

Knowledge Network Analysis of Dutch Alternative Farms: A Case Study Perspective



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Abstract

Alternative agriculture increasingly receives attention from academia and researchers. However, little research is done on the process by which farmers generate, situate, and transfer knowledge. This is also called the knowledge network. In this study knowledge networks of two alternative farms are analyzed. This research aims to inspire policymakers, academic institutions, and other farmers to create a clearer view of knowledge networks. Through observational research and semi-structured interviews, this thesis shows how knowledge is generated, applied, and exchanged, and how this results in a network structure. Even though the case studies differ in terms of farming systems and business models, this study shows that the farms share a similar knowledge network. The informal social network shows collaborative knowledge exchange and formal social networks show a unilateral relationship which hinders innovation and resilience. It would be recommended to create more personal ties between actors which will help create a better understanding of knowledge networks in alternative agriculture.

1 Introduction

When agriculture became a commercial enterprise and its development accelerated quickly, knowledge was developed based on increasing production through improved agricultural practices. Therefore abandoning knowledge of alternative agriculture regarding maintenance of the farm business, land, and its employees. Nowadays we see more and more farms transitioning towards alternative agriculture.

We are moving into an era in which more alternative farming networks exist and are being acknowledged (Ashrit and Aguilar, 2021). Alternative agriculture refers to farming systems whose production differs from conventional farming methods (Kremsa, 2021). Past research has indicated that alternative farming models play an important role in both nature, society, and culture and have verified that they can meet the growing food needs both sustainably and efficiently (Carlisle et al., 2019).

Alternative agriculture has been widely researched. However, most research is done from a socioeconomic and ecological viewpoint (Pagliarino et al., 2020; Van der Meer, 1995; Teschner et al., 2017; Vanbergen et al., 2020). Much less is known about the process by which farmers generate, situate and, transfer knowledge (Stuiver et al., 2004). This is especially important since the knowledge base and transfer differs between conventional to alternative farming. This does not imply that alternative agriculture has more importance. However, to fully move towards more sustainable farming models, the understanding of the knowledge flows and knowledge base of these farms is vital for their performance. Knowledge is partly based on one's social network, therefore questions to ask are who holds the power in the social network, where the knowledge comes from and where does it go to.

In our current system, decision-makers create policies based on political considerations, thereby disregarding the physical evidence where the farmer is placed centrally. There is a need for adopting more localized knowledge and moving beyond a one-size-fits-all solution coming from political bodies (Adolph, 2020; Šūmane et al., 2018; Ogunyiola et al., 2022). Kloppenburg (1991) theorized the transformation of agriculture as the process of de- and reconstruction. Deconstruction is the breakdown of the current science-based perspective on agriculture, which fails to specify situated knowledge. The next step is to perform reconstruction through alternative practices that acknowledge a variety of voices, necessary to make optimal use of the knowledge that is situated on and around a farm.

Agriculture has been around for a long time and has known various discourses, one of which is the scientific discourse. This discourse is facilitated by the assumption that the scientist holds agency and the farmer applies what is being preached (Kloppenburg, 1991). Not much later the scientific discourse was followed up by the academicization of agriculture. This new discourse led to the narrative that academic experts are more knowledgeable than farmers. Over the years, the information flow moved from experts (academics, scientists, etc.) to practitioner (farmers). The former failed to acknowledge that farmers are those who generate knowledge and should be the main focus point.

This research aims to bridge the knowledge gap that disempowers farmers and how they gather and disseminate knowledge, also referred to as the knowledge network. Hence why, the farmer and his farm are central to this research.

2 Analytical framework

2.1 Conceptualising knowledge: learning and knowing

The journey of knowing and learning is an ongoing process that is situated within practices. Learning is defined as the process by which knowledge is acquired (Eraut, 2000). Knowledge can be gained via social encounters, materials, or experiments (Vellema et al., 2021; Gherardi, 2009; Lave, 1993). The capacity of solving problems and achieving certain goals comes from the knowledge interaction between both humans and non-humans (Bruni et al., 2007; Gherardi, 2009).

There are three main sources of learning. The first learning source is learning through experience. Experiential learning is the process in which knowledge is created through experiences (Quay, J., 2016; Kolb, 1984). Experiential learning is an ongoing cycle. Based on the work of Kolb and Kolb (2005) a theory has been created regarding four modes of learning. The happening of the concrete experience, the reflective observation of the experience, the conceptualization of the experience -meaning creating ideas and concepts regarding the experience. And lastly, active experimentation, refers to the practical application of what was learned including follow-up activities (Faber et al., 2015). This is the final part where the individual puts theory and reflection into practice. Experiential learning requires an individual to adapt, evolve and learn throughout their experiences. Experiential learning can be stimulated by facing unanticipated problems. This requires the individual to have a sense of flexibility in their behavior.

The second type of learning is called situated learning. This type of learning is where learners are considered active participants in social and cultural connections within an ongoing cycle of adapting, evolving, and learning. It involves both the learner and the teacher. This type of learning shows that learning is not an individual endeavor and that the teacher is also part of the community of practice. Teachers play a role in structuring the learning situation. An example of such a structure is apprenticeships. Novices learn from the most skilled person. In this case, learning is interwoven with the social structure on site (Jaarsma et al., 2011). The participation of a newcomer is not achieved by the instruction of the teacher but by facilitating change in the identity of the learner. Therefore teachers have a vital role in involving the learner by letting him/her gain access to the community, knowledge, social relations, and tools. Afterward, the role of the teacher changes, it moves from knowledge transfer to helping the learner find his or her way in the community of practice by direct guidance or through observation. In this study, a distinction is made between formal learning and informal learning based on a social perspective. Formal learning is learning from formal network actors e.g., municipalities or controlling agencies; informal learning is learning through peers with stronger ties.

The last type of learning is by use of technology. Lave and Wenger (1991) emphasize how the technology of practice is an integral part of the learning process. Technology is not only formed through its materialistic aspects such as tools or gadgets but it is embedded in situated practices. This means that technology changes with different actors, within different sites, or different applications. Learning through technology for each situation brings to light new insights. This is also described by Gao et al. (2022) who indicate that technological innovation, especially since the industrial revolution, has played a vital role in human social development. The application of technology is important for effective knowledge transfer. The materialistic part of technology helps apply practical experience, therefore, stimulating skill development. The work of Sampath (1990) illustrates that senses are vital for learning. The most important sense when it comes to learning is a combination of sight and hearing. This implies that gaining knowledge requires all senses to be stimulated (Tuimur and Chemwei, 2015).

Besides these three sources of acquiring knowledge, there are also three knowledge types. These are explicit, implicit, and tacit knowledge. Below, all three types will be described and explained further.

Explicit knowledge is a type of knowledge that can be made explicit through verbal communication. Explicit knowledge relates to conscious knowledge that can be passed along easily and happens within a certain social framing (Davies, 2015). It can be expressed through words. However, it can also be expressed through writing think about documentation in reports or manuals.

Implicit knowledge is knowledge that cannot be shared explicitly, it happens incidentally (Seger, 1994). This means implicit knowledge is learning without verbalization and is less easily learned (Patterson et al., 2010). However, it is knowledge that can be gained through observing, experiencing, and experimenting. Such as learning to walk or swim. It is linked to learning a skill. Masters (2000) investigated how the skill of learning to ride a motorcycle happens implicitly and rarely explicitly when it comes to the mechanisms of both the vehicle and the movements. Riding a motorcycle requires observation and simply experimenting to learn.

Lastly, there is tacit knowledge. This type of knowledge transfer goes a step further, it still covers learning through experiences however it is harder to transmit via communication (Polanyi, 1966). Tacit knowledge is not something you can describe in words. It is similar to having your own recipe, and experimenting with it for many years until it becomes perfect. After years of experimenting, you have gained a feeling which is hard to write down. Due to the more subjective and indescribable nature of tacit knowledge, research proposes tacit knowledge to be more personally based rather than factual experiences and reflections (Hau and Evangelista, 2007). However, similar to the other knowledge types, tacit knowledge is also shared within a social framing (Insch, McIntyre and Dawsley, 2008).

2.2 Conceptualising knowledge: knowledge types and social structures

Knowledge knows various sources; however, all are situated in time and space based on sociocultural influences (Poole and Stevenson, 2001). Practices help achieve knowledge through learning, working, and innovating which are enabled by those participating in a practice, application of resources and sharing a collective and goal-directed rationality (Pacharapa and Ractham, 2012). The environment of creating knowledge often happens within a social structure. A set of actors perform within a social network (Carley, 1986). A social network is a structure consisting of actors bonded together by links (And and Llamas., 2013). To create knowledge in a social structure, network actors must collaborate. Research should not solely focus on one's capacity but also study the connecting practices, flows of knowledge, and relations between actors.

As mentioned above, gaining knowledge occurs within a social framework. The work of Sutherland et al. (2017) demonstrates three types of knowledge networks: Firstly, the centralized network as presented in Fig 1. This network can be visualized by one central node which all knowledge flows through. Knowledge is spread on a one-to-one basis. The type of knowledge shared is considered explicit and standardized. It relates to 'know-why', meaning principles of how things work, and 'know what,' meaning knowledge about facts. An example can be one advisory agent, collaborating with a larger community of advisors, and interacting with multiple farmers.

Secondly, the distributed network. This is a dense network of people where mostly tacit and implicit knowledge is shared (Heikkinen, 2015). This means the network is relationship-wise closely linked together and has a certain bond, also called communities of practice. This network is dependent on the networks' social capital. Social capital refers to the strongness of the ties determined by the shared norms and values of the network actors (Grandpre et al., 2022). The knowledge shared in this network is often based on experience. Fig 2 visualizes this network. Here a farmer as shown in the center of the figure has multiple ties and links to other farmers.

Finally, the decentralized network. This network contains multiple ties connecting a variety of individuals, think about farming associations, advisory boards, municipalities, etc. This network is focused on knowledge exchange through weaker ties in the form of disparate social groups. One or multiple actors act as gatekeepers who are the bridging factor within the network. The gatekeepers link the diverse groups together which results in a network. Fig 3 represents such a network with a variety of actors, having both distant and close ties.

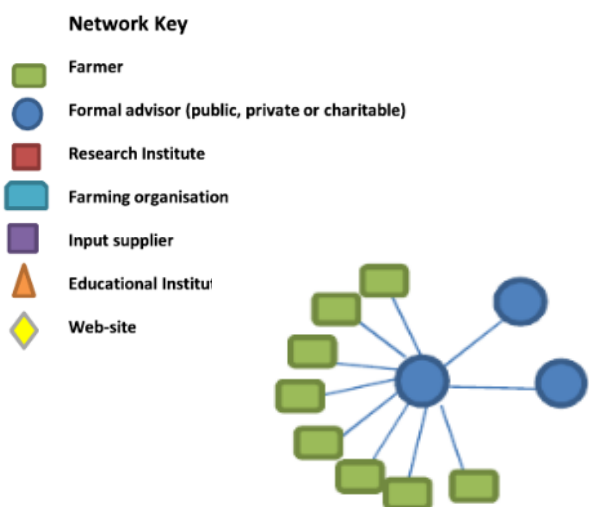


Figure 2 Visualization of a centralized network



Figure 1 Visualization of a distributed network



Figure 3 Visualization of a decentralized network

Understanding these concepts will act as the basis for comprehending the concept of a knowledge network. As described above, a knowledge network cannot be viewed without its social structure. The social network is needed to identify the connectedness and influence within the system represented by a web of actors. It will identify the resources, goods, and information flows through social ties. Besides that, the network will also showcase social capital. The length of the social ties creates an indication of the structure of the knowledge network. Shorter ties indicate a higher degree of knowledge exchange compared to longer ties. Hence a social network analysis will help build the knowledge network. These concepts and the three types of learning will be applied in the results of chapters 5.3 and 5.4. This makes a connection between theory and practice based on the executed fieldwork.

3 Methodology

This research emphasizes the interplay of epistemology, ontology, ethics, and politics of an alternative farming system with both its human and non-human interactions. The overall aim of this research is to gain a better understanding of the social and knowledge structure of alternative farming systems.

For this paper two case studies, both located in The Netherlands, were identified. These particular case studies were chosen since they both fit the ‘alternative agricultural farms’ category. However, the case studies perform within a different agricultural sector. One is a biodynamic dairy farm in Lunteren, and the other is a care farm focusing on organic crop production in Wageningen (see Table 1). Firstly, the main objective will be researched by investigating the everyday practices on farm and the knowledge situated in those practices. Secondly, an analysis will be done on the social structure of each farm including actors and stakeholders and what kind of knowledge they share. Finally, a comparison will be made between the two case studies.

Table 1 Case study overview

	Paid employees	Farm size	Main activity	Main product
Remeker	7	50 ha	Dairy farm	Cheese
Hoge Born	8	2 – 3ha	Horticulture and care farm	Crops

3.1 Data collection

To develop a research structure, a review was conducted of academic literature. This was done with the use of Scopus through the following search terms ("knowledge network") AND (learn*) AND (soci*) AND (farm AND agricul*) AND (organi* OR biodynami*) AND (Dutch OR Netherlands). This search term was used since it covers the research objective. No other agricultural practices, including circular farming or regenerative agriculture, were used since they show no overlap with the case studies of this study. A second search was done by using the search term (knowledge OR acqui* OR transf*) AND (learn* OR mech*) AND (social OR capital OR analysis) AND (business OR company) AND (LIMIT-TO (SUBJAREA,"SOCI")). This search term allowed a more deepened literature finding on the theories of knowledge networking and social learning based on businesses in general rather than focusing on agriculture.

Additionally, a practical approach to data collection was done through fieldwork. Findings are based on qualitative and quantitative field research conducted between November 2022 till January 2023. Every week two days were spent at the Remeker farm and two days were spent at the Hoge Born farm. Each case study has been researched with an observational methodology based on the concept of

situated knowledges, where a combination of vision and participation was used. The use of visions helped to materialize what knowledge flows happen within the system. Participation generated a better understanding of the everyday practices of the system and an understanding of how knowledge is situated. The approach was to ‘shadow’ the everyday practices of the farmer, participate in its system and therefore generate finding in terms of the situated knowledge of the system and its participants. The findings through observation were written in a diary which was updated every workday. The diary explicitly focused on the activities seen and dialogues heard.

As an add-on, semi-structured interviews were taken with the farmers and the working employees. The interviews were used to gain further insights into the performance of the system. The interviews aimed to establish functions within the system and identify the roles of the actors. Topics addressed in the interviews were: the history of the farm/farmer, business structure of the farm, practices on farm and associated knowledge for those practices, knowledge resources, knowledge flows, and social structure.

Before the fieldwork started, a planning was made based on the identified research questions. For each research question, it was determined what type of research was needed to answer the question (observations or interviews), which actor to talk to, and how the data would be acquired. An example of such a planning can be found below. For the full planning see Appendix 1.

Table 2 Planning for data collection fieldwork

Questions	How to answer?	Who to ask?	How do I get data?
1. What are the everyday practices of both farms? How is knowledge situated in those practices?	Daily diaries describing precisely what the activities on farm are and what has been done each day. What knowledge is needed for the practice?	Through dialogue with the actors I work with discover how knowledge is situated. Whom to ask: - The farmer - Volunteers on the farm - Employees	Questions for participant and farmer: 1. How did you learn to do this activity? 2. Who taught you what to do for this task? 3. Did you have to do some preliminary tasks (reading) to do this task? 4. Is this an individual task or do you work together? 5. If you work together, who do you work together with? 6. When you arrive at work how do you know what you are going to do that day?

The planning was experienced as helpful in organizing the research and going into the fieldwork with a structured approach. This way the directionality of the data collection was easily formulated. The first two weeks were used to familiarize with the farms and the actors and to start with the observational diaries. Week three was used to start planning interviews that were held in weeks four, five, and six. The last weeks were designated for analyzing the findings.

3.2 Data analysis

The method of transcribing and coding was used in both the interviews and the observational diary. The interviews were audio recorded and transcribed verbatim. This type of transcription is a word for word transcription of the recording including filler words such as stutters or repetitions. This leaves a transcription that encapsulates the tone or personality of the interviewee. The transcriptions were needed for coding the interviews. The first phase of coding is called 'open coding' which requires reading the transcribed interview and connecting labels to the text fragments. These labels resemble the main themes of the fragment.

"I came from the high school of agriculture where I attained my knowledge. In my surrounding no one in the wide area had followed this education."

Open coding: Transition, knowledge from the high school of agriculture

The next step is called axial coding meaning comparing and combining codes of text fragments. For example, some initial labels can be linked to the main label of "knowledge transfer". This step aims to work towards a limited amount of main categories which will make analyzing the codes easier.

Axial coding: knowledge transfer

The last step of coding entails selective coding. Here, you once again go over your main themes and start building connections between the themes. Together with the codes founds in the diary, theories were built. This entails accumulating the main codes and dissecting what this meant for the research. If it is a code that is often mentioned within the research, it can indicate that it is a theme that is of relevance to this research. Eventually, all of the main themes are gathered in a table (see Appendix 2) which helped to shed light on the topics that are the most important to the case study.

4 Case studies

4.1 Remeker, Lunteren

Located in Lunteren near the highway is the dairy farm of family Van de Voort. Since 1650, this family has owned the land on which the farm is situated. The farm itself was built in 1925, during that period the farmer owning the farm was not dedicated their time to farming and therefore outsourced work to others. From 1926 till 2013, the next-generation farmer was the first so-called innovative farmer. He was the first of his timeline to execute daily milking all by himself. He was the first farmer in the Netherlands and within the family business to introduce Jersey cows.

The current farmer, Jan Dirk, started in 1957 and first had his mind set on branching out the business and focusing on efficiency for higher production. Up until this point, no milk was made into cheese. Jan Dirk was the first farmer to start developing the process of cheese-making on the farm. He introduced his cheese under the name Remeker and shortly after got the company organically certified.

Jan Dirk has undergone a huge shift in mindset, moving from increasing scale to a more biodynamic and holistic approach to maintaining the farm. Jan Dirk started to apply old wisdom in combination with current knowledge. He realized that this conventional path of business as usual is a dead end stating that "one cannot win from nature". Together with his wife, Jan Dirk stopped de-horning the cows in 2004 and removed all antibiotics on the farm. That was the moment, as Jan Dirk mentions when he stepped out of the system.

4.2 Hoge Born, Wageningen

Near the campus of Wageningen University & Research, one can find the Hoge Born. The Hoge Born farm started as an experimental farm from the university. The main crop they experimented with were potatoes. At a certain point, the university started to divest farms in the Netherlands, one of which was the Hoge Born. One of the researchers during that time, Jan Hassink, just developed a plan to research a care farm and spoke about wanting a test farm-like environment in Wageningen to do field research, particularly in care. While this idea got planned out further, the university came in contact with the care group Lievegoed. Lievegoed is an organization providing care for people with a distance to the labour market in the form of assisted living facilities, work- and daycare, and psychiatry.

Nowadays, the farm consists of two main elements: the horticulture element and the care element. The idea is that these two elements go hand in hand. The Hoge Born is a self-producing care farm, meaning they produce crops and other produce while providing daycare activities for their target group.

Alternative agriculture is a system that does not rely on conventional farming methods (Vladimir., 2021). In general, alternative agriculture is used as an umbrella term for various alternative agricultural models and technologies that focus on sustainability in the long run. Alternative farming refers to a broad spectrum of low-input and energy-conserving systems (Mukhopadhyay et al., 2013). However, these systems are also characterized as diversified since they are considered to have more resilience and financial stability (Alternative Agriculture, National Research Council., 1989).

Both farms employ alternative agricultural practices. They both contribute to sustainability within their production by maintaining organic practices. Nature is first and foremost. In these systems, nature gets the opportunity to thrive and recover from the imbalance that once was created. This means that both cases eliminate the use of pesticides and antibiotics. They emphasize on resilience and diversity of the soil. Soil is in circulation with cattle and crops. If one of them is failing to perform, the entire system

will experience difficulties. Diversity is also expressed in the business model, alternative farming systems increase their financial risk by expanding their business. This can either be in the form of a catering facility, or hosting events and excursions.

5 Results

5.1 Situated knowledge based on practices

As described in the empirical chapter, knowledge is gained through three sources of learning. While working on both farms and observing the practices happening on-site, both experiential and material learning were identified. Experiential learning professes an individual's or collective ability to learn through experiences and transformations. Both businesses showcase growth through their experiential learning however in the research it was shown that this learning is often combined with material learning. The case studies learn from experience X and alter their process with material Y.

When coding the interviews with the participants of the Remeker farm, experimenting was a code often mentioned. Even though the participants were interviewed separately, all described the journey of 'trial and error'. They indicated to have gained a majority of their knowledge by doing, discovering how to 'make a practice work', and learning through trial and error. After each season both case studies evaluate, and determine what practices were useful and which weren't and in this way adapt their system one season at a time.

Indigenous knowledge is being used, however, the farmers do not shy away from modern technologies. One example from the Remeker farm is the development that happened in 2015, where Remeker was one of the first farms to adopt a so-called nature warehouse (natuurpakhuis). This nature warehouse is a modern version of a cheese cave. Back in 1970, cheese caves were first introduced in traditional cheesemaking (DiModica, 2021). The caves created an environment that maintains constant cool temperatures and high humidity which are beneficial for aging cheese. The idea of the nature warehouse is to mimic these conditions and therefore create the perfect environment for the ghee-washed cheeses. However, this innovation did cause Remeker to experiment. "The moment we went to the new warehouse we could reinvent the wheel with the cheese and with the humidity." (Annet, interview).

During the process of using ghee as a natural cheese rind, the team found out that there was mite eating the rind. They first experimented with putting the cheeses in the freezer, however, this did not generate the desired effect. Then in 2013, they experimented with silicic acid. This is a fine rock-like product that eliminates the mite. Sadly, this solution was highly intensive and was also stopped. A few years later, in 2015, Remeker developed the new warehouse. Here, initially, the temperature and humidity were higher than default. This caused the mite to grow freely and rapidly. To this day, the team is still experimenting with figuring out what methods suits best to eliminate or remove the mite. For now, the team uses a blowing technique done three times a week to stagnate the mite impact. Similarly to the mite, the Remeker farm also experiments with another unwanted guest called the bacteria *Uberus*. *'We now lime three times a week, because we found out the pH spectrum at which uberus is not performing. So we raise the pH in the deep litter barn. We used to do this once a week, now we do it three times a week. And we measure the pH and we started dipping'* (Jan Dirk, interview). With dipping Jan Dirk refers to the dipping of hydrogen peroxide on the cow's teats which is done to reduce the chance of bacteria from the teats entering the utter.

Within the cheesemaking facility, experiential learning has also been relevant. In the process, ancient methods are still adopted. After the rennet has been added, the curd is pressed into the curd bed.

Then the curd is tested on its consistency with a flattened knife. The curd bed is sliced and depending on the way the knife slices through the curd, the thickness is identified. If it slices through too easily the rennet needs longer to thicken. After the curd is approved, the curd is cut into cheese blocks. The cheesemakers are taught to use a particular finger method in to determine the number of cheeses made. Three fingers are placed next to each other on the edge of the cheese tub. Three times three fingers represents the width of one cheese block. Then comes the pressing. For the pressing, the Remeker used to work with more ancient methods such as the tubs called jarbes. This old tub consisted of a ring with a wooden block attached to it. Into the ring, a cheesecloth is placed. After using these materials for a while the team quickly realized that this method was highly labour intensive. "We needed four of us to turn the cheeses, put them under the press, after pressing smooth the surface of the cheese, turn and press again with the brand and lettering. After all of that you also needed to take out the cheeses and clean" (Annet, interview). The moment the team decided to upscale their production from 30 to 40 cheeses it was necessary to look for alternative methods to maintain the co-worker's wellbeing. Nowadays, the team is using tubs where the cheese only has to be turned once, so it is one tub for the entire process. In this example, the team is using ancient knowledge with modern technologies.

Something similar happens at the Hoge Born. Even though the Hoge Born as a care farm is a completely different farm. They also learn through experience. Their biggest experiential learning example can be found in their combination of care and horticulture. As described above, for the Hoge Born to thrive, both facilities need to coordinate. "We have always done it in such a way that we look at the clients. We have adapted the cultivation to the clients" (Hans Jansen, interview). Therefore the care supervisors at the Hoge Born are required to have knowledge of the client's well-being, meaning what the clients capabilities are. In addition to this, they should know what crops they need to produce to fulfill the customer's demands. This constant experiment with crops and clients has led to some crops being eliminated for the Hoge Born production, for example, carrots. Trijnie, one of the supervisors at the Hoge Born, explained in our interview how carrots were a difficult crop to harvest because the clients often couldn't distinguish between the crop and the weed. On the other hand, pumpkins are a great crop and very applicable for their clients. In the end, there will always be a constant experiment where one only finds out the answer by trial and error.

In addition, the experiment has a financial aspect. "In terms of money flows, it is always around 50 percent from agriculture, 50 percent from healthcare. And there can be a few percent difference per year, but that is somewhat the rule of thumb. Therefore it is good to check what kind of products we are cultivating where the client can participate in, but also where we can earn something from" (Hans Jansen, interview). Hence why the Hoge Born decided to build their own horticultural greenhouse. "There was a lot of demand for it [greenhouse vegetables]. So yes, that [the greenhouse] has considerable added value for the Hoge Born, having your own tomatoes and cucumbers in season and being very early with lettuce and endive" (Hans Jansen, interview). In this sentence, Hans Jansen describes how through the experience of uncertainty he felt coming from the combination of cultivation and healthcare, he came to the conclusion to create a stable factor that adds value to the business.

Situated knowledge is put to the test by social, cultural, and physical contexts. In the case studies it is shown that the situated knowledge in practices is challenged by unforeseen problems which can come from social structures that are bound to social entities, norms, and values. The challenges lead to a need for situated knowledge to be dynamic and able to change over time. These case studies indicate that trial and error within knowledge is needed in which experiential knowledge is the learning source often used.

5.2 Knowledge transfer types

Explicit knowledge

Both case studies show signs of explicit knowledge. Within the Remeker farm knowledge transfer occurs on various levels. It was noticed that most communication occurs during the coffee breaks. Here all colleagues are together and share their findings and troubles.

The Hoge Born farm requires a structured manner of transferring explicit knowledge. They make use of intervention groups where all the central actors are joined together. Each session is used to learn from questions and problems coming from daily practices. During the meeting, a case is presented. The team analyses the case by asking questions regarding how they approached the case, what did they do to solve it, etc. By asking questions the team generates new ideas and insights. This way the central actors learn from each other and generate new tools for problem-solving.

Both of the above cases are using vocal communication as a means to an end. However, explicit knowledge is also shared through materials. Especially for the Remeker farm, this is a very useful knowledge tool. They make use of two material ways of exchanging knowledge. The cheese team consists of part-timers all working on different days of the week. They communicate through a handwritten notebook. In the notebook, remarks are written down that happened during the process. Through this notebook, the cheesemakers who do not work together, make their knowledge accessible. Next to the notebook, the entire team also works with a cheese book. This book contains all aspects of the farm, from microbial monitoring to the details of the milk. The book is used to trace back any inaccuracies happening during the process.

Implicit knowledge

An example of implicit knowledge transfer is learning a skill. In the case studies, this is often done via apprenticeships where novices learn from a skilled individual. In both case studies, there is a clear division in the skilled individual. For example at the Remeker farm, there is one main actor per specialization. Meaning the head cheesemaker, one person responsible for the warehouse, etc. Therefore there is one teacher designated for teaching skills to the novices. It is a continuous cycle of knowledge sharing. Every teacher, whether manager, executive, or cheese maker, has learned their knowledge from their teacher. The origin of the teachers mostly comes from schools, and internships, but also shared across generations. In the case of the Remeker, the current farmer learned his knowledge partly from his father and partly from school.

The novices are learning from their teachers through three methods, 'learning on the fly' meaning learning by asking questions and seeking help, 'learning by collaborating' meaning working alongside a more experienced person and lastly 'learning by observing'.

Both farms, when taking up any novices, make use of a trial period. This is a period where the novices work alongside the teacher. A clear example can be seen in the cheese-making facility. "[novices] need to understand the story around it [the cheesemaking process], why something is important to do, and why they do certain things. Everyone can copy, but truly understanding why do they do it and what do they do if something goes wrong, that's what is most important to me. Once you can do that then you are allowed to make cheese in our facility." said Annet, the head cheesemaker of Remeker. This is a type of knowledge that one can only learn through observing, asking questions, and collaborating.

For the Hoge Born novices working on the farm not only execute agricultural practices, which can be taught via explicit knowledge transfer, but also need to have a certain degree of social skills. Especially in the care farm environment, working with clients requires sensibility when interacting with the

clients. This is something that cannot simply be taught. The novices need to work alongside the executives to absorb and internalize the social behaviours and norms. The novices need to have a feeling for how to work with and approach clients. To some degree social skills can be taught, however, social skills are highly influenced by someone's cultural background. For example, some cultures prioritize belongingness and cooperation whereas others might prioritize autonomy. It is the task of the teacher to discover whether or not the novice suits the environment.

Tacit knowledge

A form of tacit knowledge is identified within both case studies in the form of 'entrepreneurial knowledge' or an 'entrepreneurial mindset'. Both farms indicate that to start a business as described above, one needs to have a mindset of entrepreneurship. Hans Jansen and Jan Dirk possess the skill of problem solving and seeing opportunities. This is a type of tacit knowledge that is not easily taught, formed over the years, and is highly personal.

Managers of the Hoge Born and the Remeker both have gained knowledge through experience. Hans Jansen gained the basic knowledge of care institutions through the experience of working at the care institution Lievegoed. As an internal auditor, Hans saw a lot of care farms and was familiar with the problems they were facing. When taking on the Hoge Born, he applied the gained knowledge and made it his own.

Also, Jan Dirk encountered a similar experience. He learned all of his farming knowledge from his father. "My father was innovative, he could come up with things. My father was also very good, he was always optimistic, and he always found a solution. And you could see that my father also really enjoyed his work. I also have those things." However, Jan Dirk took his entrepreneurship a step further. The combination of growing up on a conventional farm, having responsibility for running the farm, and studying at the school of agriculture created his mission. Jan Dirk took this knowledge to heart and is now expanding his business and changing perspective by giving excursions and working on a project called *Natuurinclusief* in which he helps other farmers transition and share his unique story through the raw milk cheese.

All forms of knowledge can happen interchangeably and simultaneously. There is no particular order in which the type occurs. Within one situation multiple types of knowledge can be recognized. Explicit knowledge is easily transferred however this research is considered not the most used form of knowledge transfer. Easy and accessible knowledge is shared through explicit ways either verbally or non-verbally. However, in the observations, most farm knowledge cannot be written in a manual or even taught in words. This is perhaps also why implicit learning in this research occurs more often. Tasks such as how to milk the cows, how to drive a wheelbarrow, or even how to harvest a crop, are tasks that are shown to the learner. It requires learning by doing and using your senses to gain knowledge. The teacher, in this case, the farmer, shows the learner how to perform the task and what senses to use. Both explicit and implicit learning are seen within all kinds of actors in the system, such as interns, employees, and the farmer. It is knowledge that spreads through the knowledge network easily and does not remain with one actor.

However, tacit knowledge is, as we described, knowledge that is hard to attain or even share and therefore mostly remains within one actor. In the case studies, tacit knowledge is mostly seen among the managers of the farm. Since tacit knowledge is hard to transfer, these central actors are rather unique to the system. Managers have an entrepreneurial mindset that brings along action and behavior that generates new possibilities. Both alternative farms face problems that are often unforeseen. Nevertheless, to solve these problems the managers need skills including creative thinking and problem solving but also networking. The managers of both case studies show great signs of tacit

knowledge use. It is knowledge they have acquired and transformed according to their norms and values.

5.3 Knowledge networks: social relations in knowledge transfer

As described above both case studies wanted to move beyond the dominant regime and close their cycle as a motive to become more self-sufficient and build a future-proof system. This closed cycle led to loyal and strong relations on an internal and external level.

In the interviews held and observations made, a clear social network of both farms can be depicted. As seen in Figures 2 and 3, the bigger dots represent the node that has the largest amount of relations, also known as the node with the highest centrality. This term comes from the node metrics used in social network analysis (SNA) theory. Degree centrality refers to the number of edges a node has (Powell and Hopkins., 2015). If a node has a large number of connections it has high centrality.

The thickness of the lines represents the strongness of the relationship. The arrows shown in both figures represent the knowledge flow. The direction of the arrow represents the direction in which knowledge is shared. This can be a one-sided knowledge flow or a two-sided knowledge flow.

In social network theory, centrality, and power are questioned. It cannot be assumed that centrality leads to power. In some cases, depending on the type of network, subgroups can dominate the central node (Mizruhi and Potts., 1998). In the observations made and the interviews held, there is a clear distinction in whom has the most power. For the Remeker, power lies with the farmers themselves. They are the ones responsible for the farm and therefore are the decision maker. The Hoge Born has a more complex network since it combines both agriculture and care. Therefore there are multiple central nodes. One is responsible for the agricultural part (establishment Hoge Born) and one is responsible for the care element (Lievegoed). The establishment is responsible for the business side of the farm and the executives are responsible for the happenings on the farm. The executives determine what activities the client will do, essentially, the day-to-day aspects of running the farm. Therefore power lies with several actors.

The Remeker farm and the Hoge Born resemble a so-called distributed network. This type of network is characterized by one central node from which several links can be found. The network is based on close relationships where mostly tacit and implicit knowledge is shared. They both facilitate connections with their external partners and share knowledge with them. One can see that the knowledge combines with one central node which then spreads the knowledge further. Decision-making is mostly done by one actor.

The only difference between the two is the fact that the Hoge Born knows multiple central nodes. Knowledge does not as easily move through one central actor. Rather, knowledge is generated within bundles of actors. This leads to multiple central nodes structured in bundles. The central node in each bundle makes decisions separately. However, the central nodes do interact with one another.

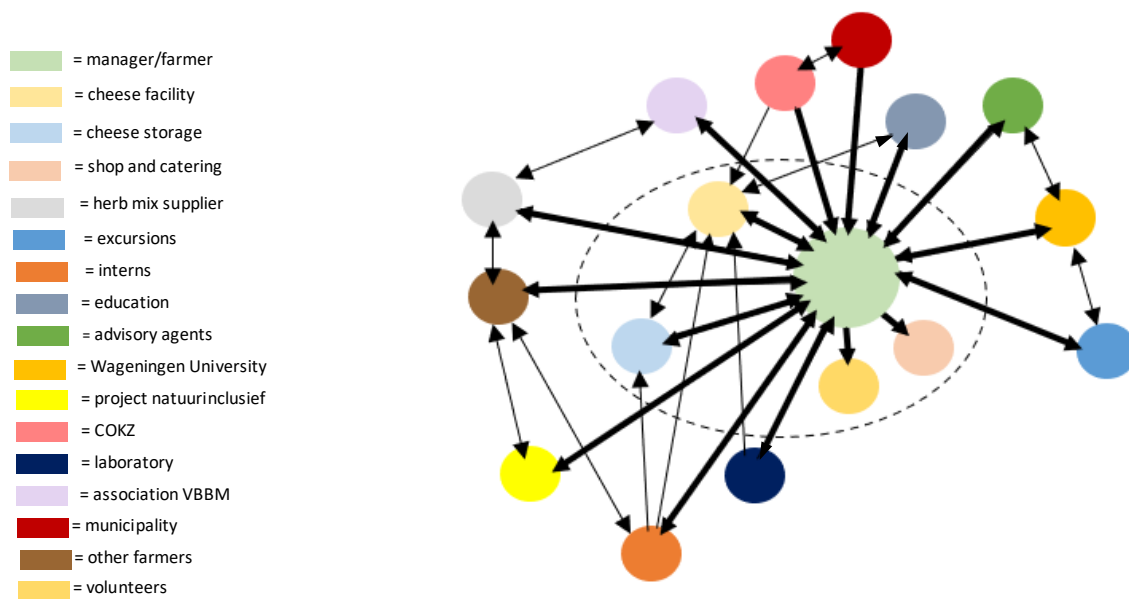


Figure 4: distributed knowledge network of the Remeker farm

Remeker has a relatively small team nevertheless their role in the system is considered large. Remeker is at the forefront of multiple innovations. They were one of the first farms to adopt organic practices, the first one to switch to a nature cheese warehouse but also the first one to eliminate antibiotics within its system. All these innovations led to experiential knowledge which they share not only internally but also externally. The farmers cooperate in an educational group, called Project Natuurinclusief and also GRONDIG, in which they interact with other farmers and transfer knowledge. Besides that, the farmers also invite a large number of excursion groups onto the property. They are active on social media and YouTube where they transfer their story further. By doing this, the Remeker expands and builds on its social capital.

The municipality is an actor that shows a one-sided knowledge flow situated in a formal relationship. The knowledge is given by e.g., the municipality where the farmers have to comply with. An example can be seen with the expansion of the Remeker farm. The Remeker bought a second location near the original farm to keep young stock but also created a catering facility and local shop to diversify the business. However, they are now waiting for a permit to build a new deep litter barn for the young stock. Similar to the permit, the Remeker is now also on hold for additional land. The municipality has established a new measure in which they determine land ownership utilizing a point system. The idea of this new measure is to give farmers equal opportunities. As a municipality they encourage farmers to work more nature-inclusively and the points system is therefore an extra motivation for the farmer. The more points, the more discount a farmer receives on the lease price. In addition, the municipality avoids the private distribution of land and also gains more control over who gets land ownership and what happens on the land. However, this new measurement makes it harder for the Remeker farm to expand and grow. This knowledge flows lead to unilateral relationships.

More two-sided knowledge flows can be found with external actors who also exchange knowledge with each other. The excursions from the university bring knowledge to the professor, the students and also the farmer. The farmer passes on that knowledge to other farmers. This way knowledge is not stuck with one actor and the Remeker, as the central node in the network, actively seeks to connect their network. Knowledge is shared evenly.

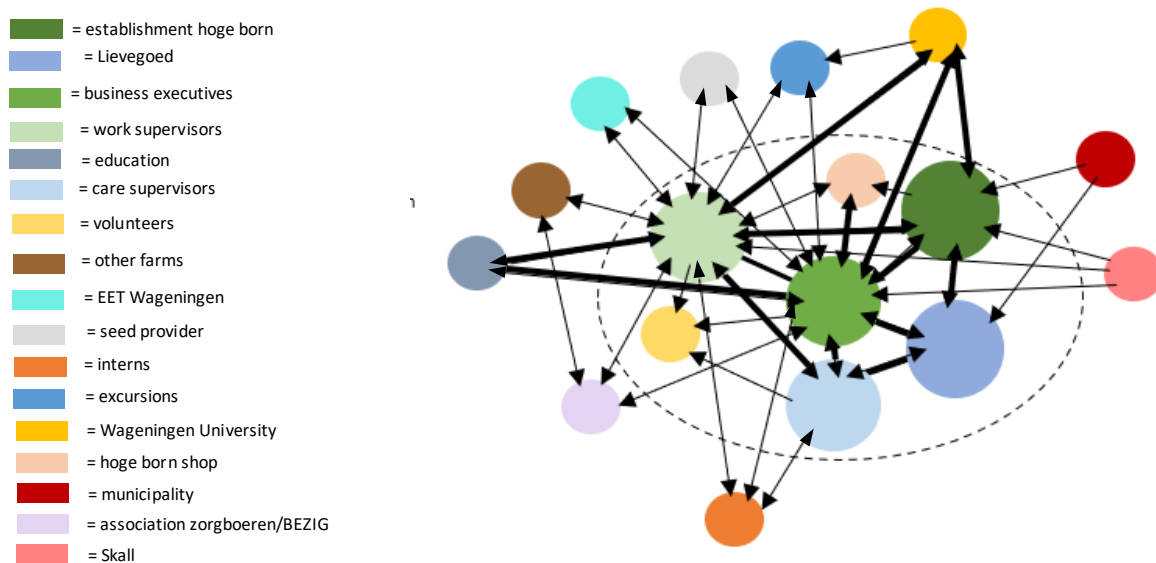


Figure 5: distributed knowledge network of the Hoge Born farm

The Hoge Born is a more complex network. Internally multiple nodes have power and knowledge is shared on a one-to-one basis. In that case, you could say that knowledge is shared less evenly compared to the Remeker hence why intervention groups are necessary. Compared to the Remeker, the Hoge Born does not interact with other care farms as much. However, they do exchange knowledge and have strong ties with their on-property partners.

One of their strong connections is with EET Wageningen. The owner of EET Wageningen was seeking extra land for their horticultural practices. In exchange for him using the land, the Hoge Born asked to have several crops to sell in their shop. Through communication, the Hoge Born and EET Wageningen decide what crops will be grown, also looking at consumer demand. This way, knowledge is shared mutually and both actors can thrive on the same plot of land.

Similar to the Remeker farm, The municipality, and Skall are two actors where knowledge flows from one direction. In interviews held, it was mentioned that these formal actors often felt like a burden. This is because inspections on farm are considered time-consuming since they often bring extensive questionnaires. It was expressed that the Hoge Born, but also other care farms, deal with a relatively large number of supervisory authorities. It was stated that care farms in their experience deal with more controlling agencies compared to a regular care institution. In combination with the Skall now also controlling shops, the Hoge Born experiences more and more difficulty.

Both case studies want to move away from the dominant regime and therefore be independent and self-sufficient. This is shown by the case studies creating their own cycle of trusted relationships that share knowledge based on mutuality. This means that knowledge is shared evenly between the trusted partners. The Remeker created their own cycle in which the cows are 100%grass-fed and the biggest input comes from trusted partners. The Hoge Born showcases this by closing the cycle and working with local partners thereby lowering their external inputs.

This also leads to the distinction between formal and informal networks. Informal networks are characterized as mutual. Meaning knowledge is exchanged between the actors. Examples are education. Academic institutions bring knowledge to the farmer but the institution also learns from the farm and farmer. Also, associations and project groups are examples of mutual relationships. Formal network actors are in this case laboratories, Skall, the municipality, and COKZ. These actors

share knowledge in a one-way direction leading to unilateral relationships. The unilaterality lies within the formal actor sharing knowledge but the farmer in this case sharing little to no knowledge.

For the full picture, a comparison is made with the social network of conventional farms. It is not shown whether or not conventional farms differ from alternative farms in terms of social and knowledge networks. The degree of social networking and exchanging knowledge has little to do with the type of agricultural system. The willingness to share knowledge is dependent on various factors, including which network actor the farmer is engaging with. Multiple reports (Kamarudin, 2015; Jamil, 2021) have been written about the diffusion of knowledge for farmers. For a farmer, peers are more trustworthy for exchanging knowledge compared to extension agents. Farmers require a sense of trust (Ganpat and Narine, 2015) in their partners to exchange knowledge.

However, a noticeable difference between the two is the following. Alternative farms, compared to conventional ones, do not rely on external inputs -or at least limit the number of inputs (Fernando R. Funes-Monzote, 2008; Altieri and Anderson, 1986). They seek locality in their inputs or even self-sufficiency, meaning generating the sources themselves. This means that alternative farms are not as easily affected by the power plays happening in the dominant regime.

This result is also supported by research. In Vermunt et al. (2022) seven system functions within Dutch agriculture are identified that hinder the transition towards more sustainable ways of farming. One of the functions that form an extreme barrier is freedom. Conventional farmers indicate to experience little freedom because dominant value chain actors dictate the system. This was also noticeable in this research. Remeker farm before creating their own system were heavily under pressure of the cheese industry which determined how many cheeses were sold and for what price. For the Hoge Born, something similar can be said. While under the wings of the care system, they experienced a struggle of the managers having more of a care perspective hence not understanding the business. Both examples create a lack of freedom, leading to a lack of innovation.

The case studies are distributed social networks that share knowledge based on implicit and tacit knowledge flows, which is also theorized by the work of Heikkinen (2015). Due to the fact that both case studies wanted to seek their own cycle of relations and resources, a web of strong ties occurred. The ties learn from each other through experience and therefore build onto their social capital. Conventional farms resemble a more decentralized network, having to deal with more dominant agents and relatively weaker ties.

6 Discussion and conclusion

This study indicates how alternative farmer's knowledge network can be understood and researched based on the case studies of Dutch alternative farms the Remeker and the Hoge Born. In the research quantitative and qualitative methodologies are used. Data collection comes from observational studies and semi-structured interviews.

The results show that knowledge networks can be best understood based on a case study perspective. The findings in this research indicate that no alternative farm is the same however between the two case studies a general line can be drawn. The two case studies share a similar knowledge network meaning they share implicit and tacit knowledge easily within strong ties. The case studies' informal network of farmers are a great success for innovation and problem solving leading to a higher degree of social capital. This makes the farmers more innovative and resilient. The farmers in the case study make use of their network when tackling problems. The network facilitates not only knowledge transfer but also increases access to resources and business exposure.

Some implications for both farmers and formal agencies can be derived from the results. First, informal actors can be encouraged to place more emphasis on the farmer and the knowledge a farmer has. The knowledge types found in this study are highly contingent. They are dependent on the social, cultural, and physical environment of the farm. This contingency and sum of all the knowledge forms results in often complex farm models. Secondly, especially now that alternative agriculture keeps expanding within different contexts (regenerative, permaculture, urban agriculture, hydroponics, etc.) it must be realized that no farm operates the same. The two alternative farms in this study alone show that knowledge knows various origins and the way a farm is maintained is context specific. Therefore, in order to understand these systems attention and time are required. Third, a focus on mutual knowledge relationships between informal and formal actors can help improve the resilience and innovation of farms across the Netherlands.

For the limitations of this research, it should be noted that this research only investigated two alternative farms in the Netherlands. Therefore for further research, it would be recommended to expand the research field and include multiple alternative farms in the Netherlands. This way the hypothesis of the complex knowledge networks of alternative agriculture can be tested on a wider target group including regenerative farms, urban agriculture, etc. Furthermore, for this study, no thorough research has been done into the perspective of the informal actor. For a follow-up study, it would be recommended to investigate which measurements are already in place to come into contact with farmers and share knowledge mutually. In addition, focus groups can be held to observe the interaction between the two actors. Only then can practical recommendations be made regarding connecting these players.

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8 Appendix

Appendix 1: Planning of data collection

Questions	How to answer?	Who to ask?	How do I get data?
<p>2. What are the everyday practices of both farms? How is knowledge situated in those practices?</p>	<p>Daily dairies describing intensively what I have done each day and activity.</p> <p>Observing what natural power dynamics I can see.</p> <p>Ask myself:</p> <ul style="list-style-type: none"> - Who is telling others what to do? - Who is asking advice from who? 	<p>Through dialogue with the actors I work with discover how knowledge is situated.</p> <p>Who to ask:</p> <ul style="list-style-type: none"> - The farmer - Volunteers on the farm - Employees - Direct stakeholders 	<p>Questions for participant:</p> <ol style="list-style-type: none"> 7. How did you learn to do this activity? 8. Who taught you what to do for this task? 9. Did you have to do some preliminary tasks (reading) in order to do this task? 10. Is this an individual task or do you work together? 11. If you work together, who do you work together with? 12. Who do you listen to? 13. When you are done with your task who do you ask for new tasks? 14. When you arrive at work how do you know what you are going to do that day? <p>Questions for farmer:</p> <ol style="list-style-type: none"> 1. Where would you say does your knowledge come from in regards to running all activities on the farm? Ask specifically about knowledge for managing a team, agricultural practices, finances, marketing, managing partnerships, 2. How do you see your role in the system? What is your function? 3. Who do you work closely together with? 4. Are there connections that you have with people because they have knowledge that you do not have?

<p>3. What actors and stakeholders are connected to each farm? In what way do they contribute to the system?</p>	<p>Through dialogue and observing discover what interactions there are with actors and stakeholders.</p> <p>While observing ask myself:</p> <ul style="list-style-type: none"> - If I listen can I hear what stakeholders are mentioned? How often are they mentioned? 	<p>Who to ask:</p> <ul style="list-style-type: none"> - The farmer - Volunteers on the farm - Employees 	<p>Questions for farmer:</p> <ol style="list-style-type: none"> 1. On daily basis who do you interact with most? 2. Whose opinions have influence on your decision making? 3. What are the partnerships that the farm has?
<p>4. What is the position of each actor and stakeholder? Who holds the most agency and which ones are isolated members and bottlenecks?</p>	<p>Make a scheme of all relations on the farm. Based on the above questions I would have a better insight into the dynamics and hierarchy in the teams. With dots and lines a visualization can be made on the interactions and - connections.</p>	<p>Look at all the actors in the system:</p> <ul style="list-style-type: none"> - The farmer; - Volunteers on the farm; - Employees; - Direct stakeholders; - E.g. governing bodies e.g. municipality, institutions e.g. universities, neighbouring farms or farmer collectives, sellers e.g. retailers, local market or shops; <p>and analyse them in their natural habitat.</p>	<p>The goal of using observations is to understand the power dynamics, who is being heard and who isn't. for this research question it is best to avoid asking questions since the observants are probably not aware of the power dynamics and if so they can give socially desirable answers. Most insights can be found through analysing the observations. The observants are not being scripted or guided into ways of acting. The goal is to have them perform in their natural habitat which will be done by working beside them. The observing of power dynamics can be done in activities but also power dynamics in the way actors communicate with each other, what languages are being used (e.g., institutional or more simple local voices). What languages are used in the team and what languages are used with external actors? How do these differ and what impact does this difference have?</p>
<p>5. How is knowledge transferred,</p>	<p>Based on the found data determine the shape in which</p>	<p>Look at the system as a whole, how does knowledge create, kept</p>	<p>Based on the found interactions and questions asked about knowledge flows also use the</p>

attained and generated in each farm?	knowledge is transferred, meaning is it a linear process, cyclical process or dynamic multidirectional process.	and transferred within the network. E.g. knowledge through socialization, externalization (formalizing in reports or documents), combination (combine with formal documents), internalization (consulting formal sources of information to obtain knowledge)	theory of knowledge networks to build a stronger argument on the structure of the knowledge flows within the system.
6. What are the similarities and differences between the two farms?	Differences and similarities are looked based on the analysed data.	Differences in knowledge transfer, situation, generation, dynamics.	Use the found data and conclusions of the data and compare.

Appendix 2: Overview of selective coding

The Remeker farm		
Code	What does this include?	What does this include?
Thinking	Letting go, action, solutions, intervening, rethinking	
Acquiring knowledge (learning)	Learning from work	Learning to delegate, work in series, prepare work Learning to manage, document, monitor, lead, stimulate
	Learning from work/internship	R&D, quality service, technology, food processes
	Learning from others	Interns – dipping, cheese making
		BBZ association of farm and dairy producers
		Van Riet (cheese equipment)
Learning from trainings	Ice cream man – recipe and method David – agricultural studies Gea van der pel, EU hygiene code, natural crusts training, Barbara Hart	
Cooperate	Team	Father and sons, team colleagues, Irene
	Farmers	For soil, nature included
	Partners	Hubert, Onno, peter v.d. hoof, membership
	Clients	Catering, cheese specialty shops
Procedure	Efficient	
Importance	People	Onno, Hubert, Arjen, dirk zaaier, Bernard Simons, Henk bakker
Interests	Transition, arable farming, teaching, soil, quality products, cows, nutrition, helping others	

Knowledge transfer	Sharing knowledge (unilaterally or mutually), giving knowledge	With farmers, cheese trade, sons and interns
Customer relations	Type of customers	Fika, bio channel, catering and cheese specialty shops
	Way of communicating	Honest, open, transparent
Share story	Film (youtube videos)	For transparency, for promotion
	Interview	To share vision
	Book	Share information
	Excursions	
Experiment	Material	Dipping, spice mixtures, test set-up, ghee, jarbe, barrels, ice bank, press, ice machine, milky
	Warehouse	Coberca, humidity, humidity, temperature
	Process ice	Turnover rate, time, heating up cooling down, ice bank, processing liters of ice, process in the ice machine,
	Process cheese	Heavier cheeses to lighter cheeses, different press, fewer operations
	Process mite	Blowing in outside, scrubbing shelves, freezer, silicic acid,
	Process ghee	Best way to lubricate
Labour division	based on position/person	Everyone: thinking along, photos in the app JD/Peter: take action, tackle, figure it out Men: heavy work, relapse, facilitator Annet: sending microplates, executive task
	based on department	Departments work in the department and do not have to deal with other departments, for example. Cheese has to do with cheese and not with animals

The Hoge Born farm			
Code	What is included	What is included	What is included
Alternative farm	Unique		
	Entrepreneurship	Being flexible, activities are not always the same	
		Innovating, keep trying new things	
		Change/develop	Through products, clients or services
		Making choices	Taking certain paths
	Risks	Spread	Spread by subgroups, work areas or products
Avoid			
Business distribution	Business type	Agriculture vs. Care	50/50 distribution

	Based on function	Care staff, care recipient, volunteer		
	Based on What do you do there	Resident, day care, mental health care		
	Business	Lievegoed vs. Foundation		
	Assortment	Bio vs. Conventional		
	Based on Target group in need of care	Dementia or autistics or drug addicts etc.		
Gaining knowledge	By doing			
	Internship			
	Trainings	Type of training	Coaching, triple C course, leadership, autism	
		Through which party	Of federation, of Lievegoed	
	Intervision			
	Networking/ learning from each other	Meetings among themselves, other care farms, day of care agriculture		
Link with the university	Trial set-up			
	Hans Jansen	Manager and unifarm		
	Eric Zeeuw	Start-up Hoge Born and professor		
	Land	Lease agreement		
	Crops	Potatoes, white coal	Biofields, Unifarm	
	Guided tours/brand awareness	Researchers, policy officers, students	List of the university with interesting companies	
	Role in society	Company/institution level	Putting organic farming on the map	
Importance of care agriculture				
Individual level Dependent on who you ask, what are they doing here and how do they experience something		Awareness of your actions	through interviews, guided tours	
		Importance of care agriculture		
		For the participant/ resident	Workplace, meeting place, home, therapy or rest place	
		For the university	Excursions, research, potato sales channel	
		For the resident	Farm to visit	
		For the employees	Workplace, a place to learn	
Procedure	Farm related	Preparatory work	Quantities of agriculture, business structure	
		Work flexible	Switching, being creative, making plans	
		Potato shed	Organic and conventionally potatoes separated	
	People related	Accompany	Depending on target group	
		Dealing with people	Valuable people → must add value	