERT ASSESSMENT OF FARM PERFORMANCE

	Scenario A	Scenario B	Scenario C	Scenario D
1. Expert	rises strongly	rises moderately	decrease moderately	decrease moderately
2. Expert	rises moderately	stays the same	decrease moderately	rises strongly
3. Expert	rises moderately	rises moderately	decrease moderately	stays the same
4. Expert	rises strongly	rises moderately	decrease strongly	rises moderately
5. Expert	rises moderately	rises moderately	stays the same	rises moderately
6. Expert	rises strongly	rises strongly	decrease strongly	rises moderately

Table 4: Expert´s assessment of the farm performance development in each scenario

IV. DECLARATION OF CONSENT FOR THE EXPERT GROUP DISCUSSION

Declaration of consent - Expert group discussion

This declaration refers to the participation in a expert group discussion for the data collection of the master thesis of Lena Kampa, which will be taken within the framework of the Double Degree Programme BoWaCo of the Universities of Wageningen and Bonn.

I hereby declare that:

- I have been sufficiently informed about the interview and its purpose.
- I have been informed that the analysis of the data collected will be anonymous and that no personal data will be accessible to third parties.
- I agree that audio or video recordings will be made during the group discussion. The recordings will be deleted as soon as the Master's thesis has been submitted.
- I agree that the group discussion may be transcribed by the interviewers.
- I agree that the data collected may be used for academic projects and related publications.
- I agree that quotations may be published in scientific publications. Only characteristics of the person, but no personal information, will be included.
- I am aware that the interview is voluntary and that I can cancel it at any time.

I agree to the above and confirm this with my signature.

First and last name

_____

Place, date Signature

_____ _____

V. TRANSCRIPTS

V.I 1. Transcript

Transcript 1. Focus group with names
Introduction miro board and experts
06:26
Lena Kampa
if I have to go to English, because the whole thing is in English. And if I don't switch now, it's going to be really complicated for me. So, hi here in English we're still waiting for two participants. Very well. I don't know how long I should wait for them. Okay, so maybe for the people who are here, give me a heads up if you're on the My report and you see what I'm seeing is the introduction with the agenda and so on. Okay, here's another participant coming. Okay.

07:45
Expert #1
My miro board is problems loading it's.

07:49
Lena Kampa
Loading yeah, there's a lot of things on. Okay, this is maybe why maybe it's just the agenda for now. I get you all on my side. Bring everyone to me.

08:08
Expert #1
I can see the agenda.

08:10
Lena Kampa
Yeah, perfect. Okay, most people are here, so I guess I just died. Hi, welcome to this expert group. I'm Lena Kampa. I'm a master student in the WD group with Double degree program with the university's Bonn and Wageningen. We are here today to create the developments behind four different scenarios in the agriculture in the U to 2028. These scenarios are already given. They were developed within two dimensions the IT integration level and the Customer Sustainability demand. And I will ask you how each scenario is influencing the farm performance of small and medium farms in the EU in 2028 and how those development will be created. So, the agenda is to first get to know miro a bit and each other. So, I know this is a bit of technical task. So, we get to get familiar with the board. Then I explain a bit the objects of this workshop.

09:27
Lena Kampa
Then you ask the experts to assess the influence of each scenario on the farm performance of small and medium Pumps in the EU in 2008. Then I present you the really nice results we got from the survey from today, which you did. So, we have good results and we're going to use them in the following up part to develop the influencing diagrams and then the experts will actually do them. The influencing diagrams behind each scenario. But don't worry, I'm going to explain everything really thoroughly and you will can tackle this. Yeah, I think that's it for that part. So maybe we're gonna go to the Myra board where you are. So now you can see the introduction to miro. And you have a bit of time here, like five minutes to just familiarize yourself with the control of miro. So, you know, that all the commands.

10:46
Lena Kampa
You can just scroll down. We have here the moving around, the SIM in, SIM out, the comment function, the following and the sticky notes and how to use errors. You're just welcome to use this a bit and so everyone is ahead of how malware is used. So just take your time a bit. Just take five minutes and set a timer. And you can go ahead and try this out a bit and I mute myself.

11:20
Expert #1
Will we have an introduction to know who we are here?

11:24
Lena Kampa
This comes directly after you know how to do that.

11:28
Expert #1
Okay.

11:29
Lena Kampa
You will get to familiarize yourself just so you know how to move around here first. Okay? I hope you feel yourself a bit more familiarized with the comments and the functions and the sticky notes and the errors. We're going to use them in the later part. So now we're going to go to the icebreaker where we introduce each other to each other. You see here a bit of a board. I did a bit of a presentation for myself already. So, you are now welcomed to just create your board a bit. You are welcomed to answer one of those questions. You can name your name, Hobbies, whatever. Just a short introduction. Take two minutes or three minutes to do that and then everyone is allowed to introduce themselves. And then you get to know a bit with the My report to work with them. Okay?

17:13
Expert #3
Sorry, could you repeat that? I was frozen.

17:16
Lena Kampa
Oh, sorry. So now it's up to you to introduce yourself. Use your own board. So, Expert #3, you're down or Expert #3. Sorry?, Expert #3. You can just select one of the questions from above and answer those and write whatever is what you want to introduce yourself, what you're working, what's your age, what's your hobbies short introducing of yourself. Take three minutes for that and then we have the round. Okay? Maybe someone Expert #1, maybe you want to start to introduce yourself. You seem ready. You muted.

20:57
Expert #1
Shall we? Better now?

20:59
Lena Kampa
Yeah.

21:00
Expert #1
Okay. Yes. My name is Expert #1. I'm working for class for the aquacultural machinery manufacturer. And there I'm working in the Advanced Engineering department. Sorry if there is some noise in the background though, I'm still not alone in the office. And in the Advanced Engineering department, it's electronics. So, we are developing robotic systems, AI and control systems and I specialize. So, my most important activity is research management. So, I disappeared a little bit from bits and bytes. And yes, that's what I do. I have an agricultural background. I also studied in Bonn that's long ago, and then I did a PhD.

22:03
Lena Kampa
I just didn't got where you did the PhD, but I guess my Internet connection is a little bit unstable. Okay, Expert #4. Maybe you're next.

22:16
Expert #4
Yes, I noticed I'm quite slow with those sticky notes, so I didn't write too much.

22:21

Lena Kampa
That's fine.

22:25
Expert #4
So maybe personal background. I know Lena because were let me so this is how we met. Lena did her or was doing part of her master's here in Wageningen, and I'm doing my PhD here in Sustainability and vertical farming, so in Controlled Environment agriculture. And my background is in sustainable international agriculture and ecosystem management, so focusing on vulnerable agro ecosystems and how to improve them. And what I really like to do I love books, so probably my favourite purchase of this year was when I was in Mastery in this big church, which is a bookshop, and I just came out with a pile of books. I love going to museums and exploring. So, moving to the Netherlands was also really nice for me because a lot of new places to explore, and I love chocolate and coffee. But yeah, that's it from my side.

23:21
Lena Kampa
Thank you. Expert #2, you want to go next?

23:27
Expert #2
Sure, I can go next. Hi. Nice to meet you all. My name is Expert #2. I have as well an agricultural background. I study Agriculture Sciences and Agriculture economics, and I did my master's as a double degree in Sweden, Italy. I finished last year. And right now, I'm working my first job as consultant in renewable energies, focusing on bioenergy, biofuels, biomass, and plans. And that's it for my side for now.

23:56
Lena Kampa
Thank you, Expert #2. Expert #3, could you introduce yourself? I see. Very interesting. Hobbies.

24:05
Expert #3
Well, yeah, hello to all here in this meeting. So, my name is Bishop, 26 years old. I also did the same double degree as Lena does now. So, I also was one year at the University of Bonn and one year at the University of Wageningen. I graduated this year in March. So very freshly graduate, so to say. I'm doing my first job right now as a trainee in sustainability management. Also have agricultural background. So, I did agricultural sciences in my bachelor's, did an apprenticeship as a farmer even before studying. Well, yeah, I think that's it.

24:56
Lena Kampa
Yes. Thank you. So, I'm really proud of my experts because they were asking me, like, I'm really an expert. I was like, I know, because you have practical background, you have a family farm, or you have the internship, or you did your PhD or whatever in Agriculture and sustainability. I know all of you are really excellent expert. I'm so glad that you took the time here for this scenario development. And so, I don't want to waste furthermore time here and go to the objectives of today. So, I have to give you a look of what those are, get you all here back. The objective is first is to discuss different future scenarios and how they will influence the farm performance of the EU small and medium farms till 2028. This will be done in the next step. Then how will the individual development of influence diagrams of each scenario?

Farm performance assessment

26:02
Lena Kampa
So there are the experts asked. Again, you will present an outcome of what you have done. So, this is why we did all this little training here to get to work on this board. And I say the dimensions of this framework is already given of level of sustainability, the amount of consumers and the level of IT integration of farms. So, we have here different scenarios. For example, scenario A is the maximum level of either IT integration levels and the maximum level of sustainability demand. The goal is how to get to this scenario in the end by the influencing factors you assessed in the survey. So, we have already like a scenario, but now the question is how we get there, what development needs to be happening in the next five years. So, we have this scenario. But before we do that,

I'm going to ask you another question about what do you think, how will the scenarios influence the farm performance of small and medium sized farms within the next two?

27:25
Lena Kampa
No. Why? I'm saying two years, in the next five years till 2028. So, the idea is to grab one of those stickers. I'm moving around maybe; I don't know if you are here. So, yeah, we are here on the next board. So, the idea is to grab one of those stickers and just put them here. I don't want to put this now here because I don't want to influence what I'm thinking or not thinking. And you do this below. Everyone has their own board. Again, you see that when you go scroll it further. Alex is not here, that doesn't matter so much, but here's Expert #2's spot. And if you go further there's Expert #4 spot. And I'm just asking you to give a really quick assessment of what do you think how each scenario will influence farm performance. Copy those and yeah, I'm going to give you another five minutes for that.

28:37
Lena Kampa
I hope the question is clear. If you have questions, just ask and please just stick to your own board without having a peek somewhere else.

29:13
Expert #4
I have a question. So, we have to label the arrows that we put with scenario A-B-C and D. So, you know which arrow belongs to which scenario.

29:22
Lena Kampa
You can just put the arrow, whatever you think is applicable to on top of the scenario. Really easy. Just on top of it. You don't have to label anything, just grab and drop. Okay. Yeah, I just wanted to make the example, so I don't influence you somehow. Okay. So, yeah, we have like, a high increase. Steady increase. High decrease, steady decrease or no. Or going back and forth.

32:15
Expert #4
I have another question. Is it correct? Why do I have twice scenario B and no scenario C?

32:30
Lena Kampa
That's a typo. It's a typo. The pinker one should be C clockwise ABCD. Yes. Okay. That's a typo. Okay. Maybe we can discuss one or two results. Maybe are you already I think so. Okay. Maybe we can discuss scenario B because or Joanna, maybe you can tell me why.

34:20
Expert #2
No, I was just moving it.

34:25
Lena Kampa
Okay.

34:25
Expert #2
Sorry.

34:26
Lena Kampa
No, I mean, that's fine. This is a result we can discuss, like okay, then. I see. Everyone thinks that performance from performance will.

34:37

Expert #4
Go.
Scenario A
34:43
Lena Kampa
Up with the high sorry, this is interesting. Okay. Expert #1, maybe you can tell me why do you think in scenario B the farm performance goes up?

35:08
Expert #1
Yes. I made a note on the right-hand side because I was not quick enough for questioning that because there are two things that I don't want to mix. That's the level of sustainability and that's the demand of consumer.

35:28
Lena Kampa
Okay. It's a bit bad formulated. It's maybe consumer sustainability demand the demand of the consumer for sustainability. It's not two different things, but so the consumer are demanding a certain level of sustainability. Those can be the regionality of a product, the organic production of a product, the low level of fertilizers and such things. So, there's a demand for a certain way of production.

36:05
Expert #1
Yes. So, if the farmer can fulfil that, so the demands are manifold. And in case we have a high level of IT integration in the specific farm, we would be able to follow that. So that's my arrow up, maybe with a tendency to just put that here with a tendency towards this. Because there's always, I don't know how much we do have to consider the other farms, those bigger than we discuss here. But basically, it's a quite good environment for the farm to develop.

37:03
Lena Kampa
Yeah. It's especially asked for small and medium farms.

37:06
Expert #1
Right, yeah. Okay. But now I noticed I explained scenario A. Was it correct?

37:12
Lena Kampa
Yeah, that's fine.

37:14
Expert #1
Okay.
Scenario D
37:14
Lena Kampa
Yeah, that's fine. Okay. Everyone's saying in scenario A it's increasing. Maybe another interesting resource is that expert #3 said that in scenario D it's not changing much. Maybe you can say something about it.

37:39
Expert #3
Yeah, I need to think about it. Give me 5 seconds.

37:45
Lena Kampa
Yes. So, it's high integration level and low demand for sustainability. Yeah.

37:58
Expert #3
Oh, I think then I have a bliss.

38:02
Expert #4
Can I comment? I was just putting the same arrow.

38:07
Expert #3
Okay.

38:07
Lena Kampa
Yeah, please, go ahead.

38:09
Expert #3
Okay.

38:10
Expert #4
Because I was thinking it sounds like it should have the goal to make the farm economically more feasible or more sustainable. So, I think it's the inherent goal of the technology that is implemented to result in more sustainability and higher profits. So maybe you meet the demand of the consumers without even aiming for it. But if you want to, or if you apply more It, but you're not even aware of the consumer demand, it sounds like you're a bit confused about why would you even implement the it. So, you might just go with a market trend without really having a strategy for your farm. And if you have no idea why you do what you do, it might mean that you don't have really no change. Really. But if you apply the It because you know it has benefits, you also have a positive impact on the sustainability demand of consumers because you meet the demand even if it's not your main goal.

39:08
Expert #1
That's a techie that might be a techie yes. Who has the tools but cannot really apply them or wants to apply them.

Survey results

39:21
Lena Kampa
Yeah. Okay, great. Thank you for your input. I guess besides those, we are really similar on the results. Yeah. Okay, maybe we're just gonna go further. I gonna present you the results of the survey you did. Thank you for doing that. I'm going to bring everyone here. Again. As we see here, we see an uncertainty impact grid. So, you were asked to assess 16 factors regarding their impact and uncertainty on this sustainability demand level and Ita integration level. And what we see here is we have these results are we have two critical uncertainties in our grid trust and data sharing. Technology going to have uncertainty and has had a high impact. And the willingness to pay for more sustainable farm product has also a rather high uncertainty and a high impact. For our scenario. We have then also four trends willingness to adapt technology and the compatibility of machinery, data and digitally digital platforms we've seen in the middle.

40:57
Lena Kampa
And the product value and quality of sustainable farm product is another trend we identified with the survey and the retail environment of sustainable farm produce. The other factors we assessed are more secondary factors. So there has had a lower uncertainty and impact in overall. So, we identified now six really high influencing factors here with which we going to develop our influence scenarios. I hope this is getting a bit clearer. What we did in the survey, this is just a technology you don't have to really get behind. It's more a foresight strategy. So, this is really relevant for my master thesis, but for you I just present to you and what needed is that you see or that you understand those factors. Because now you know, we have ABCD scenario, and we want to develop an influence diagram how those trends and uncertainty will influence each other in development in the future.

42:12

Lena Kampa
But I go into that in the next step. Are there more notes on this slide? Is it clear where we did the survey? So, we assess which factors we're going to use further.

42:28
Expert #3
So for me it's clear where we did the survey. But I have a question. What do you exactly mean by retail environment or sustainability farm produce? So, I don't get the retail environment. What do you mean by that?

42:42
Lena Kampa
Is it like if you imagine of river or direct marketing or online marketing even how is the produce marketed? So, this was thought about that factor. This was the general idea. Yeah. How you sell it, how is the sustainability the thing? We can talk about the factors research later on. I know you did a similar factor. No, you didn't. You hadn't had your research newer exploratory.

43:19
Expert #1
I also have a question you are writing so retail environment of sustainability farm.

43:25
Lena Kampa
Produce, sustainable farm producer.

43:28
Expert #1
Okay, sustainable farm produce. Is it the product or is it the process that is mentioned here? A sustainable process or a sustainable product.

43:38
Lena Kampa
Or the result let me translate it in German, then it becomes more clear. Landwirtschaftliche Erzeugnisse.

43:48
Expert #1
Okay. Yeah, that's good.

43:50
Lena Kampa
Thanks.

43:52
Expert #4
I also have more comment than a question about the willingness to pay for more of sustainability farm produce.

44:01
Lena Kampa
This is also sustainable farm produce.

44:03
Expert #4
Yeah, I don't know if it would make sense, or I think it would make sense to also include ability to pay more. I think the often score is quite high when you ask consumers but what consumers actually pay is not as much as they say they are willing to. And I placed it quite high on a scale of uncertainty because of just people not having the money to pay for high quality produce. And the uncertainty of rising prices, for example, for electricity is quite high. I think electricity is paid before the food bills. So, there are a lot of uncertainties income for consumers or possible consumers. So, they might not go for the high quality produce.

44:52
Lena Kampa

Yeah, very good comment. This is also what I actually thought about the willingness or the ability to pay is also a bit in the product value and quality of sustainable farm produce. Farm produce. So, is there actually a higher value for someone in that factor?

Influence Diagrams

Okay, we can move on then to how you're going to do the influence factors influence diagram. So here you see you have those little notes. So maybe first uninfluenced diagram is a series of causes and consequences that outline the mechanisms behind each scenario. So, as we said, we have the scenarios ABCDE, no, E, not D. And now your task is in each you have four inference diagrams. You put the trends and uncertainties in and put them into relationship and you're going to tell me how each trend and scenario uncertainty develop and influence each others within the next five years.

46:17

Lena Kampa

So this is why there is the timeline to 2028. So, you are allowed to get creative, use errors, use stickers, use whatever you like. You can comment on those. I guess we just can go over to maybe Johannes board here. There is a bit of a more detailed explanation. You see your board where you're going to work on. So, you are asked to do four inference diagrams for each scenario you have been given. On the left side, the trends and uncertainties going to bring you all back to me. So, the blue stickers are the trends we assess. The greens is the critical uncertainty, and you ask to put them into relationship within this five-year timeline. So, you are just pulling them here back and putting them into relationship with each other. You can use the errors from the left toolbar here. You just put them somewhere and put those factors in the sticky notes into relationship with each other.

47:29

Lena Kampa

So we trained that for this use. And then if you need more factors, this is just in case. I have given you the secondary elements below, but just use them if you need them because you primarily ask to work with the trends and uncertainties. And you can put the stickers, the plus, minuses, up downs to each element. How they will develop in future, I don't know. Sorry, I put you an error and I can't remove it. I don't know why. Still not. Is there any questions about the task? You have six minutes for each scenario.

48:17

Expert #1

Excuse me.

48:20

Expert #3

Go ahead. Sorry.

48:21

Expert #1

So there's plus and minus and there is these arrows that we had. So, I'm just thinking about system dynamics notations. So, we have enforcing or limiting factors. So, if we have an arrow from one box to the next box and then we assign a plus, what would that say? If you put it into words, what would this say?

48:53

Lena Kampa

Okay, it could be either one. I mean, if you put an increase arrow next to one trend, that means that the trend will increase in time. If you put maybe the plus in between or like you see in the third year, there is just the plus and the minus on the arrows means the development of one trend influenced the other positively or negatively. Right, but it could be also the trend itself could be developed themselves. So then maybe you just put it next to the trend or uncertainty and not next to the arrow. Yes.

49:43

Expert #1

Do we have to stick the blue arrows to each of these trends and uncertainties? Or can it also be that we just use plus and minus?

49:57
Lena Kampa
Yes, you can do both, whatever you like.

50:00
Expert #1
Okay.

50:00
Lena Kampa
And then everyone and after you did this, everyone is presenting one of the scenarios, what you created. So, then it becomes very clear to me what you mean, what your stickers or errors means. Okay, we're going to just start for the next six minutes for this.

50:24
Expert #1
Sorry for that. I still don't have it. Because you have new access.

50:29
Lena Kampa
The blue ones, the blue ones is just the time.

50:34
Expert #1
The blue one is the time. On the top left, there's a timeline on the left-hand side, but there's also the black arrow which says there is a high level of integration. Yeah, I just want to avoid that I made mistakes that you cannot work with. Yes, that's great.

50:59
Lena Kampa
Okay. Yeah, that's confusing. I'm sorry. So maybe I put that one here away. So, you know the scenario one, scenario A is the maximum level of IT integration level and the maximum level of sustainability of farm. So, this needs to be reached how? The trends and uncertainties needs to develop within the next five years so that this scenario is reached. Okay, I got to just let you six minutes for each scenario.

52:06
Expert #1
My board is still hidden.

52:13
Lena Kampa
Now it's there. Sorry, Johanne, I cannot change the error. Do you want to work in Alexander's boat?

52:54
Expert #2
But which error is it exactly?

52:57
Lena Kampa
The blue error, which is just in D. I cannot remove it. I don't know why.

53:05
Expert #2
For me, I can see I have no error that is visible to me, at least.

53:09
Lena Kampa
Okay, then just continue, please. Okay, thanks.

53:25
Expert #1
We have to fill all four quadrants.

57:53
Lena Kampa
Okay, the first six minutes are up. For the first scenario. I wanted to ask you if there's any complications or any questions, because if you're good, then you're just pleased to continue with the next three, and then each of you can yeah.

58:13
Expert #4
Expert #4, is it possible to copy those sticky notes and those icons so I can use them? How do you do that?

58:22
Lena Kampa
Right click and then pass like you normally would pass. But I just put you all the trends and uncertainties. I doubled them all for you for the next scenarios. Okay, but yeah, if there is anything needed, you can just right click copy and pass, so you have them duplicated. Okay, then we just continue with the next six minutes and you're free to work on the next scenarios. Or so, ladies, don't be too perfectionistic and start with the next one, maybe. Hey, I hope you're done with the second scenario.

Scenario A

I was thinking maybe someone wants to present their development of scenario A, because this has already everyone has been done, so we can already maybe discuss one of those, maybe. Expert #1, would you like to present your scenario one development or the influence diagram behind scenario one? Better say scenario A.

01:05:52
Expert #1
Yeah. Okay. So, when I designed this scenario, I became aware that it might make sense to copy into other quadrants. And then not wasting too much time about new arrows but thinking about the valuation or about how to say the plus and the minus to assign plus and minus to the arrow. I think that's in the scenario, that is positive from my point of view, positive in both ways. So, there is enforcing relationships. So, when I start, the compatibility of machinery, data and digital platforms is increasing, or I think positive about that. And the trust in data sharing technology also is improving. These two aspects might be independent from each other, but I think if they are both in a positive way. The willingness for the farmer to adopt to this technology is fostered by that and on the other side, the product value and product value so we are more sustainable.

01:07:38
Expert #1
So on the right-hand side, so this is also in a good situation and also the retail environment of the products. So, this means consumers are willed to pay more for the products. And if consumers are willed to pay more for the product, this has a sort of force feedback to the willingness of the farmer to adopt technologies. So that's within these few minutes I hope this goes in the wrong direction.

01:08:12
Lena Kampa
It goes in the right direction, not even in the wrong direction.

01:08:15
Expert #1
Okay.

01:08:17
Lena Kampa
So what I was just thinking, when we also add the time dimension, the willingness to adapt for technology, it's inferenced by the willingness of to pay more, but it's the willingness to pay more. It's more in the future. Maybe

if we just put it a bit higher so it's not back in time here. This is the only thing I was mentioning because this year yeah. Because we want to reach the scenario. Right.

01:08:50
Expert #1
Scenario A, it's just a matter of scale. It's just a matter of scale, exactly.

01:08:58
Lena Kampa
Yes.

01:08:58
Expert #1
But I think they shall be on the same level.

01:09:05
Lena Kampa
They should or should not?

01:09:07
Expert #1
They should, I think.

01:09:09
Lena Kampa
Okay, that's good. That's a good expertise of yours, the good assessment. So maybe we then develop the next scenarios and I get you back to your scenarios with the next six minutes. Expert #4 Sterling said hid. Thanks. Okay, the next six minutes are up since we all have developed already.

Scenario B
Scenario B, I was wondering if, Expert #4, you would like to present your influence diagram behind scenario B where we have minimal level of IT integration, so limited digitalization of farms but maximal level of sustainability.

01:15:57
Expert #4
Yes. So, I think the main driver is on the sustainability side. That's why I have product value which I combine also with how sustainable and especially ecologically sustainable a product is. That's related, I think with a product value that the consumer attaches to the product. So, there's a large drive towards this. So, this is a big driver also the retail environment. So, the retail environment also has an interest in sustainability, not only the producer and the consumer. And the willingness would also be at the start of my diagram. So, I have those three on the same level. So, they're like intrinsic drivers from the consumers, the producers to drive sustainability forward.

01:16:48
Lena Kampa
And I see you put the errors up already like behind us next to the factors means they are high in the beginning. Right. So, this is how I interpret it.

01:17:00
Expert #4
Yeah, those blue errors mean that I think they are strong drivers in this.

01:17:04
Lena Kampa
Okay, perfect. Thanks.

01:17:06
Expert #4
And then I think those three trends also drive the willingness of the farmer to adapt new technologies which help

to achieve more sustainability. But I made. Small pluses because the scenario is that minimal technology or it is implemented, there is a driver, but it's not so large. And also, with a willingness to adopt technologies comes an improvement in technology that is available. So, compatibility, for example, and I think once a farmer adopts a technology and sees that it works well, it will also increase the trust in this technology. So, I also see a positive trend there.

01:17:51
Lena Kampa
And when we put in the time dimension.

01:17:58
Expert #4
Yeah, I use the same timeline.

01:18:00
Lena Kampa
As that's fine, we can just put it other way around. But I just wanted to make sure that you were thinking about this will develop within the five years. Okay, I just put this narrow down.

01:18:10
Expert #4
Here from bottom top.

01:18:13
Lena Kampa
That's fine.

01:18:14
Expert #4
The bottom and then reaches the top. But yeah, here it's other way around.

01:18:18
Lena Kampa
I didn't know, that's totally good. I just wanted to make sure how you interpreted those. Yeah, perfect. Thanks. Okay. Going to do this lately. Then the next six minutes for the last scenario are going up. Now the last six minutes are up. I wonder if Johanne would like to present scenario C? Because I find really interesting what you did there.
Scenario C
01:24:51
Expert #2
Well, so I thought if you have an early trust in the data sharing technology, you will also have a high willingness to adopt the technology. And as well, if it's compatible like the machinery and data and the digital performances, if they are high, it will also show a higher willingness to adapt in the early age. And this will also kind of influence the product value and quality of sustainable farm products. But anyhow, if you have a low willingness to pay for more of the sustainable farm products also in the future, this is also influenced like if the retail environment and sustainability farm products needs to be low. If in case, you still want to have in the future also a low willingness to pay for them. But I was struggling a bit with the time access to how to influence it. So, I was shifting it around a bit.

01:25:48
Lena Kampa
So.

01:25:51
Expert #2
Yeah, is it me on I don't know, but I cannot hear you, sorry.

01:26:00
Lena Kampa
Yeah, it was mutted.

01:26:02
Expert #2
Okay.

01:26:04
Lena Kampa
No, that's fine. Just the comparability of machinery you stay is low or high?

01:26:13
Expert #2
It's high. I mean, if you trust in it and if you have a high comparability, you will also have a higher willingness to adapt to the technology.

01:26:21
Lena Kampa
I was just wondering because of the blue error next right to it, is.

01:26:28
Expert #2
It then to be just an influential error, not a negative error?

01:26:35
Lena Kampa
Okay. This was just the only thing that was a bit counterintuitive for what you were saying. Okay. And maybe then Michael can explain what he did in scenario D. Michael, that all lectures did to him.

Scenarios D

01:27:05
Expert #3
Yeah, of course. Let me first read what scenario D was about. Well, I think if you have a maximum level of IT integration then probably hopefully the compatibility of your machinery, data and digital platforms will be higher. This will probably directly influence the willingness of the farmers to adopt the technology. So that would be at least my experience and it will indirectly also influence the trust in the data sharing technology. That would at least be what I would expect. And yeah, a higher willingness to adopt the technology would probably also interrelate with more trust and data sharing technology. So, the arrow only shows inference from willingness to adopt technology to trust the data. But maybe it should rather be I should change it to an arrow that has that shows an interrelation. So maybe I should replace it like that. Do you have an interrelation?

01:28:24
Expert #3
I think that's better.

01:28:31
Lena Kampa
So you mean like an arrow in both ways? Like in both directions? Yeah, there are those in miro they are given I can add that it's when you click on the arrow then there is type of there was something like that. Right.

01:29:00
Expert #3
That's the thing.

01:29:03
Lena Kampa
You can move them around but there was a possibility to make them go both ways.

01:29:09
Expert #3
I mean, I can make a comment.

01:29:10
Lena Kampa
Afterwards so that you or we just put two errors.

01:29:15
Expert #3
That's also fine. Of course.

01:29:20
Lena Kampa
Okay. And I really like that you said okay, we have this with the dotted line are indirect influences.

01:29:27
Expert #3
Yeah.

01:29:28
Lena Kampa
This I really liked. It makes a lot of sense.

01:29:31
Expert #3
And then I think this is a section for itself. So, these three trends are also impacts. Right. And then this will probably impact your product value or at least your quality because I assume if you have more data about for example in your crop production then you can easily optimize or not, let's say more easily optimize your sustainability and also probably the quality of your products. So, this will lead to an optimization of your quality, I guess. Or I assume and the retail environment from me is only an indirect factor because I think this is a factor that also could lead to willingness to pay more for sustainable farm produce. But I think if I'm persuaded of a higher product value and quality of this sustainable farm produce as a consumer, then the retail environment won't be the most important factor for me to buy this more sustainable farm produce.

01:30:48
Expert #3
Okay, but in this scenario, this is more indirect factor.

01:30:54
Lena Kampa
Sorry.

01:30:57
Expert #3
What do you want to say.

01:30:58
Lena Kampa
In the scenario D, the level of sustainability to mount is quite low. Right, or it's on the lowest. But you had the willingness to pay more for sustainability is influenced positively, right, exactly.

01:31:15
Expert #3
Yeah. It's the last one, right? The last one would appear in 2028.

01:31:22
Lena Kampa
Yes.

01:31:22
Expert #3

So I think if you offer the consumer higher product value and quality then this might lead to a higher willingness to pay. So that's the logic that I at.

01:31:37
Lena Kampa
Least pursue someone else saying about when we have certain scenario deals. I find it really interesting because we have a high technology level or a high digitalization but a low sustainability demand of consumers. Does someone say something about it or share their development or we just go to did we put C already? Yes. Right. We did. Hannah, I guess was C. So, we did all the scenarios, we discussed those if there's any marks on some experts on any scenarios that they maybe did totally differently because it's really hard to assess this in one quick note.

01:32:40
Expert #1
For me it's quite difficult but it's just because of the time of the day too quickly. It's interesting for me to hear you thinking and arguing and putting arrows in. This is very interesting for me to follow because everyone has different viewpoints, different experience. So that's very nice.

01:33:13
Lena Kampa
I really like that you like it. I'm really glad because I found it very fun to write my master thesis and I really like to share my ideas, what I had and that you gave like a great deep of what you're thinking, what might be developing and what influences each other. I found it really interesting and talk about it with you. I was thinking, if I have any further questions of what you were thinking about what you put in these scenarios, I really would like to maybe ask you in the following days when I write down my scenarios so I can maybe ask again what did you mean with this error? Because then in the end I want to give you the scenarios how I came up with this data. I'm really glad that you liked it. I hope you all enjoyed the progress.
It was quite right, and we super in time.

01:34:06
Lena Kampa
Never that I thought I would make it in 90 minutes. It was quite complex. So, I'm really happy I did not put you out with your timeline because it's late in the evening. I totally agree. Thank you for your time and your trust for your all, if you're putting in here. Yeah. Any final remarks? Yes, Expert #4?

01:34:29
Expert #4
I agree with Expert #1 that it was difficult to really think so fast and make those connections at this time of day. And honestly, if you would ask me again tomorrow morning, I might make different graphs. So maybe my recommendation would be to look at to compare between the scenarios of different people but also what we put at the extreme because this is at least how I reason that I try to see do I think it's the first step in the scenario and what is the least important step. And then I try to fill in the gap but maybe to see where the overlaps are and what we put at the different extremes and the reasoning in between might be also depending on what kind of length you look at it, if you look more from retailer side or the consumer side or the farmer side.

01:35:20
Expert #4
So I try to mostly look from the angle of the farmer itself, but yeah, I would just say look at the extremes and then about at the reasons, but not so much where exactly we place things, because that's maybe a bit more like oh, I feel like this might be actually sure.

01:35:39
Lena Kampa
Yeah. Thank you. I found this also a limitation with the time. This is what my supervisor advised me, because then people are free, and I don't have meetings thank you. That you gave up your free evening. Any further comments?

01:35:58
Expert #1
Just one small comment. So, I'm working, I have many years here in this company and discussions like that, of

course they're getting more complex. Just five, six, seven boxes that we have here. But that's a thing I'm sometimes missing discussions like this I'm missing in the company here. So, we have technology, we have economic aspects. There are so many things, and I'm quite happy that the research organizations and universities care about that. And we should make more use from that. Yes. Also, in the company. That's very nice. Yes.

01:36:47
Lena Kampa
Yeah. Really, glad, you liked it. I can maybe recommend class, get yourself a foresight department who develops future scenarios and how different scenarios can have an impact on your business plan. So, this is what I did, for example, within Evonik, and it's a really great tool for strategic developing your business. Right. And I see that the farms or agriculture business in every world are greatly influenced by climate change, by biodiversity decline protests, social changes, demand changes. So, there's a lot of unwrapped and really unfortunate future. And yeah. Maybe I can facilitate your project the next time and I can moderate your question. I don't know. But yeah, thanks for having given me the time and your expertise. So, I'm going to close the meeting now and thank you so much. I'm so glad. Have a good night. See you. Bye. Bye. Bye. Thank you.

Transcript 2. Focus group
Introduction miro board /Experts
00:00
Lena Kampa
Record because this is based, this is all my data. I beat for my messages. Hi Expert #5, good to see you. Welcome here. Hi. So, since I just had like really serious internet problems, I'm a bit out of the loop here right now. And were also just waiting for another participant or maybe two. So maybe we have one or two more seconds or minutes, and we will have an introduction round so everyone will be introduced and so on. But before we do that, we also will have a small tutorial with the miro board. So, this is the feedback I got with prep round that it was not so intuitive to control the board, but with the icebreaker it should go smoothly. So, I hope my internet connection is fine. If not, just saying it's unstable. But if not so just let me know, raise your hand or something and then we can go over it again.

01:15
Lena Kampa
So very sorry about this technical issues.

01:19
Expert #5
So far so good. I mean, can hear you just fine.

01:22
Lena Kampa
Okay. That's the most important in any case, then I would just not record my video and then this runs it. Okay, it's three after. I just going to start here. So, the official welcome. Hi, I'm Lena Kampa. Welcome you to this expert group discussion. I'm doing my master's studies in a double degree program in Wageningen and Bonn. And we are here to create together the developments behind four different scenarios for the EU agriculture till 2028. So, I have given you the scenarios already, like the ABCD scenarios, and they were developed on two dimensions, the IT integration level on farm level and the consumer sustainability demand in the EU. And so, overall, the objective for today is that I will ask you to create for each scenario a influence diagram and what the influence on the farm performance of small and medium farms are in the EU 2028.

02:47
Lena Kampa
I hope this is also exciting for you. And as I said before in the invite, I can send you my results afterwards, so your company can work with that as well. So, thank you for your time and your trust. Since I did it already two times, I know we're going to be ready within 90 minutes. So, this is the good news for you. It's not an early evening, but at least we're not going over time. So, the agenda for today is, as I said, get to know miro and each other the objectives of the workshop real quick. Then the experts are going asked to assess the influence of each scenario on the farm performance of small and medium farms in the EU in 2028. Then I present you the survey results of the influencing factors. After that, I give you the instructions on how to create the influence diagram behind every scenario.

03:46
Lena Kampa
But this is the tricky part. But we go there really slowly. Then you are asked to create four scenarios no to create the four influence degree diagrams to reach each scenario, so it can be used simultaneously. But we have this five-year timeline, so what needs to happening to get there and then it's all right. Thank you and goodbye. So, I hope you see all the introduction slides. No, not really. I thought I made it a state. Okay, can you see the introduction slide on miro yes. Perfect. Okay, this is what I just said. And now we go to the left. I'm just going to bring you all back to me. So now we have a bit of time that you familiarize yourself with the miro board. So, I thought it would be a good idea to try out a bit on the miro board.

05:02
Lena Kampa
You're free to just click on it and try everything around. So, we have different steps here. You can click on the videos and make yourself a bit familiar with all the tools. And I just give you five minutes to do that. We have a really handy timer here and then you are welcome to just go there.

05:30
Expert #6
Is it possible, even though I am only a viewer, that I can change?

05:39
Lena Kampa
Yeah, of course. You need to. Actually, very sorry, could you say it? I have to make you edit. I just did that. Thank you for bringing that up. This is what I wanted to do beforehand with the timers running out with the preparation. So now you're free to edit. Thanks, Expert #6.

06:05
Expert #5
Cool. Actually, I've been using this a couple of times already. That's the first time I'm actually playing with some of those.

06:33
Lena Kampa
It's good to know.

06:38
Expert #5
The arrows. I don't know what the.

07:00
Lena Kampa
Is not so much more to it than write something a bit and drag and drop, zoom out comment, maybe, and use the arrows. Besides that, it's not so much on the technical part.

07:52
Expert #5
So I'm ready. Expert #6, if you want to, I'm ready.

07:58
Lena Kampa
Okay, so then we have a little icebreaker when you're already done. So, I bring everyone back to me for that. You're not already there. So now we have all seen how this works and we are ready to jump forward to our first exercise, where everyone introduced themselves and answering maybe one of the given questions. I would love to spend just a few minutes getting to know each other. You can select a board there and then write whatever you want to share. What's your expertise? What makes you come here? What's your recent job? Last job? Education, maybe. And there are two boards given for you, so you can just work on them.

09:07
Expert #5
Okay. Two people just share quickly, right?

09:16
Lena Kampa
Yeah, we can do that. It was made for more for a bigger group. I'm sorry. I was actually expecting two more persons today. But yeah, we can do this also. Just with us here.

09:31
Expert #5
Expert #6, do you want to start, or do you want me to say something first?

09:35
Expert #6
I can start. Yeah.

09:37

Lena Kampa
So.

09:38
Expert #6
Expert #6. I'm based in Bonn, Germany. I work for the Global Nature Fund, which is an environmental NGO project manager for business and biodiversity for one year now. And that's also the question. What was your first job? Oh, no, I want to add that after studying agricultural sciences, I worked two years no, before studying agricultural sciences. Sorry, I make it complicated. I worked two years as a farmer, so we have a farm at home. I like number ten. I like my eggs pan-fried. (Answering get to know questions).

10:30
Lena Kampa
Very German. German answer.

10:33
Expert #5
Yeah.

10:34
Lena Kampa
Thank you. Expert #5, what do you go next?

10:39
Expert #5
Yeah, sure. My name is Expert #5. I'm also German. So, I mean, if you guys want, we could actually continue in German. I'm also French. My mom is French. I'm from Munich, originally. My background is robotic software. I worked for four years at Bosch doing research with agriculture robots. Before that I was in the US also doing agriculture robots for like, chicken broiler farms. And we founded a company called Farming Revolution in 2019, making autonomous robots for farmers that recognize plants and remove weeds with a mechanical solution. So, the goal of our vision of our company is to enable every farmer to move from using herbicides to using a machine that doesn't use chemicals. And since it's a machine and drives day and night, it's a scalable solution, a low-cost scalable solution for weeding. And right now, it's the third year, almost three and a half years of this company, which is usually a good sign for startups, because you say, like, the hardest part is already, or the riskiest part is already done.

11:52
Expert #5
We have twelve robots and did around 200 ha this year in a variety of fields. And I think this evening five robots are running, so that's always a good sign, even though it's off season. So, the main season already stopped and that's basically it. And I think we met at this pheno rob fair and so that's basically why I'm here.

12:15
Lena Kampa
Yes. Thank you both. I'm going to make it quick. So, I'm Lena. I'm finally writing my master thesis. Why I'm doing a foresight methodic is because we did that also in the methodic. We did that already in the masters, but then I did an internship in Evonik for the foresight department there. Evonik normally is a special chemical plant, but they also are diversifying their portfolio and therefore it's important for them to look in different business fields. So, this is what we did there. So, we talked a bit about the agriculture feed and what they continue working there on, and I found this methodic really interesting. So, the scenario analyst so this is why I'm doing this again in my master thesis. And it's a bit more creative than the normal just survey or normal interviews. And I hope you find it also very interesting as me.

13:14
Lena Kampa
So yeah, I guess then we can just continue with the objectives for today and I'll show you them. So now that we know each other a bit, I want to quickly go over today's objectives. Are you there to the left for the yes. First is to discuss different future scenarios and their influence on the farm performance of EU small and medium farms in the 2028. maybe I actually wanted to add to you because I saw your website so you're renting out the robots, right? What is the yeah, what is the average farm size they're renting?

14:17
Expert #5
Depends a lot. So, we have guys that have like quite large scales, say 60 ha, something like this. Some of them have 5 ha. So, it depends a lot on the type of crop, specialty crops, smaller organic farms. And then it depends as well, some people, they share robots. So, it's like three small farmers that share one. Depends on the regions as well. More eastern Germany, northern Germany, its usually bigger farms, so there's a variety of customers.

14:47
Lena Kampa
Okay. Yeah. Because today we're just looking into small and medium farms. So, I give you a definition. It was also like family owned and up to 50 hectares guess the lowest number was 2 ha. So, it's not like a micro farms but like the typical farm type in dominant that's not like the super bigger farms. So that we have this in mind. Exactly. Okay, back to the objectives. This was not so smooth run, but after that the second objective is that we individually, so each expert developed the background of each scenario. You present your outcome and what the impact on farm performance would have in the end. This brings me already maybe it's interesting to talk about the dimensions here. For these scenarios we have the IT integration level on farms. So, it means the minimal level that they would have like little digitalization they may be just using weather app or so on high IT integration level that they are very they are already like in a digital ecosystem with other farms, suppliers and buyers of their crops or other agriculture produce.

16:22
Lena Kampa
And the consumer sustainability demand is in totally different demand. As we said, the consumers demands a certain sustainability and they're willing to pay for that. So, we can think of in the EU already the consumer says they buy a lot of organic or regional produce. What surveys don't always actually say, but there's a bigger awareness than in other regions of the world where this is not in demand at all. Okay. And then we have four different scenarios where they have different levels of each of the scenarios (meant dimensions). So, with that said, we come to the first task, which is task one is how will each scenario influence the farm performance of small and medium sized farmers in the EU in 2028? So far, performance here is the farm profit and the idea is below there's for each of you fields with just what I with the same kind of graph here and you just drag and drop what you think how the farm performance will be performed in each scenario.
Farm performance assessment
17:50
Lena Kampa
So for that I give you a couple of minutes. What did we say? Eight minutes and you just drag on scenario one A, whatever you think, it will decrease, increase, stay the same and so on. And then after that we just discuss why you thought about it. Hey, are you done?

20:28
Expert #6
Maybe we can discuss.
Farm performance assessment- Scenario A
20:32
Lena Kampa
This is actually the total reason of it, discuss this. So maybe we can start with scenario A. I found it always the most easiest one because we have a maximalization of digitalization maximal demand for sustainability. And Expert #6, maybe you just can start with it what you thought about it.
Farm performance assessment- Scenario A
20:53
Expert #6
Yeah, I thought that then the farm performance of the farm profit will be high or highest. Should I elaborate?

21:09
Lena Kampa
Yeah, please.

21:12
Expert #6
So I think with the high performance of IT integration that we can give like that; we have a lot of indicators to

prove that the product is sustainable. So, we have the high demand and with the high technology, we can prove we can have many indicators from the field through the product that the consumer can know it when he's buying it in store.

21:50
Lena Kampa
So an increased transfer transparency. Exactly. That's their English word, transparency for the consumers. Right. Which would then I don't know what were the results and high transparency for the consumer.

22:10
Expert #6
Yeah, I think also with high I hope like with high (IT) integration that we can have like lower inputs for irrigation system spraying. Maybe also not thought this through minimum tillage or stuff like this, but also, I think so then we can have low inputs which I assume will make it sustainable but also make it transparent to the consumer.

22:48
Lena Kampa
Yeah. Expert #5, you said also the farm profits are increasing in scenario A, but it's not like the highest possible increase.

23:02
Expert #5
Correct. I think my opinion is a bit less optimistic. So, I mean, the concern that I had about this topic is it's good that you said that about the small and medium sized farms because in my impression, the larger farms will benefit more from the IT integration. Right. Because you're a small farm, you sort of already know your fields, you know your crops, you know your close environment. And I sort of see with some of the bigger companies that we work with that they can really gather all this data and gather more information from different fields. And I'm a little bit worried that the small farms will in the end have more of a competitive difficulty, will increase with respect to the large farms, if it's more integrated in terms of IT. That's a little bit of the thing why I didn't say it's like going up too much.

23:59
Expert #5
But still it's going to help. Right. The question is how much does it help with respect to the other farms? And then the demand for sustainable demand from the consumers for sure. That's also a thing that's going to drive it up, especially for the small farms because same thing. A small farm has to somehow specialize in something more specific, maybe something a little bit out of the common things and then try to sell directly to consumers. And that's always where the big margins are. So, if the consumers are more interested in sustainable goods that will also, I think drive the market for the small farms. In terms of this transparency, what you said, I like the vision that the consumers want to look into where the goods are produced and how they are. But my impression also from me actually initially not having a farming background, just getting into this last six, seven years, is that the average consumer doesn't know anything about how the things are produced.

25:07
Expert #5
They think organic is good, but they don't know what organic means. Really. If you ask them on the street, what does organic actually mean? Most people don't know. And if you give them more, IT transparency. I don't even know if they care so much. Right. It's like it has to be a simple label. And I have a little bit of a question mark. I'm sure it drives things, but I'm let's say not that optimistic about it. As you were. That's why I didn't put the big arrow.

25:31
Lena Kampa
Okay. But in this scenario, we just assume we have this high IT integration, right? The highest possible and the highest sustainability demand. And we are in scenarios. So, we have to think about different scenarios. Okay. What does the future looks like when we are in the definition areas? Not currently, not if we actually going to reach it, if it's like realistically or how we get there. Just imagine a word where we have each small farmer or medium sized farmer is actually interconnected with mostly all variables in their farm within higher ecosystem, right? And then again, we also have very high sustainability demand. So, this is the scenario and just thinking

about it, what would the farm performance would be? So, it's not about is this dimension actually applicable, but it's a possible future.

26:37
Expert #6
But also in five years. It's not in five years time.

26:40
Lena Kampa
It's not much time.

26:42
Expert #6
I think that's the problem.

26:45
Expert #5
Tricky part. So, I really think for me the big question is who's going to benefit from it more? If you think small medium farms, if really all farms are more interconnected, the small farm going to benefit or the big one, right? And we'll see about that. Just my impression is now that larger farms will benefit more from this than smaller farms.

Farm performance assessment- Scenario B

27:08
Lena Kampa
Okay, let's go to scenario B then where we have minimal level of IT integration, but still and high or maximum level of sustainability met of consumers.

27:22
Expert #5
Shall I say? First maybe I have to change. For me it's more or less the same arrow I put. So maybe a little lower. A little bit lower. But I think in general, small and medium farms will benefit for sure from sustainability demand. That's something that the smaller ones benefit from, and so it will increase for sure.

27:51
Lena Kampa
Expert #6, you said the same, right?

27:53
Expert #6
Yeah, I have the same. Is it almost the same?

27:58
Lena Kampa
Yeah, you have also the highest increase.

28:05
Expert #5
Very similar. In the end, the trend between yours and mine is actually similar. Yours is just bigger arrows. Mine is more smaller ones.

Farm performance assessment -Scenario C

28:19
Lena Kampa
Okay, then maybe we can just go to scenario C. I'm sorry, Expert #6 still has a typo in his graph.

28:27
Expert #6
Yeah, I've just seen it. It was b two times.

28:31
Lena Kampa

Yeah, it's a typo. So, it goes clockwise. ABCD. Okay, let's talk about see then, because Expert #5 is saying there's no change. So, if we having a decline, even maybe in the level of sustainability demand and IT integration, or, like, I don't know if you would say right now, we have a very low level of IT integration level, or is it already?

29:03
Expert #5
I would say it's low. That's why okay. I was not picturing, really a decline in IT integration. I have a hard time thinking how this would happen. So, I was more thinking like, okay, there's no development, or almost no development. And then that was my thought. If things stay as they are, maybe actually right now, if you look at the demand for sustainability, I mean, you might know this better. But also, my feeling is that it's not really growing much or rather declining at the moment. That's one scenario where I would say not much changes for the farmers and stays.

29:43
Lena Kampa
Okay. Expert #6's, your farm performance goes down.

29:47
Expert #6
Yeah, initially, I thought it would go down, but now, as it will be. As it is now, I think that nothing will change. So, it's like it stays.

30:06
Lena Kampa
But the scenario can be, I don't know, Trump or Trump goes back in office and Elon destroys Twitter, and we don't have trust in any data anymore, and everyone is ditching any social media and all the digital device, and we have a low. So, this could be a scenario. So, we're thinking the farmers not even.

30:32
Lena Kampa
Checking the weather from its weather app.

30:36
Expert #6
I guess this is I mean, the weather app. I think it would stay the same. I mean, this is so basic. Yeah.

30:44
Expert #5
Farmers will keep on using the technology if it works. I think that's the main thing. So whatever Elon does with Twitter, in my opinion, I don't think it will affect this. And actually, now that I think about it, I was not really picturing this decrease in sustainability, but what this could mean, it could mean something like GMOs are authorized in the EU, full Roundup ready, kind of seeds and stuff like this. And in terms of depends how you define performance. Right. But performance might actually go up for the farmers. I mean, it might be easier, more competitive internationally. It's not something that we want as a society. But I think for the farmer it might even be a better situation in terms of just his business and the competitiveness on the international level.

31:34
Lena Kampa
This is a really interesting thought.

31:37
Expert #6
Yeah, I think what we leave out here, we have the sustainability demand. I mean, we leave out policies. I mean, policies can drive all this. Then in 2028 we have a new CAP. So, with new regulations and maybe more subsidies for even more biodiversity friendly farming practices and also demand can be generated from the government, especially like organic goods, stuff like this, when we only focus on consumers demand on sustainability. Yeah, I always have in mind that policy can have a big influence and drive changes, force changes.

32:35
Expert #5
Of course, I agree.

32:39
Lena Kampa
You muted.

32:42
Expert #5
Bigger driver consumer sustainability demand of the consumers.

32:50
Lena Kampa
Because you were just a bit lacking.

32:51
Expert #5
I tried to repeat I had a call, that's why my headphone switched. Yeah, I was just saying I also agree with this with the fact that policy impacts this a lot, right? Subsidies, regulations and so on. And it probably is a stronger driver than what the consumers actually push for. Because consumers, as I've said before, I always have the impression that in the end they don't really care that much or they care for some goods, but like the things that they eat directly, like a lettuce or something, but everything else is a bit they don't care as much. And just to give you one idea about this thing is sustainability reducing. For example, in the field that we work in a lot is sugar beet. There is a new type of seed which is resistant to an herbicide. So, it's not GMO, but it's like bread to be resistant to herbicide which just started in Europe and all the farmers are moving to this because it's working like magic.

33:50
Expert #5
I mean, it's just really good system in the end for the farmers, very simple, gets rid of the problem. And that's really a thing sometimes where you think, okay, a technology that reduces the sustainability but, in the end, for farmers it's amazing and they like it, and they'll adopt it. That's why, from our perspective as a company, we really want to produce something, a solution which is easy to use, which gives the same value, which basically same price. To really have a better solution than herbicide and not just try to convince our customers to the sustainability kind of side of things, but really just a better solution than the non-sustainable solutions.

34:35
Lena Kampa
What you're talking about? What's the non-sustainable solutions?

34:39
Expert #5
GMO, for instance, or here, for instance, like the example now for sugar beets it's something called Conviso Smart, right? It's a new solution. I don't know if you're familiar with this. It's from Bayer and KWS. It's a combination of herbicide and seed with the seed being resistant to the herbicide. So, you basically can apply a total herbicide. It's pretty much analogous to glyphosate and what's been used in the US. And of course, that's not GMO.

35:11
Lena Kampa
Okay, I have to make this open question because I can just assume what you mean by what is not sustainable and then just to make sure and come to same base level.

35:29
Expert #5
There could be other scenarios. This was just one idea that I had in terms of reduced sustainability. It's really interesting that we look at this scenario because for me when I looked at this first, I was thinking it stays as it is,

that's already bad enough. But the fact that it could actually get worse is interesting.

Scenario D

35:46

Lena Kampa

Yeah, because future is always uncertain, we can never know. So, who thought that? I know a lot of people never thought about that there would be again a war in Europe in the next decades, but here we are. Or a pandemic that big like COVID. So, there are always outside factors that could develop things really fast. So, this is why we can also it's harder to go in our scenarios that are further away than five years. Okay, did we discuss scenario D? No, but you have the same results here. Maybe we just go over it really quick. Why you think it goes up? The farm performance.

36:37

Expert #6

I think with having better data and I think with more technology, you can produce at lower costs. At some point when, like I don't know. I think initially you have to pay a lot for the machinery, but then at the end, I assume I don't know, maybe you can produce at lower costs. And then the integration level of IT outweighs the lower demand of sustainable products from the consumers.

37:29

Lena Kampa

Expert #5, you want to add? No.

37:31

Expert #5

Okay, I would agree with this. I think that's sensible.

37:37

Lena Kampa

Okay then I would go to the presentation of the survey results, hope you see it. So, the idea is to go from simple factors I present you in the survey to get to trends and uncertainties and these are the results. So, we have the impact and the uncertainty level of each of the factors measured and the result is that we have two critical uncertainties in these scenarios which is trust in the data sharing technology and the willingness to pay for more sustainable products. And we have four trends given there the uncertainty is not so high, but the impact is still high for the future scenarios. Therefore, they are important to measure. This is willingness to adapt digital technology, the comparability of machinery, data and digital platforms, the retail environment of sustainable farm produce and the product value and quality of sustainable farm produce. And then the other factors will be left out in the further analysis because they don't reach high of an impact and uncertainty levels.

39:03

Lena Kampa

So they will leave out for the influence diagram which will follow. Is this understood? For now. The trends and uncertainties.

39:22

Expert #5

Kind of this trust and data sharing technology is interesting to me because my experience working with farmers is that in the end, if you give them some value, they will share the data with you. So personally, I don't see that as an issue, at least with our customers, definitely not an issue at all, but might be some other farmers like that. So that's surprising to me that this is a critical uncertainty here, but I think the rest of the things I pretty much agree with.

40:01

Lena Kampa

I don't have the practical insight, but just from the paper I've read, what this is understanding for is there's a lot of in the EU, especially for very rural areas or thinking of Spain or Italy, that there are a lot of older farmers that are not that big in technology at all. You're talking about your clients which are maybe already really innovative and forward looking and maybe pioneers in their fields. Apparently, they're using robots. And then if you look in the adopting factors or the adoptive farmers, there's also theory about like that there are the pioneers, the invent invaders, the mainstream and then the followers or so on. I don't know. They actually terms right now. But there's a lot of people that maybe not trust any digital data.

40:58
Expert #5
Yeah, I'm sure that'd be interesting. So, if you could share some data about this would be interesting. So of course, we're very biased because our customers, for sure, as you said, they're more open minded to technology and so on. But I feel but even from when we talk to farmers and get into discussions about those things, in the end it's like, okay, if your solution works and it does the job, I'm happy with it. And I have not seen many farmers that have problem using, they all have a smartphone or WhatsApp, right? I mean, some really older people they don't have, but then they have someone that can help them out and so on. This data thing is really for us. We get all the data from the fields of the farmers because we needed to improve the systems and that's always something at least from our customers, which might be open minded for sure, and more modern.

41:54
Expert #5
They say, okay, just take the data if you can improve it for my field, you might as well take my data, right? So that's quite an openness for that. As long as it does the job and they're happy with the product and what they get from it, we see even really old, I mean what's really old, like say farmers that are over 65, in the end they're quite open to the technology.

42:17
Expert #6
Yeah, but I think from you, sorry, I think from you, if they get, they I think they know that they can trust you. I can give you a different example. We work in my NGO, we work with farmers on biodiversity. So, we developed a tool, it's the Biodiversity Performance Tool, you. Have, I don't know, many 100 indicators. And you go with the farmers to the farmer, and you ask him about all the practices and knowledge. I don't know how much he sprays, if he ploughs the land, and how many cultures he fruits he produces. I know many questions. But we collect the data, and we want to give it to in the supply chain. So, we go to the farmers who produce wheat and then the, what's it called? So, we go to Nestle distributors.

43:31
Expert #5
Distributors. Distributors, right.

43:34
Expert #6
No, the retailers, yeah.

43:36
Lena Kampa
You can also say it in German, if you like.

43:40
Expert #6
Lebensmitteleinzelhandel. Yeah so like Einzelhandel (Retail), so. Kaufland and nestle. And also, they want to know about biodiversity from their farms. So, they ask the farmers in their supply chain, maybe the wheat producers or herb producers and all those, to answer these biodiversity Monitoring System or biodiversity performance tool, two different tools, doesn't matter. And with this, the company gets all the information from the farmer, and they are sceptical about this, even though you need data to improve the situation. And we want to improve biodiversity on the farm, which the farmer most of them know. It's good, but I don't know, they weighed this. Okay. Is it okay for me to give the data to the company and improve biodiversity, or shouldn't we? Or they don't want to do it, and don't give the data and say, okay, my data is more important than improving biodiversity if I want to frame.

44:56
Expert #5
It this way, well, can I just.

44:59
Lena Kampa
Maybe just go ahead.

45:03
Expert #5
That's really not surprised me. I mean, the thing is, for a farmer, distributors, it's really like the enemy, right? Because they're the ones always pushing down the prices, negotiating super hard with them, not treating them well, and you don't want to share data with them because what are they going to do with the data? They're just going to try to reduce you and try to basically pay you less. And they just had very bad experience with this. So, I think, okay, I really understand that I would not share data with these companies as well because it's not the right partner. So, you would need somehow to go through a different medium where you know that the data is really only shared among farmers in order to improve the produce and get better at negotiating with the distributors. I think this is for us, it's always been key from the beginning, don't associate with those companies because from all the customer service we had, this is like not the right medium to get to the farmers because the relationship is usually not very good, right?

46:10
Expert #5
And then, of course, then the question is, you say increased biodiversity for the farmers, that's great, but what is the monetary thing? As soon as you can tell them.

46:19
Expert #6
Okay, that's why we have the companies on board, so they can pay for biodiversity measures on the field. Like it's only in ten pilot projects. But we also give the farmer the tool to farmers for free, but then they have to give like input. They get no monetary value for this. So, they spend 4 hours of giving their data input and then they know how they could improve, but they are not doing because nobody is paying more. And like the vision of this project is at the end we have biodiversity friendly products, and the companies want to sell it to the consumer for additional value because this product is more biodiversity friendly. But yeah, we are not there yet.

47:13
Lena Kampa
Yeah you're talking about really important step because I just remembered in this paper where the trust and data sharing comes from is that the farmers doesn't know the direct benefit of the digital service which, Expert #5, you make really clear you said from the very first beginning is but the benefits are clear for the farmers with my product. So therefore, it's easy to sell for Expert #6 on the other side, it's not really clear for the customers what is the benefit. Yeah, why biodiversity? But it's so abstract. It doesn't reduce any weeds. Exactly. It's maybe increasing them. Even so, maybe my yields getting lower or so on or I have other negative effects and there are no monetary incentives for them to actually apply. Yeah, we're thinking digitalization on very different levels here from the robot who's actually reducing weeds or to the program who collects data for increasing biodiversity.

48:13
Lena Kampa
This is really interesting. So, we have on the dimension of digitalization, there are so many other deeper things to think about. So, this is great discussion. Thank you for your input. This was very valuable for this master thesis. Great thing. Then I would go further to the instructions of the influence diagram because now it gets really interesting. Now I'm going to explain you what your next task is. So, we discussed already what scenario A, for example, is and okay, let's start with the what is an influence diagram? It's a series of causing and consequences that outline the mechanisms behind each scenario. So, it answers the questions what will influence each other? What factors, trends, uncertainties. So, we get within five years to scenario A, where we have a high integration level and a high consumer sustainability demand. So, what needs to happen within the trends and uncertainties we just discussed and how they will interact with each other.

49:36
Lena Kampa
So the task is to put the trends and uncertainties into relationship and how will each trend and uncertainty develop and influence each other over the next five years to reach the scenario? Therefore, I'm just going to open this here again, Expert #6 so I'm just going to go to Expert #6, here is a bit of an idea how this could look like on the pinkish influence diagram. So yeah, Expert #6, you are right. Expert #5, you have to come up a bit. Yeah, I can bring you to me.

50:14
Expert #5
I think I'm there.

50:17
Lena Kampa
So you have this different trends and uncertainties on the left side here on the left side, on the actual ones on the right side. And you put them in each board, and you put them into relationship how they will influence over the next five years. So maybe right now the willingness to adapt is really high. But to get the willingness to adapt, the technology is really high. But if we go to scenario C where IT integration level is low, then maybe this must go down. I don't know. You're the experts, you're going to tell me exactly. So, the task is to put those trends and uncertainties into relationship. Please use all the trends and uncertainties for each scenario. You can just copy them. I can copy them for you should have done this before. But as I said, my preparation time was cut short by the Internet issues.

51:20
Lena Kampa
And you can also use the secondary elements if needed. There are the other factors from the survey. Sometimes they're good to make a better storyline and better explain the cause and effects, but you don't have to. And you can use the stickers how each factor is influencing the other, or if the factor themselves are just increasing or decreasing over time. Are there any questions?

51:49
Expert #5
So you put the minus and plus signs to show how if it affects negatively or positively the next factor.

51:57
Lena Kampa
The next factor. But you can also say, for example, the trust in data sharing is right now really high or very low because we have also the dimension of the timeline. Right. And you can also use the trends and factors multiple times so you can show a development.

52:19
Expert #5
Okay, we only do scenario A for now, right?

52:22
Lena Kampa
Yeah. For the next six minutes you can do anyone you like. If you do both A, then we can discuss them right afterwards.

52:31
Expert #5
Okay, sounds good. Mine is still hidden, so I think you have to hide it. Yeah. Thank you.

52:38
Lena Kampa
No problem. Expert #6, did you have any questions? You muted.

52:48
Expert #6
Okay, because I hit the spacebar. Okay. So, we both do scenario A now.

52:54
Lena Kampa
Yeah, if you like. With that.

52:56

Expert #6
Individually?

52:56
Lena Kampa
Yeah.

52:57
Expert #6
Okay.

52:57
Lena Kampa
Please no copy pasting here. I want your own opinions.

53:03
Expert #6
Okay.

53:05
Lena Kampa
Then I set the timer for six minutes and after that we can discuss what we have two minutes left.

57:19
Expert #6
Not much time.

57:24
Expert #5
I think I'm more or less ready to discuss.

57:28
Lena Kampa
The first one always takes a bit longer with the arrows and everything.

57:34
Expert #5
I made easy arrows, to be honest.

57:36
Expert #6
That's also fine once you have secondary elements.

57:40
Lena Kampa
Yeah, don't worry, it's all good. But with the arrows for the other scenarios, you can just copy them and then adapt. So, then it gets easier. Expert #5, you left out one of the trends.

58:20
Expert #5
Yeah. Which one is this? I don't know. Retail. My setup is very simple, I think. Anything else would be too complicated for me.

58:36
Lena Kampa
Okay, that's fine. Maybe bit more arrows between those factors.

58:52
Expert #5

Yeah, I think they come as a group. I don't see how okay; we will discuss it. Yeah, I'll have to see what Expert #6 did too. Better job on the next great work here.

59:13
Expert #6
Oh no, time's up.

59:15
Lena Kampa
Yeah, please finish. I mean, take one more minute or so it's fine.

59:21
Expert #5
I'll look at what Expert #6 does. I don't change mine anymore.

59:24
Lena Kampa
No, please. It doesn't need to look fancy.

59:59
Expert #6
Almost done. No.

01:00:09
Expert #5
It's interesting.

01:00:17
Lena Kampa
Okay, perfect. You're done, right? Maybe you just want to start because we're here already.

01:00:26
Expert #6
Sure. Okay.

01:00:28
Lena Kampa
Just explain what you thought here.
Influence diagram scenario A
01:00:32
Expert #6
So I thought at first on the lower left corner that we need the compatibility of machinery, data and digital platforms. And this is followed by the willingness to adapt technology. Times up again. And on the right side we need the level of awareness regarding sustainability which needs to increase for the willingness to pay more. And following this so we need more awareness than higher willingness to pay.

01:01:18
Lena Kampa
The awareness is rising here already.

01:01:21
Expert #6
Right? Yeah.

01:01:23
Lena Kampa
Same with the comparability, you said, right?

01:01:26

Expert #6
Yes.

01:01:28
Lena Kampa
Just putting that there because then it's easier to write it out.

01:01:31
Expert #6
Yeah, sure.

01:01:33
Lena Kampa
Okay. The level of awareness regarding sustainability increases the willingness to pay more also positively.

01:01:42
Expert #6
Yes, that's why I put plus then we have so then we have the product value let me think about it. Willingness to pay more increases. So, the product value and quality of yes, with this the no, this needs to be here. Okay. You can't see my cursor with the willingness to adapt technology, this also increases the product value and quality of sustainable farm produce.

01:02:35
Lena Kampa
Sustainable sorry, there's a typo again.

01:02:40
Expert #6
Yeah. So, we have the willingness to adapt technology, then we have adapted technology and with this the product value and quality of sustainable farm produce increases. And from this we get to more higher sustainability in the retail environment. Thank you.

01:03:12
Lena Kampa
Making a plus year. Okay.

01:03:16
Expert #6
And then we have scenario A.

01:03:20
Lena Kampa
Perfect, Let's get yes, of course. Expert #5, can you explain what you did here?

01:03:29
Expert #5
Yeah, sorry. It's very much more simple than and it's interesting because it's different a bit. My main idea was that some factors are jointly now affecting the whole business. Right. So that's the level of awareness let's say people are more interested in sustainability and push this. As well, the product value of sustainable farm produce, this is how I kind of read it would be like the value is good. People understand that it has a high value, and it drives demand, which I don't know if that's really what this card meant. Same about the retail environment. So basically, willingness to pay more and also ecolabeling for me, those are the measures that could happen fast, which drives the demand. And in my opinion, if the demand is there, the farmers will move. If the technology is there and the demand is there, in my opinion, technology is mostly there already.

01:04:36
Expert #5
And then this will be like the second stage which I have here in the middle, which is willingness to adapt. Technology will increase because if the farmer sees that he can sell it for more and people will buy the produce, they will adapt the technology, the trust as well. If they see the value in sharing the data, they will also use it.

And the attitude towards digital agribusiness, as I said, in my opinion, those distributor companies would have to really change the way they act if they do that. Or maybe other actors come in that are more digital, that will also drive things. And then the last level, I would say I put this on top because and I don't know even if there must be an arrow there, so I know those are the wrong arrows, but on top I just put those very far away because I don't see this happening fast.

01:05:30
Expert #5
So compatibility of machines is something that lasts. We have 2028 on top, will last at least ten years. And education level of farmers is also something that it's a small process, right. So, if we want to move things, we have to work with what we have, which is incompatible machines mostly, and not a high education level of farmers. And so, this is why I put it basically this structure. So really my main thing is if demand is there which can be driven through policy, this will move everything forward.

01:06:07
Lena Kampa
Yeah, for this is okay, maybe we can say this level of education and comparability right now is here, but it's kind of low, right? Like those factors, those both are kind of low, but they need to increase to reach that, right?

01:06:28
Expert #5
That is correct.

01:06:30
Lena Kampa
And the other five here, you said they are what they need to be the first level.

01:06:38
Expert #5
In my scenario they would be high. Let's say scenario A is that there's an increase, so they should all be high. Okay, they are kind of high, I would say. But let's say they stay high, and they get higher and then I think they will drive the second stage and then the third stage sorry, I got.

01:06:57
Lena Kampa
A mess a bit with your stickers here.

01:07:01
Expert #5
So it becomes education level. It's quite simple, right? I mean, if everyone starts buying organic produce, then farmers will adapt technology and they will educate themselves. And same thing with the compatibility, right? If demand is there, the machinery producers will look more into more sustainable machines and integrating them. So, it's a process, I think which is driven by demand.

01:07:33
Lena Kampa
Okay, so first level is demand of consumer site. Perfect. Good.

01:07:38
Expert #6
And on the lower side you say ecolabeling of sustainable farm produce. I mean, we are lucky because the EU, I don't know about next year or something, they want to bring a label to the market ecolabeling to see how sustainable a product is. So maybe this can increase the demand for sustainable produce.

01:08:03
Lena Kampa
Okay.

01:08:03
Expert #5

I think those are great things, information and also educating the consumer. I think those are really good points, equal labelling and so on and hopefully also use it solutions for that effect.

Influence diagram Scenario B

01:08:18
Lena Kampa
Yeah. Okay let's go to please create scenario B or the influence diagram behind scenario B. So, we have in scenario B minimum level of IT integration on farms and maximum level of sustainable demand.

01:12:27
Expert #6
Sorry. So now with this the willingness is low and the technology is no technology is low and demand for a sustainable product is high and now we need to say from this situation how it improves or how we get there.

01:12:54
Lena Kampa
How we get there. So, we are still in 2023 right now but how the factors influence each other and develop from themselves to really reach this scenario. So, I need to write a storyline.

01:13:09
Expert #6
From now.

01:13:11
Lena Kampa
And maybe how this scenario looks further. Yeah.

01:13:15
Expert #6
Okay, thank you.

01:13:17
Expert #5
Okay.

01:14:20
Lena Kampa
Just going to give you one more minute.

01:14:22
Expert #6
Okay, thank you.

01:15:35
Lena Kampa
Do you want to start again? I guess wants to fix some mistakes.

01:15:39
Expert #5
No, to be honest it's fine. I turned it around once because I had 2028 on the top first.

01:15:46
Lena Kampa
Yeah, this happened last time too. I just changed in the time axis. Yeah, well happens before but still Expert #6, do you want to start?

01:16:01
Expert #6
I can start even though it's not really done but maybe when explaining I can add something. So, the willingness to adapt or the trust in data sharing technology is low and the willingness to adapt technology is low or like even decreases and with this we might lose compatibility of machinery and data and digital platform, or it stays the

same. I don't know and yeah, I don't know really how we get to the retail environment of more sustainable farm produce. I think we might get there without technology because yeah, I don't know, they just go for organic or something and with this the high demand from the consumer is covered. Covered. Yeah. Thank you. Even without better technology. So that's why I think because yeah, I don't know for somehow the willingness for the consumer to pay more for sustainable products increases and with this the attitude towards sustainable products increases.

01:17:55
Expert #6
Okay, I think I have to shift this here and then we get the environment of the retailers is more sustainable I think might be through organic or something and with this we get to scenario B.

01:18:18
Lena Kampa
So the retail environment is increasing for that and how is the what I want to say do you have a reason why the willingness to pay more for sustainability pump produce is increasing? Do you have a reason?

01:18:37
Expert #6
Yeah could be through education to the consumers. Do we have this on the secondary elements?

01:18:50
Lena Kampa
Not so really like that but good you're saying it's all in the transcript.

01:18:55
Expert #6
Now so I can use it through governmental I don't know, awareness, full programs.

01:19:08
Lena Kampa
Okay. Expert #5, you want to start?

01:19:13
Expert #5
Yeah, sure. I think it's the same idea in the end. Basically, we get there without technology, or without IT technology at least. I mean, there's many ways to be sustainable, especially if you're a small farm doing more manual things, different types of crops, different types of ways to grow crops and so on. There's many ways to do this without technology, in my opinion. So, I have the level of awareness. The ecolabeling, which are two potential drivers for the willingness to pay more and the willingness to pay more drives demand and in the end will also affect how much sustainable product is there, what's the price of the product. And at the same time, we could have in this scenario, low trust, low compatibility, which definitely is the case at the moment, low education of the farmers, which is also true. And thus, a low willingness to adapt technology.

01:20:20
Influence diagram scenario C
Lena Kampa
Yeah, perfect. I'm going to let you get to scenario C because we are discussing a lot. So, time is a bit lower now, so we get through it. So, six minutes for scenario C. But I really like your result.

01:20:40
Expert #5
What is C again?

01:20:41
Lena Kampa
What is C against C is minimal level of IT integration and minimal level of sustainability demand. So, both dimensions are super low.

01:20:51

Expert #5
Yeah. Okay. Yeah.

01:21:31
Lena Kampa
Now is Expert #5 taking my advice and just copy pasting this scenario and adapting them? Very smart moved.

01:24:15
Expert #5
Once I'm more or less done. But I also copied basically everything. So.

01:24:26
Expert #6
I'm just rearranging a little bit. It okay.

01:25:25
Lena Kampa
Hey Expert #5, you want to start?

01:25:29
Expert #5
Yeah, sure. If you're both on somehow what happened here?

01:25:40
Lena Kampa
You're gone.

01:25:42
Expert #5
Yeah, I think my laptop is going to well, I can explain it. In the meantime, my main thesis is so basically everything goes down in that case. But for me, the main driver is demand more than the technology. So that's what I said before. It might be a bit extreme position, but in my opinion, if the technology works and the farmer can clearly see that there is a demand and that it will increase everything, efficiency, productivity and so on, based on the technology and the demand is there, then we'll go up. And in this case, it will go down mostly because the demand is not there. So, demand goes down, willingness is going down and the fact that technology is not there is making it even worse.

01:26:34
Lena Kampa
Okay, didn't understand so much the beginning. So, demand is down, and technology is also going down, right?

01:26:44
Expert #5
Correct. But in my opinion, the main driver is really the demand. If the demand goes down, there's no point in adapting any technology because why would I? There's no demand, there's no one to sell it to. So, I'm just going to keep doing things the way I've always done.

01:27:00
Lena Kampa
But then we are assuming digital technology increases sustainability rate.

01:27:11
Expert #5
It it could yeah, it could so.

01:27:14
Lena Kampa
Because you're saying the demand for sustainability goes down, the technology goes down. But there could be other reasons, right.

01:27:22
Expert #5
For technology going down, the willingness to adapt. Technology goes down if the demand goes down. If the demand goes down, the prices stay down, people don't buy organic food and so on, then the willingness to adapt technology will also go down from the farmers. I think that's quite a natural thing. And if technology is there or not, that won't matter anymore because the demand is down.

01:27:48
Lena Kampa
Okay, but we could also think even though sustainable product demand is down, then I can really sell really good conservative whatever product, right. Like my product could be whatever, then maybe I want can.

01:28:13
Expert #5
Increase, I can increase produce and so on in a non-sustainable fashion. Is that what you're yes. Okay. Yeah. That's actually a good scenario that I didn't even see there. Yeah, so you're completely right. So, this would be the scenario where actually productivity is being increased without sustainability.

01:28:34
Expert #6
But only if the farmer thinks he's only producing sustainable for the consumers and not for his farm.

01:28:44
Lena Kampa
For his own good.

01:28:46
Expert #6
Yeah, for his own good and to produce even foods in the future and the next generation on this land. And so, I think that's also the idea of sustainability. Right? Yeah, I know it alive and not like using all the resources in our generation.

01:29:07
Lena Kampa
Yeah. Most farmers I know, they see themselves as their guards of their lands or their animals. Right. Not just taking advantage of it, but interesting thoughts here. Expert #6, your scenario?

01:29:24
Expert #6
Yeah. So basically, the same. No demand for sustainable products and with this, the farmer doesn't see any advantage investing in technology and this decreases the product value of sustainable farm produce, and this lowers the retail environment of sustainable farm produce.
Influence Diagram Scenario D
01:29:54
Lena Kampa
Yeah. Perfect. Should we do scenario D really quick? I know we are overtime, but maybe you have fun and still can do me the favour.

01:30:04
Expert #6
We are overtime. I thought we have till nine, but you are right.

01:30:09
Lena Kampa
Thank you. I got to put the timer six minutes and then we're quickly done.

01:30:15
Expert #6
How do I copy all?

01:30:17
Lena Kampa
I can copy all. Which one you want to copy?

01:30:21
Expert #6
C, because I'm only moving everything around.

01:30:38
Lena Kampa
Wait, I gotta leave you the time dimension, which is the other way around now. But this is fine for me, right?

01:30:50
Expert #6
Yeah, I think I can work with this.

01:30:52
Lena Kampa
Yeah. Just make sure which is D now. Yeah, perfect.

01:31:00
Expert #5
Okay.

01:31:15
Expert #6
No technology, higher demand. Yes.

01:31:20
Expert #5
I think this is more technology, low sustainability.

01:31:24
Expert #6
Right, okay. No, okay. More technology, low demand for sustainability.

01:31:30
Lena Kampa
Yeah. Maximum level of IT. Integration. Everyone is super interconnected digital wise with all the suppliers or the consumers in a digital ecosystem.

01:34:47
Expert #5
I'm more or less ready.

01:34:51
Expert #6
One moment. I just need to include more secondary elements. Okay.

01:36:03
Lena Kampa
You want to start, Expert #6?

01:36:06
Expert #6
So the idea here is even though we don't have, even though the demand for sustainable products is low, I say that we get an retail environment that's more sustainable with higher level of technology. So I think that it could be the way to get there is that the farmer gets educated about environmental problems and also, I don't know, things of the vision that he wants to improve the land for the next generation, maybe his son who wants to take over the

farm or something like this. So, we have high concern about environmental problems. And with this we think he looks for solutions and he finds solutions in technology. Or could be that he finds solutions in technology to produce, to farm his land more sustainable. And with this he adapts with more technology to have more knowledge about the soils and like to decrease inputs.

01:37:39
Expert #6
And with this the products get more sustainable because of more knowledge and lower inputs or decreased negative inputs. And with this the retail environment is more sustainable in the end, even though we left out the consumer.

01:38:07
Lena Kampa
Okay. Yeah. Just by the awareness of the farmer themselves, they are pushing for a sustainable future.

01:38:15
Expert #6
Kind of he thinks he's doing it for himself, the globe and maybe his family.

01:38:25
Lena Kampa
Okay, very idyllic. Okay. Last scenario for Expert #5.

01:38:36
Expert #5
Yeah. Let's go down quickly.

01:38:41
Lena Kampa
There's a lot of arrows development here from scenario A to D. Getting wild.

01:38:49
Expert #5
Yeah. Basically, here I have like two things that run in parallel, kind of. So, one would be willingness to adapt technology and trust and data sharing technology. So here I'm thinking the farmer basically sees there's no demand for sustainable products, but I'm still going to use technology to produce more and cheaper and increase the attitude toward digital agribusiness. If it works and I save some money there, produce more, so I might as well grow like that. And the compatibility and education, I put them on top because I think that from all those factors, those are the things that take the longest time to move. So, until everything's compatible and farmers are educated, that's really a long way to go. This is the thing that lasts ten years and I think it's driven by technology. And on the other side, basically trend of awareness is going down.

01:39:50
Expert #5
People not aware of what is sustainable and whatnot also they're afterwards not willing to pay for the produce because they're not aware. And also, in my more pessimistic scenario than yours, in the end we have cheap non sustainable produce in the supermarkets, but the farmers in the end are still producing more or producing more efficiently.

01:40:19
Lena Kampa
So you have two different lines. But I see like from in your scenario you discussed, like there's this willingness to adapt and like the left side, this also influences right. The produce value rate or quality.

01:40:34
Expert #5
Not necessarily the quality, right? Yeah, the product value, but this is product value of sustainable farm produce. Right. I mean in this scenario, for me, this is just a scenario where, I don't know, agriculture in Europe is becoming like in the US. Or in South America, maybe the small farms might be more difficult for them, might better, but they use more technology. Let's say GMO technology, let's say they're more dependent of the

distributors, which take control of what they should do, what to put on which field, which chemicals to put, which seeds to put. And in the end the product value might be higher, the efficiency and productivity might be higher, but less sustainable produce.

01:41:27
Lena Kampa
Yeah, what I don't understand is the level of concern regarding environment which is high.

01:41:33
Expert #5
Yeah, I put this as a thing that in my opinion it might be high. It probably is high today that people are concerned about the environment, but it doesn't mean that they're aware or that they're willing to pay. So that's why I didn't put any arrow here. I mean, those things, in my opinion, can stay pretty much separate. So, people are concerned, but in the end, they still don't buy organic produce.

01:41:59
Expert #6
They know that smoking is bad, but still smoke.

01:42:05
Expert #5
And this is why policy has to I mean, we have to educate people and move people to buy the right goods and understand where does it come from, what does it mean, what does organic mean? One organic is not the same as another organic. And those are the kind of things that are still pretty much missing.

01:42:23
Expert #6
Or, like that's educating the consumer. But also, we can make an environment where all the products in the store are sustainably produced. And then it's not the consumer bashing because he can only go for sustainable or more sustainable products.

01:42:42
Expert #5
Yes, I mean, that would be amazing. You don't have the right to choose them, but this could be driven maybe by technology as well. But I think it's tricky because the technology will always go into the path of least resistance. Right? And unfortunately, it's very cheap to make things unsustainable even with IT solutions. And there's a good way to get a lot of data and manage the field more efficiently, but without being sustainable. And that's something that could happen if the demand is there. I think for a lot of farmers it could be an interesting way to go, which I don't support, but it could go this way. I'm more pessimistic than you.

01:43:26
Expert #6
I don't know. I think the farmers should use more technology that exists nowadays. But how can they do it if the workload is super high? They don't have time to get familiar with the technology. I don't know. Sometimes it's even good to go on the field and dig a hole and see, okay, how's the soil before you start doing what you want to do. And this is basic knowledge and basic rudimental technology. But I think this also the farmers need to do. Again, I don't know. Nowadays everybody's talking. About regenerative agriculture and this is more crop diversity, soil coverage, I don't know, looking how good is this hole? How can I improve like the humus content and all this? This is working without new technologies. But with technology you can improve irrigation system, or I don't know, spraying if you don't want to go for organic and stuff like this.

01:44:43
Expert #5
Sorry, real quick, this is scenario B, right? A little bit like no technology but still sustainable, right? I mean, this is also something that I could picture.

01:44:53
Lena Kampa
Exactly. This was my question. Please put it in one scenario so I have the data so I can write it.

01:45:00
Expert #6
Yes.

01:45:03
Expert #5
Is it my understanding that would be scenario more scenario B, right? I mean, that kind of thing where you say no technology but still, I'm more being more sustainable and I'm finding kind of all technology solutions to do that. And there's many ways in the end this is why maybe our technology that we have doesn't necessarily need to fit in this IT thing. So, for sure there's deep learning, but in the end, we're going back to mechanical weeding and a lot of things are a little bit okay, like, okay, is this really going forward in terms of technology or maybe going back and more sustainable? I mean, that's also a way to go.

01:45:38
Lena Kampa
This is a good question. Is this driven by also EU policies? Like you could also use your robots to have a spray adaption, right? But you're doing a mechanic field.

01:45:51
Expert #5
Yes, we could also do more intelligent spraying, right? I mean, that's definitely something that we're also looking at. But in the end, this is the same thing in my opinion. It's driven by demand. If farmers want more like this or like that, and the policy drives the demand as well, then we as a company, our vision is ensure that every farmer can move in that direction. So, we want to make it as cheap as possible so he can actually meet the demand. And if the demand goes more in that direction, then it will be easier for him to adopt the technology. But in the end, for me, it's unlikely that the farmers will all become organic from one day to another without the demand being there. Because why would you do it? And it's not even possible because you cannot sell those things, right? If the market is not there, you cannot get rid of your produce and you're paying too much.

01:46:46
Expert #5
It's just in an open market, it's just difficult.

01:46:55
Lena Kampa
Thank you very much for your time. I really enjoyed your expertise, this discussion. Thank you for your viewpoints, the trust with this process. I had a lot of fun. I'm really glad that we did this interview because I got a lot of great data. So, I'm really thankful. My last question is if I have any question regarding your scenarios, I'm going to write them down in the next couple of days. If I can send you an email if I have question, if something is unsure about the transcript of hey, you're nodding so this is a yes. Okay. Yeah. Then I will come back to you and present my results. Maybe there's also a bigger discussion, if you like, where I find not just your results, which I could have questioned for, but I have already one expert group with four experts, and if maybe a couple of you all are interested, we can discuss the final results, like the final scenarios which came up in the end.

01:48:10
Lena Kampa
I'm just asking if you're interested right now, because I just had the idea, because then you see also the other experts and maybe there's a bit more networking possibility. Good. Thank you for your time again. And this was great.

01:48:35
Expert #5
Thank you.

01:48:36
Expert #6
Thank good luck with your work.

01:48:38

Lena Kampa
Thank you. You too. It's really exciting.

01:48:41
Expert #5
Good luck with the season. Thanks.

01:48:44
Expert #6
Take care. Bye.

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