INTERNET OF FOOD & FARM

D7.4 ANALYSIS REPORT OF THE INTERACTIVE SESSIONS

FUTURES OF FARM DATA SHARING PRACTICES

PERSPECTIVES OF EUROPEAN FARMERS, RESEARCHERS AND AGRI-TECH BUSINESSES

WP 7

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Author of the document	Simone van der Burg, Elsje Oosterkamp, Marc-Jeroen Bogaardt, Aine Regan, Ewa Tabeau-Kowalska, Eugen Popa, Cor Wattel, Gianluca Brunori, Elena Favelli
Contact details of the coordinator	George Beers (george.beers@wur.nl)

PROJECT SUMMARY

The internet of things (IoT) has a revolutionary potential. A smart web of sensors, actuators, cameras, robots, drones and other connected devices allows for an unprecedented level of control and automated decision-making. The project Internet of Food & Farm 2020 (IoF2020) explores the potential of IoT-technologies for the European food and farming industry.

The goal is ambitious: to make precision farming a reality and to take a vital step towards a more sustainable food value chain. With the help of IoT technologies higher yields and better-quality produce are within reach. Pesticide and fertilizer use will drop and overall efficiency is optimized. IoT technologies also enable better traceability of food, leading to increased food safety.

Nineteen use-cases organised around five trials (arable, dairy, fruits, meat and vegetables) develop, test and demonstrate IoT technologies in an operational farm environment all over Europe, with the first results expected in the first quarter of 2018.

IoF2020 uses a lean multi-actor approach focusing on user acceptability, stakeholder engagement and the development of sustainable business models. IoF2020 aims to increase the economic viability and market share of developed technologies, while bringing end-users' and farmers' adoption of these technological solutions to the next stage. The aim of IoF2020 is to build a lasting innovation ecosystem that fosters the uptake of IoT technologies. Therefore, key stakeholders along the food value chain are involved in IoF2020, together with technology service providers, software companies and academic research institutions.

Led by the Wageningen University and Research (WUR), the 70+ members consortium includes partners from agriculture and ICT sectors, and uses open source technology provided by other initiatives (e.g. FIWARE). IoF2020 is part of Horizon2020 Industrial Leadership and is supported by the European Commission with a budget of €30 million.

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EXECUTIVE SUMMARY

The sharing of farm data is a delicate topic, not only for farmers but also for agtech businesses and researchers. In order to find out how farmers, researchers agtech companies envision the data sharing future, including the conditions for their trust in data sharing, we organised a series of focus groups involving farmers, tech-providers and researchers across the EU. The primary reasons to do these focus groups were to explore: (a) what visions farmers, researchers and tech businesses have about the future of data sharing, and (b) what values foster trusted data sharing relationships according to them. Based on this research we wanted to acquire a more informed overview over if and what is needed to foster more trust in farm data sharing and whether presently available codes, principles and guidelines intended to govern farm data sharing are offering sufficient support.

Method

In total we conducted 22 focus groups: 11 with farmers, 2 with researchers, 1 with SMEs and 8 with a combination of SMEs and researchers during which a few large tech companies also attended. In total we involved 233 participants in our focus groups: 117 farmers and 116 SMEs and researchers. We made sure that we included participants of different ages and stemming from different countries across the EU.

To enhance the reflection of participants in our focusgroups, we used a Responsible Research and Innovation approach: we used vignettes that offered alternative perspectives to the data sharing future and we provided them two sets of cards: one with personal values and one with societal issues noted on them. These vignettes and cards structured the conversation between focusgroup participants in three rounds of dialogue. In the first round, participants were asked to choose the vignette that they intuitively preferred and explain that preference in the group. In the subsequent two rounds they were asked to reflect on that choice and elaborate the vignette -or combine it with other vignettes- based on personal values or societal issues. As the cards were used as triggers for reflection and conversation, they left participants free to either develop their opinion in agreement with a vignette or card or in contrast with it, or they could add content on empty cards. In this way, reflection of participants was enhanced by the vignettes and the two sets of cards, without steering it in a direction or imposing imitations on it.

Box 1. The vignettes of future farm data sharing that were used in the focus groups

Vignette 1: The ‘ I choose’ vignette
In this vignette, farmers are allowed to choose with who they will share their data. Data users have to provide full information to farmers about what they will do with the data that stem from their farm and always ask for the farmer’s consent.

Vignette 2: The digital farm data library
In this vignette, farm data are collected in a library where they can be accessed and used by everyone. Farmers who agree to put their data in the library delegate data governance to the management of the library. The library management develops conditions that data users must respect, just like there are conditions for the use of books in a traditional library.

Vignette 3: The laissez-faire or market vignette
In this vignette, development of the do’s and don’ts of farm data sharing is left up to the market, where actors have to develop ways to be trusted business partners. This includes also the development of trusted ways to deal with farm data.

Vignette 4: The value-chain vignette
In this vignette, data are shared among partners who already do business in the value chain; such as, input suppliers, farmers, food processors, retailers and consumers. Within the value chain

partners determine together for what purposes data can be used. Data are not accessible to outsiders of the value chain.

The vignettes and cards proved to be successful reflection and dialogue enhancers, for the focus groups were lively and the inputs that people gave were rich and diverse. While it was sometimes difficult to get people to join, once they were participating they had a hard time stopping the conversation when the focus group reached its end. We audiotaped the focus groups and had them transcribed verbatim. Afterwards we analyzed them using two methods. First, we scored the first intuitive preference of focus group participants for one or more of the vignettes in a quantitative manner. Afterwards we performed a thematic analysis bringing out the values that played the most prominent role in their reflections and discussions.

Results. Quantitative scoring of preferences

On the whole, the results of our scoring indicate that most participants (farmers, researchers and tech developers) considered the first vignette that provides farmers the right to control their data (the so-called 'I choose' vignette) most preferable, as it leaves farmers the freedom to decide about their data based on information: 90 farmers (young and old) and 70 innovators (SMEs and researchers) chose this vignette either by itself or in combination with one of the other vignettes. The second preferred vignette is the one that imagines the development of a digital data library: 49 farmers (young and old) and 50 innovators (SMEs and researchers) chose this vignette either by itself or in combination with other vignettes. While these numbers suggest some level of agreement, the comparison between the results of different groups, provide a more diverse picture of preferences. Young and older farmers stemming from Southern EU countries (from Italy, France, Spain and Portugal) expressed a stronger preference for the 'I choose' vignette, whereas farmers situated in the north (Scandinavian countries, Ireland and the UK) or mid-West of the EU (the Netherlands, Belgium, Germany, Luxembourg and Austria) were also attracted by the data library, either in combination with the 'I choose' vignette or in some cases, with the fourth vignette that proposes to share data in the value chain. Preferences from participants originating from countries in the mid-east of the EU (from Poland, Estonia, Lithuania, Slovenia and Czech Republic) were more diversely scattered over the various vignettes, including also the vignette that proposes to let the data be regulated by the rules of the market.

If we look at the results of the focus groups with researchers and agtech businesses, what is striking is the much stronger interest in the market vignette than in any other group, sometimes in combination with the 'I choose' vignette. This preference comes forward most prominently in the focus groups with innovators (SMEs and researchers) which were carried out in IOF2020 and SAH. In the other focus group with SMEs unrelated to these projects we have seen some interest in the market vignette, but not as strongly; in our focus groups with solely researchers we have not seen this interest in the market vignette at all. Given the market interest of agtech businesses it was however interesting to see that in our focus groups with combinations of SMEs and researchers, as well as in our focus groups with solely SMEs there was also a lot of interest in the 'I choose' vignette in combination with the library vignette and some in a combination of the market vignette with the development of a data library. This may be surprising as a library would make the data accessible to them as well as their market competitors; agtech businesses however argued that it was in their interest that data are processed in a uniform fashion which allows to access them and re-use them, and they expected there to be more chance that this will happen in a library. Researchers show a large interest in either giving farmers a choice or combining that with a data library, which is a preference that they share with a lot of the farmers and there is also substantive interest in the value-chain vignette.

Results. Thematic analysis

Our qualitative thematic analysis started out on the basis of the vignettes and list of values that ordered the focus groups and which originally stem from interviews with stakeholders that we performed in a previous phase (See D7.3). These themes shaped the initial lens through which we looked at the data, but we also let the data speak for themselves and revised, refined and clustered the themes based on our findings in several iterative rounds. We analyzed the transcripts by attaching codes to parts of the text that describe the content of the selected text passage. Subsequently we

looked at patterns in the codes, which led to a refinement of the themes that we already had on our list which reflected the viewpoints of our focus group participants. After that, in order to come to a better understanding of linkages and hierarchies between themes and subthemes, we returned to the original transcripts and studied how the focus group participants link themes that we identified in their reflections and we clustered them together in a 'wordweb'.

This analysis led to the selection of four main values that came forward in our focus groups: (1) Autonomy and transparency; (2) Fair business collaboration; (3) Care for the commons; and (4) Inclusiveness. These values play an important role in the reflections of all focus group participants, including farmers, agtech businesses and researchers, but they also attract most questions and uncertainty.

Some of the values identified in our focus groups are familiar and confirm findings from other studies, such as autonomy and fairness. During our focus groups, participants discussed at length why they have doubts whether these values (fully) materialize in daily farm data sharing practices. Farmers as well as tech companies, for example, seek control over data by claiming an individual right to decide about data or benefit from them, which is a right they often refer to with the term 'data ownership'. According to our focus groups, however, there is a lot of uncertainty and unclarity about what this right entails for different people. It is for example unclear to a lot of farmers and tech companies what data they are allowed to control by means of their personal choice: is it raw data that stem directly from measurements on farms? Is it processed data which the tech business has combined with other data and transformed into information or knowledge? Different understandings and disagreements about who gets to say or do what with which data, stand in the way of the development of trust in data sharing. They hinder a proper understanding of what responsibilities and rights values such as autonomy or fairness entail for various stakeholders in the data sharing network.

In addition to revealing uncertainties about familiar values, our focus groups also identified relatively 'new' values, such as 'care for the commons' and 'inclusiveness'. We did not see these described in previous empirical studies. In our focus groups, however, reflection on the values that govern data sharing, inspired participants also to consider the shared goals they wish to serve with data; such as for research, for policy making (for example regarding the protection of the environment), for showing their compliance with the law, to foster food safety and consumer's acceptance of food production methods. Many participants considered these 'commons' in relation to the vignette of the data library, which elicited reflection about the sharing of data as if they are a shared source of information or knowledge, such as books are in a library of books. Just like a library has rules to which those who want to borrow books have to comply, our focus group participants considered having rules for the use of data in a library. In addition, they imagined having a library management that would take care of compliance with those rules. Many participants however also raised the question who should take seat in the library management and they considered different options such as the (EU) government, businesses, farmers, or a combination of those.

With respect to the data library, many participants considered their own (limited) negotiation power. We summarized these reflections about negotiation power -which farmers as well as agtech businesses brought forward- under the theme 'inclusiveness'. This value labels conversations in our focus groups about not knowing where to go if one wants to get information about data sharing, or if one wants to influence data sharing rules, or file a complaint. Furthermore, under the theme 'inclusiveness' we also ordered concerns about differences between people with respect to digital expertise and competitive power, which raises questions about who gets to decide about who gets to use data, for which purposes and under what conditions. There's a lot of concern that stakeholders with digital expertise and access to large data sets will dominate the market, as well as the decisions about the rules that data sharing practices have to respect.

Conclusion and discussion

While the focus groups gave insight into a wealth of preferences and considerations, we conclude that participants find it important to have autonomy and decide for themselves whether they want to share data or not. But apart from having individual control, they also call for social values that govern the context of data sharing to which individuals have to conform. Fair access to data, fair distribution of benefits, data sharing for 'the commons' and inclusiveness, all call for 'playrules' that govern the

behaviour of the various data sharers in concrete data practices and which –to some extent- define the game of data sharing, about which no one can decide individually.

The preferences for vignettes and values call for the further elaboration of the guidelines that are available at present to govern farm data. Guidelines, principles and codes of conduct that have been developed in the US, New Zealand, Australia and Europe all prescribe the formation of contract agreements prior to the sharing of data. These existing documents therewith successfully attend to autonomy which is an important value that receives a lot of support from participants in our focus groups. The documents also succeeded to enhance discussion about several issues, for example about fairness with regard to data access, data use and the distribution of benefits harvested from data. But these documents also have limitations. They only attend to fairness issues in as far as individuals can decide about it. However, fairness is often not an issue that individuals settle in a contract agreement about data. Furthermore, as contract agreements become digital it will become less likely that data sharing partners discuss data sharing issues. Nor do contract agreements usually attend to the other social values that participants in our focus groups addressed, such as care for the commons or worries about the uneven decision making power of different actors about the rules that govern data sharing.

These shortcomings suggest that present principles or codes that govern data sharing ought to be expanded, to include more values. And it should become clearer what these values entail to avoid that every person has to shape an opinion about how to deal with them individually, prior to signing a contract agreement. Based on the results of our focus groups we conclude that it is important to think beyond contract agreements. More serious thought should go into the development of playrules for data sharing practices, which does not depend on the decisions of individuals, but concerns the constitution of acceptable interactive relationships between them. Just like other contracts (such as, employment contracts, purchase contracts, cooperation contracts) are not shaped in a social void, but are always embedded in a wider social context of interactions that are already governed by do's and don'ts, contracts about the sharing of farm data also need to be embedded in data sharing practices that already respect some norms and values. In our vignettes, these data sharing practices are imagined to be as 'a library', as 'a market' or as a 'collaboration in the value-chain', but there are probably also other possibilities that are more suitable to the developing variety of data networks or 'data spaces'. What we take from our focus groups is however that if data networks or data 'spaces' are to inspire more trust, we need to not make the individuals the only ones responsible for making the right decisions about their own data sharing; we also need to think about what makes the relationships that come about between them trustworthy. A focus on these social values in addition to the individual values could help to foster trust.

Relative contribution of co-authors:

Name	**Development of workshop material**	**Researchers and tech companies IOF and SAH**	**CEJA young farmers**	**Po-land**	**Ita-ly**	**Ire-land**	**Analysis and draft article**	**Feedback on analysis, initial draft and finalization**
Elsje Oosterkamp	x	3	1					x
Marc-Jeroen Bogaardt	x	2	1					
Aine Regan						3		x
Ewa Tabeau				2				
Eugen Popa			1					x
Cor Wattel			1					x

Gianluca Brunori/Elena Favelli					1			
Simone van der Burg	x	4	1			2	x	x

1. INTRODUCTION

Digitalization of farming is usually understood as a means by which to address a wide variety of envisioned future problems, such as shortage of available healthy and safe food, resulting from ecosystem pressures and a growing population. (Lajoie-O'Malley et al. 2020) Enhanced capacity to produce more and healthy food for the growing population in a sustainable way, is envisioned as resulting from digital agriculture's potential to allow farmers to have more data-based information about their farm. Digital farming allows them to anticipate and predict natural events based on local circumstances and conditions and develop a more tailored farm management response. It raises the possibility of simultaneously increasing yields, increasing incomes, and reducing inputs into the environment that might impede ecosystem functions such as nutrient cycling, carbon sequestration, and pest control.

The realization of these promises depends however on relationships of collaboration and trust between actors across the agrifood sector. These actors include farmers and other contributors to the food system such as input suppliers, farm machine manufacturers, food processors, food logistics, retailers and consumers, as well as the so-called agtech-providers who make the digital farming technologies. These diverse actors should be willing to work together to attend to the anticipated problems, as the digital farming technologies can only be developed and continue to function well if these actors are willing to share data with each other. Digital farming technologies include tractors, drones, robots, sensors and cameras, which collect data on farms. These data are subsequently processed, combined and interpreted in order to develop information and knowledge that help make farms more efficient and environmentally friendly, or which improve the effectiveness of the collaboration between farmers and other stakeholders in the value-chain.

Results from surveys from Australia and interviews in Europe and North America point out however that farmers are not eager to share their data (Jakku et al. 2019; Wiseman et al. 2019; Regan 2019; Fleming et al. 2018; Carolan 2017; Zhang et al. 2017). Farmers express distrust of agri-tech businesses who want to collect their data in order to be able to develop accurate technologies and they sometimes distrust other stakeholders who could have access to the data, such as their competitors, collaborators in the value chain, their clients, controlling bodies of the government, NGOs, insurance companies or researchers. To inspire more trust in data sharing, stakeholders (farmers, their stakeholder organizations and agribusinesses who make or deliver digital farming technologies) began to shape their own guidelines to improve ag data management practices and provide a basis for trust; such as the American Farm Bureau's Privacy and Security Principles for Farm Data (2014), the New Zealand's Farm Data Code of Practice (2014) and more recently in 2018, the EU Code of Conduct on agricultural data sharing by contractual agreement and in 2020 the Australian Farm Data Code was launched (National Farmers Federation 2020). These guidelines usually ask to shape transparent contract agreements with farmers about the sharing of their data, which should help to realize trust.

The sharing of farm data, however, is a delicate topic, not only for farmers but also for agtech companies and researchers. In order to find out how farmers, researchers and small and medium tech companies envision the data sharing future, including the conditions for their trust and the role the code of conduct can play in realizing it, we organised a series of focus groups involving farmers, tech-providers (SMEs) and researchers across the EU. The primary reasons to do these focus groups was to enhance their thinking and explore their vision of the preferred way to develop the data sharing future, as well as the values they think data sharers should respect or serve. Based on this research we aim to acquire a more informed overview over what (else) is needed to attend to foster trust in farm data sharing.

2. METHOD

2.1. STUDY DESIGN

This research was part of a large innovation project focusing on the further development and implementation of IOT technologies for farming across the EU, called Internet of Food and Farm 2020 (www.IOF2020.eu). A work package on ethics was added to this project in 2018, as innovators (researchers and small and medium enterprises) were encountering ethical questions for which they could use some support. One of the most important problems that they encountered and which they termed 'ethical', related to farmers' resistance to data sharing.

To approach the questions surrounding farm data sharing, we adopted a Responsible Research and Innovation approach (RRI), which is broader and more empirical than a typical digital ethics approach. RRI is a concept that gained particular visibility in the EU over the last decade. (Owen et al. 2013; Von Schomberg 2013) Part of the motivation for this policy interest is the desire for more and more rapid innovation, as innovation is expected to offer goods to society in terms of improvement of health, safety, economic competitiveness, environmental sustainability and wellbeing. But there is also increasing interest in fostering a more critical eye for the ambiguous value of some innovation and try to turn it into a topic of normative reflection, deliberation and evaluation (Blok and Lemmens, 2015). Technologies that attracted the attention of RRI researchers in the past decade (such as human genomics, nanotechnology, synthetic biology, genetically modified foods, but also AI and robotics etc.) all have in common that they have potential high stakes, but also imply a lot of uncertainty and possible adverse effects and changes in human (social) lives and/or their relationship with each other as well as with animals or their natural environment. These broad changes, which effect the wider public, have inspired scholars to involve a broader array of stakeholders and laypersons in decision-making about the value of such technologies (Van der Burg, 2016). Although the nature of stakeholder engagement for RRI is still under debate and various strategies are proposed (Blok, 2019), RRI work starts from the supposition, argued for by Winner (1977, 2011), that like legislation, technology can produce enduring ways to steer (and limit) human (inter)action. It is for this reason that citizens in a democracy should have a say in where technology goes, as technologies will influence their future lives and wellbeing.

While there is a variety of approaches to RRI, they all contribute to a common goal: to broaden and enrich the perspectives of technological innovators (including scientists, technicians, businesses, and policy makers) to help them make decisions that are responsive to societal and ethical aspects. This demands, at the very least, to anticipate (or engage in an informed imagination of) the effects it may have on human (social) life and to foster reflection and deliberation amongst stakeholders as well as the wider public about the desirability of these effects. This is what we did in IOF2020 about digital farming innovation. We wanted to enhance the reflection of both innovators and farmers about data sharing in the digital farming future in order to inform future innovators about stakeholder's viewpoints and enhance and broaden their thinking about what they consider to be desirable and undesirable ways to deal with data. The questions we seek to answer are:

- What visions do farmers and innovators (researchers and SMEs) across the EU have about the future of data sharing ?
- What are the values that foster trust relationships around farm data sharing, according to farmers and innovators?

Answers to these questions will be used to inform innovators to improve the further shaping of their innovations as well as the collaborative data sharing relationships around them. It will inform farmers and their organizations and policy makers (regionally and at the EU level) who aim to realize the preconditions for trusted data spaces.

Visions of the farm data sharing future are however not easy to collect. It is difficult to foresee the various effects that data sharing may have on collaborations and (business) interactions in the agrifood sector. Furthermore, most of our stakeholders were not in the habit of reflecting deeply about the effects that might occur. While some of the researchers and businesses involved in the development of ICT obviously have an abundance of technological knowledge, it is not common for them to reflect on societal consequences of data sharing, let alone to actually do research to learn more about preferences of other stakeholders, such as farmers. While some farmers are very much engaged in digital innovations, it is also not common for them to think very long about the pros and cons of data sharing for themselves, their peers, their business partners and for the rest of society. We therefore needed to provide varied input which reflects the viewpoints of different people in society, in order to enhance their thinking about the varied effects that data sharing might have, but also leave them free to pick and choose what they themselves consider most important to take into account.

To enhance reflection and dialogue we chose to engage stakeholders in focus groups and we used cards to give input to their reflective exchange. Cards are regularly used in qualitative research, and are appreciated as a way to engage people in a reflective dialogue about a variety of topics (Kitzinger 1994). Cards are especially used in focus groups in which people are asked to talk about topics they feel reluctant or ashamed to talk about, or when they feel they lack knowledge or expertise such as is the case with the future societal effects of innovations that haven't yet materialized. Cards are often used to stimulate reflection and dialogue about innovative artefacts or technologies among citizens who are layman in science but who are asked to explore or assess the value of scientific or technological futures that may impact their personal and social lives. (Felt et al 2014; Boenink et al 2018; Van der Burg et al 2019; https://playdecide.eu)) In the reflection on farm data sharing, we used a presentation and two sets of cards to enhance and broaden the imagination of participants about the data sharing future. These were used in three rounds of conversation during the focus groups.

1. *First round*. We presented four possible futures (or 'vignettes') of farm data sharing. (See box 1) Participants were asked to share their reasons for their intuitive preference for one or more of these futures.

2. *Second round.* The second round asks participants to reflect on values with respect to farm data sharing in subgroups of 2-4 people. The cards present values and we ask participants to prioritize three values and afterwards explain their preferences to the group, as well as how they would relate them to the vignettes.

3. *Third round.* The third set of cards present societal issues that data sharing might raise and asks participants to reflect on the value of the various vignettes for society as a whole. It invites participants to reflect as citizens on the data sharing future.

In each of the conversation rounds, participants received cards with different input for their reflection. But the cards function only as a reflection and dialogue starter; they do not determine the course or content of the conversation. What is specific about the card method, is that the choice of cards is up to the participants themselves. Participants receive a set of cards and choose cards that are relevant to them and shape what they want to say either in agreement or in contrast with these cards. The cards trigger reflection and help to shape thoughts about a sometimes new and unfamiliar subject, but participants are also free to do with the cards as they please: so, they can choose cards they agree with or which they criticize, or they can ignore the cards and add new topics on empty cards that were provided with every card set.

To make the presentation and the cards effective enhancers of reflection and discussion, we gave them a content specific to this project. The content of the cards was based on a combination of a literature study and a series of interviews with stakeholders. Based on an exploration of the literature describing the societal and ethical aspects of digital (or ' smart') farming (Van der Burg et al 2019), the first three authors of this deliverable (SvdB, EO and MJB) developed an interview guide to conduct interviews with 23 Dutch and Flemish stakeholders; such as, farmers, ICT developing companies (small, medium and large), a developer of farm machinery, farmers representatives, a representative from a sector organization (dairy), NGO's, a bank, researchers (see deliverable 7.3). These interviews

provided the content of the four vignettes for future data sharing (See Box 1) which we described in the presentation with which we started the focus groups and which offer input to the first round of conversation.

Box 1. First presentation— vignettes of future farm data sharing

Vignette 1: The ' I choose' vignette In this vignette, farmers are allowed to choose with who they will share their data. Data users have to provide full information to farmers about what they will do with the data that stem from their farm and always ask for the farmer's consent. Vignette 2: The digital farm data library In this vignette, farm data are collected in a library where they can be accessed and used by everyone. Farmers who agree to put their data in the library delegate data governance to the management of the library. The library management develops conditions that data users must respect, just like there are conditions for the use of books in a traditional library. Vignette 3: The laissez-faire or market vignette In this vignette, development of the do's and don'ts of farm data sharing is left up to the market, where actors have to develop ways to be trusted business partners. This includes also the development of trusted ways to deal with farm data. Vignette 4: The value-chain vignette In this vignette, data are shared among partners who already do business in the value chain; such as, input suppliers, farmers, food processors, retailers and consumers. Within the value chain partners determine together for what purposes data can be used. Data are not accessible to outsiders of the value chain.

In addition to the vignettes, we developed a set of cards with personal values (see Box 2) and a list of societal questions (Box 3), which were also based on the reflections of the stakeholders we interviewed. In this way, we aimed to offer participants some content for reflection that is available in the social environment at present, as it comes forward in the reflections of the stakeholders that we interviewed and whom we asked to reflect on issues that came forward in the literature. This is a way to broaden reflection, as it allows participants to take into account the inputs that are available in society and in the literature at present. But in no way we wanted to limit their reflection. Therefore, we gave participants in the workshops the freedom to pick and choose the cards they were interested in and to add cards that they were missing.

Box 2. Second set of cards – personal values

Autonomy Data ownership Privacy Safety Transparency Efficiency Competition Food safety Health	Trust Fairness/justice Empowerment Conservatism (keeping things as they are) Knowledge Innovation Sustainability Fun Food security

Box 3. Third set of cards - societal questions

1. What societal goals should we serve with data?
2. Data can help to shape policy that protects the environment. Should the government be allowed access to farm data to inform their environmental policy?
3. Several organizations and businesses (banks, insurance) make attractive offers to farmers in exchange for data that reveal how they treat the environment. What do you think of this? Whose role is it to foster environmental sustainability?
4. Data can introduce a new basis for social inequality. Even if data are accessible to everyone, only people who possess the relevant technologies and expertise can do something with data. What is the appropriate answer to this emerging social inequality?

During the focus groups we changed one value card: this value card originally said ' justice', but as we discovered that many participants took this card to mean that acting ' justly' meant acting in accordance with the law, we changed it into ' fairness' which is more in line with the meaning that came forward during the interviews that led to the development of the cards. Also a card was added with the value 'competition' , which was often mentioned as something that needed safegarding. All other cards kept their content.

2.2. DATA COLLECTION

In total we conducted 22 focus groups: 11 with farmers, 2 with researchers, 1 with SMEs and 8 with a combination of SMEs and researchers during which a few large tech companies also attended. In total we involved 233 participants in our focus groups: 117 farmers and 116 SMEs and researchers. Table 1 provides a more detailed overview over the participants that we involved. In two focus groups with farmers (one in Poland and one in Italy) there was also a policy maker present. We excluded the reflections of these policy makers from the analysis.

Table 1. Participants in the focus groups

Type of participant	**Number of participants**
Young farmers (from countries across the EU)	63
Young farmers Ireland	8
Older farmers Ireland	20
Older farmers Poland	21
Older farmers Italy	5
Total farmers	**117**
SMEs some large companies and researchers (from countries across the EU, who have a role in IOF2020 or SAH)	64
SMEs (who do not have a role in IOF2020 or SAH)	11
Researchers (who do not have a role in IOF2020 or SAH)	41
Total SMEs and researchers	**116**
Total number of participants in all focus groups	**233**

As it is difficult to involve SMEs and farmers working in different locations across the EU in focus groups, we took a pragmatic attitude towards the recruitment of participants. SMEs and researchers involved in Internet of Food and Farm 2020 (IOF2020) and Smart Agrihubs (SAH) were recruited during the joint annual meeting of these projects, in March 2019 in Prague. During this meeting focus groups were provided as part of the program and participants could choose to take part in them. This

occasion allowed to involve many participants, SMEs and researchers combined, who are active in 22 different EU countries. As these projects involve commercial as well as university researchers and innovators, it was hard to separate the two and we involved a mix of both in our focus groups. In addition, in collaboration with the FairShare project, we conducted two focus groups with researchers in Ireland and one with SMEs. These three focus groups involved mostly Irish researchers, but about one third of the participants in these focus groups had another nationality.

It is perhaps even more difficult to involve farmers in focus groups, as they are busy people and would not usually take the time to travel to a different location for a focus group. Digital farming and associated lack of trust in data sharing among farmers is however a topic that is high on the agenda of farmers organizations. The European young farmers organization CEJA therefore gave us the opportunity to do focus groups during their annual meeting in Sweden in 2019, which allowed us to do our focus groups with the national representatives from young farmers organizations (below 40 years of age) from 19 European countries, including at that time the UK. During the timeslot we were provided by CEJA, we were able to do five focus groups in parallel with farmers that we grouped according to the regions from which they stem: we did two focus groups with participants from southern EU countries (Italy, France, Spain and Portugal), one with countries from the west and middle of the EU (Netherlands, Belgium, Germany, Luxembourg, Austria), one with participants from northern EU countries (Denmark, Sweden, Finland and we included there also Ireland and the UK), and one with participants stemming from the east of the EU (Poland, Estonia, Lithuania, Czech Republic and Slovenia). In addition, we collaborated with the FairShare project, we conducted an additional focus group with young farmers in Ireland.

As many studies show that there is a difference between older and young farmer's attitudes towards digital farming, we did extra effort to involve older farmers (40+) in focus groups that were carried out between May 2019 and February 2020 in three different regions in the EU: Ireland, Poland and Italy. Participants in these workshops were recruited via the network of colleagues (in Italy), via municipalities who contacted farmers in the neighborhood (Poland) and via the network of the research center (Teagasc) specialized in agriculture in Ireland.

We involved 9 colleagues as facilitators of the focus groups, for two reasons. First, to facilitate participation of older (40+) farmers with less proficiency in English, we involved a Polish speaking colleague (ETK in the list of authors) from WUR and connected to GB from the University of Pisa to do the focus group with Italian farmers. AR from Ireland carried out focus groups with older Irish farmers and we collaborated with her to engage researchers and SME's situated in Ireland. The choice to work together with many colleagues was also motivated by the fact that we were sometimes offered the chance to do several focus groups in a limited timeframe, which demanded to them in parallel sessions. MJB, EO and SvdB carried out the focus groups during the annual meetings of Smart Agrihubs and IOF2020 and all co-authors affiliated to WUR facilitated focus groups with the young farmers at CEJA. To make sure that all colleagues conducted the focus groups in a similar fashion, we invested substantive time in training everyone prior to facilitating the focus groups.

2.3. DATA ANALYSIS

The focus groups were recorded and transcribed verbatim. Transcripts in Polish and Italian have been translated by the researcher who conducted the focus groups. As we were interested to explore what would be the preferred way of participants to develop the data sharing future, what they would consider acceptable or desirable about data sharing, and what possible uses of data do farmers and innovators want to avoid, we analyzed the transcripts in three rounds.

In the first round we developed a broad quantitative overview over the intuitive preferences that participants in the focus groups brought forward for the different vignettes in the beginning of every focus group. We did this by reading the transcript and scoring participant's preferences in to tables that reflect the intuitive preferences of young and older farmers, as well as the preferences of innovators (SMEs and researchers).

In the second round we conducted the analysis using thematic analysis, which is a variant of the grounded theory approach (Glaser and Strauss 1967; Lingard et al. 2008; Tong et al. 2007). The thematic analysis focuses on substantive themes that are important to a specific research project at hand and is particularly suitable to put order in a large amount of data. This type of analysis fits with our purposes in this research as we wanted to come to a better understanding of participant's reflexive viewpoints and opinions on what constitutes desirable and undesirable data sharing and thematic analysis is suitable to do that. As we had a lot of qualitative data, which needed ordering, we started the analysis with a list of themes that were also noted on the cards and which we derived from our previous literature study and interviews: the vignettes (box 1) and the values (box 2). (See D7.3) These themes shaped the initial lens through which we looked at the data in the first round of analysis. But we also let the data speak for themselves and revised, refined and clustered the themes based on our findings in several iterative rounds. A semantic analysis was performed on the focus group transcripts, meaning that we focused on the explicit content of the data: we highlighted parts of the text and attached codes that describe the content of the selected text passage. After that, we looked at patterns in the codes, which led to a refinement of the themes that we already had on our list which reflected the viewpoints of our focus group participants. After that, in order to come to a better understanding of linkages and hierarchies between themes and subthemes, we returned to the original transcripts and studied how the focus group participants link themes that we identified in their utterances, and we clustered them together in a 'wordweb' in a powerpoint presentation. For example, after we completed the analysis, the theme 'autonomy' on the original theme list, included sub-themes such as: 'being able to decide for oneself', 'having control over data and who uses them', 'informing farmers adequately' and 'being given a place at the negotiation table' etc. Sometimes new themes were added, such as 'care for the commons', which is an overarching theme under which some of the other themes can be ordered as subthemes, such as 'informing consumers about food production', 'getting more consumer acceptance for food production' or ' protecting the safety of food' etc. There were also themes that disappeared from our list after the analysis, such as 'conservatism' and 'fun', as the cards mentioning them were sometimes chosen but not much was said about them during the focus groups.

As the focus group participants started to talk on the basis of the vignettes, we first clustered the themes in relation to the vignettes in our analysis. But the vignettes also seemed to be too restrictive, as participants frequently thought beyond and combined different vignettes. It is for this reason that the results of our thematic analysis eventually also caused us to let go of the vignettes and simply focus on the values that participants consider important for trust in data sharing.

3. RESULTS

PART 1. QUANTITATIVE OVERVIEW OVER INTUITIVE PREFERENCES FOR VIGNETTES

In all focus groups there was a lively discussion about all four presented vignettes. When invited to make a choice in the beginning of the focus group, participants expressed their initial preference, which they subsequently developed further during the three different rounds of conversation in the focus groups. Our scoring of the preferences for vignettes that participants articulated in the beginning of the focus group therefore only provides a first insight into their preferences regarding the data sharing future when confronted with four alternative vignettes. These preferences were further elaborated, and sometimes revised, during the focus group.

On the whole the results of our scoring indicate that most participants (farmers, researchers and tech developers) considered the first 'I choose' vignette most preferable, as it leaves farmers the freedom to choose: 90 farmers (young and old) and 70 innovators (SMEs and researchers) chose this vignette either by itself or in combination with other vignettes. The second preferred vignette is the data library: 49 farmers (young and old) and 50 innovators (SMEs and researchers) chose this vignette either by itself or in combination with other vignettes. While these numbers suggest some level of agreement, the comparison between the results of different groups, provide a more diverse picture of preferences.

The separation we made of groups of young and older farmers originating from different regions in the EU, allow to make a rough comparison between regional and age groups. While the scores (noted in table 2) indicate a young farmer's preference for either the 'I choose' vignette or a combination between 'I choose' and the data library vignette, there are large differences of emphasis across the EU. South European participants (from Italy, France, Spain and Portugal) expressed a strong preference for the 'I choose' vignette, whereas young farmers situated in the north of the EU (Scandinavian countries, Ireland and the UK) chose to combine the library with the 'I choose' model. Young farmers from the mid-west of the EU (the Netherlands, Belgium, Germany, Luxembourg and Austria) were also attracted by the library in combination with the I choose vignette, while some tended more towards 'I choose' and there was some interest in the sharing of data within the value chain. Interestingly, preferences from participants originating from countries in the mid-east of the EU (from Poland, Estonia, Lithuania, Slovenia and Czech Republic) were more diversely scattered over the various vignettes. Compared to other regions, we encountered high interest among young farmers from countries in the mid-east of the EU in the value-chain vignette, which participants usually combined with the 'I choose' vignette or the library vignette and in one case also with the market vignette.

Table 2. Young and older farmer's preferences for vignettes

Vignettes	1	1&2	2	3	1,3	2, 3	4	1, 4	1,2,3	1,2,4	3&4	All 4	Don't know	Total
CEJA, young farmers, total	**22**	**29**	**1**					**4**	**1**	**3**		**2**	**1**	**63**
South	17	5												
North		15												
Mid-west	4	8						1						
Mid-East	1	1	1					3	1	3		2	1	
Older farmers total	**10**	**7**	**4**		**5**	**3**	**8**	**8**			**1**			**47**
Ireland	4	1	4				4	7						
Poland	6	2			4	3	4	1			1			

Italy		4			1									
Total all farmers	**32**	**37**	**5**		**5**	**3**	**8**	**12**	**1**	**3**	**1**	**2**	**1**	**110**

A comparison of the preferences of young farmers (40-) and the preferences of older farmers (40+) from Italy, Ireland and Poland, reveals a slightly more diverse picture. It is of course difficult to compare as the groups of younger farmers include people from a variety of countries. Nevertheless, if we compare older and younger farmers from the same region, older Irish farmers (which in CEJA we ordered under North-Europe) showed more interest in data sharing in the value-chain than their younger colleagues, sometimes combined with the 'I choose' vignette. Results from workshops with older Polish farmers suggests a stronger support for the 'I choose' vignette than their younger CEJA colleagues from Mid-East EU countries would give, but the diversity of their choices complicate the already diverse preferences of young farmers from mid-east EU countries. Remarkable is the interest that older Polish farmers express in the market vignette, in addition to the value-chain vignette. We have not seen this interest expressed so strongly in any of the other regions. Only in the focus group with older Italian farmers one person expressed an interest in the market vignette in combination with the 'I choose' vignette.

As SMEs and researchers were hard to separate during the IOF2020 and SAH focus groups, we cannot make a comparison between the preferences of participants occupying these two roles. If we look at the results of the focus groups that involved both SMEs and researchers, what is most striking is the much stronger interest in the market vignette than in any other group, sometimes in combination with the 'I choose' vignette. This preference comes forward most prominently in the focus groups with innovators (SMEs and researchers) which were carried out in IOF2020 and SAH. In the other focus group with SMEs unrelated to these projects we have seen some interest in the market vignette, but not as strongly; in our focus groups with researchers we have not seen this interest in the market vignette at all. Perhaps the fact that most of the participants in IOF2020 and SAH work in a commercial context, partly explains this market interest. Given their commercial interest in data, what is perhaps more surprising is that in our focus groups with combinations of SMEs and researchers, as well as in our focus groups with solely SMEs there was also a lot of interest in the 'I choose' vignette inn combination with the library vignette and some in a combination of the market vignette with the development of a data library. This may be surprising as a library would make the data accessible to them as well as their competitors. There was also some interest in all these groups in vignette 4 which proposes to share data in the value-chain. Researchers show a large interest in either giving farmers a choice or combining that with a data library, which is a preference that they share with a lot of the farmers and there is also substantive interest in the value-chain vignette.

Table 3. SME and researcher's preferences for vignettes

Vignettes	**1**	**1,2**	**2**	**3**	**1,3**	**2, 3**	**4**	**1,4**	**2,4**	**1, 2, 3**	**1,2,4**	**All 4**	**Don't know**	**Total**
Total SMEs &researchers	**13**	**13**	**7**	**10**	**11**	**2**	**10**		**5**		**1**		**3**	**75**
SME & Researchers IOF/SAH	13	11	3	9	11	1	9		5				1	
SME(unrelated to IOF/SAH)		2	4	1		1	1						2	
Total researchers	**12**	**15**	**5**			**1**	**3**	**4**			**1**			**41**
Researchers	5	11					3	4						
Researchers Ireland	7	4	5			1					1			
Total researchers and SMEs	**25**	**28**	**12**	**10**	**11**	**3**	**13**	**4**	**5**		**2**		**3**	**116**

These numerical overviews offer an interesting first rough overview over the first preferences of participants for different ways to shape the data sharing future, and it gives an indication of the differences of opinion. In the following we will present the results of our qualitative thematic analysis of the transcripts of the focus groups, which throw a more substantive light on their values related to farm data sharing.

PART 2. VALUES THAT SUPPORT TRUST IN DATA SHARING

Focus group discussions were lively. While it was sometimes difficult to get people to join, once they were participating they had a hard time stopping the conversation. Participants (SMEs, researchers and farmers) had a lot to say about the topic, as they realize that digitalisation does not only bring about a technological change, but also a change in the social interaction between people in the social network around farms. New actors from the software industry are introduced into this network and traditional business relationships around farms change when the data shared between them accumulate, travel fast and can be accessed by more people more frequently. These changes bring about trust issues, as the people in that social network become vulnerable to each other in new and unprecedented ways.

In the following we will present the main values related to farm data sharing that came forward in our focus groups: (1) Autonomy and transparency; (2) Fair business collaboration; (3) Care for the commons; and (4) Inclusiveness. The number of quotes we inserted into the text to support our analysis are however limited, as we fear the text will otherwise become too long. To support our analysis, however, we have included a wider selection of quotes in the appendices. In the text below we will sometimes refer to these appendices where the reader can look to find more and more diverse quotes. (For the quotes about the importance of trust in data sharing, please look at appendix 1.)

Autonomy and transparency

As the wide support for the ‘ I choose’ vignette indicates, many focus group participants wanted to have a choice about data sharing. In our theme list we took this to be expressive of an interest in the value of autonomy. Our participants thought that data sharing relationships should start with the consent of farmers. Prior to that consent, transparent information has to be provided to the farmer that explains that their data will be collected, how they will be stored and used and by whom. That information should be provided by the party who is going to collect the data and use them. Farmers subsequently should be given the chance to make an informed choice about whether they want to accept what is proposed to them or not.

The interest in the ‘ I choose’ vignette fits very well with the approaches chosen by the diverse guidelines that were created to provide a basis for trust in farm data sharing, such as the American Farm Bureau’s Privacy and Security Principles for Farm Data (2014), the New Zealand’s Farm Data Code of Practice (2014) the EU Code of Conduct on agricultural data sharing by contractual agreement and the Australian Farm Data Code. All these guidelines prescribe that farmers should be enabled to make an informed choice about data sharing and that this should be noted in a contractual agreement. This way of thinking about how trust in data sharing can be fostered, fits our participants’ preference for the ‘I choose’ vignette, as well as the way they combine it with other vignettes, such as the data library vignette, the market vignette or the value-chain vignette. This indicates that giving farmers a choice is important to many participants, regardless of the question whether these data will be used for public or business purposes afterwards. For some participants in our workshops, it is self-evident that farmers should have a choice about whether to share data or not; it is simply what you do if you decide to collaborate or do business together (Please see also appendix 2 for more quotes),

> I think that the first model "I choose, I decide" is best. What data I collect, how I store it, how I use it and who I give it to should be my decision. (Poland, older Dairy Farmers)

> .... it should be, like, a voluntary collaboration between parties, it can be voluntary if people are allowed to choose and if it’s transparent. (SAH, SMEs and researchers, EO, Group 2)

Having a choice is important for farmers because they think it will help them exercise a level of control over their data. Being granted the right to have a say about who has access to data stemming from their farm and for what purposes they can be used, gives farmers the chance to say 'no' to uses that they disagree with or which they consider too risky. Farmers expect this to help them protect the safety of their data, but they also think it makes them a partner in the data sharing network whose opinion has to be taken into account. Alternatively, SMEs and researchers think that giving farmers a choice would help them to trust sharing data and it gives farmers a little power in the negotiation with tech companies.

> (..) I chose the 'I choose' model as a default position. If farmers think that the value chain or their suppliers are taking advantage of them and they're not honoring their commitments in terms of data sharing. Well I think the farmers are going to want to make the 'I choose' model the default because they just don't trust the system (..) (Young farmers, CEJA, North EU)

> I'd agree with number one as well, you've control -or I've control- you can choose to read the terms and conditions. If you don't agree with them then you know you don't have to go ahead. (Ireland, older Sheep farmers)

> Trust is really the basis, (..) because the farmers don't have trust. We want them on a voluntary basis to share data (..) They will have the right to the data and therefore it gives them, a number of them, a bit more negotiation power (..) The contract's in any case there but they should be formed in such a way following code of conduct that it's clear for farmers what their added value et cetera is…. (IOF, SMEs and researchers, SvdB, group 3)

Autonomy of farmers is therefore an important value that needs to be respected in the data sharing network, as it is believed to provide farmers some control over their data and it gives them a voice in the negotiation with other contributors to the data sharing network. There are however also challenges to the realization of this value, which raise questions with regard to its limitations and the way it should (not) be applied if it is to enhance trust. In the following we will describe these challenges.

Being pushed to make a choice

First of all, farmers told us that they expected to have a choice about data sharing, whereas they found out later that saying ' no' was either not considered an acceptable answer or it was not a realistic option. Some of them reported feeling pushed toward saying ' yes', which they thought did not respect their autonomy.

> … well for that yield map, I clicked No for [Brand Name] to have access to it. And within a couple of days I got a couple of phone calls from [Brand Name] to say oh we can't see this, we can't access this, we can't look at this. (Ireland, older tillage farmers)

> ...a lot of times you have to tick yes. (laughing) you have no choice, for otherwise you cannot use the service. (Poland, older Potato farmers)

Experiences such as these raise the question whether saying 'no' is and will continue to be an acceptable and realistic option. Granting farmers a choice also demands something from tech businesses. It demands to not only accept the farmers choices even if they deny access to their data, but also to continue to make services available that can function without the digital collection of farm data. If such (non-digital) services will no longer be available, or when farm equipment becomes all digitalised, then saying ' no' to farm data sharing is no longer a realistic possibility. Granting farmers a choice regarding whether to share data or not therefore means that there should continue to be an alternative available that does not need a farmer's data.

Difficult to understand/provide information

Making autonomous choices about data sharing requires that farmers are adequately informed prior to their choice. However, participants in our focus groups observe that the information provided is often quite technical and therefore hard to understand for farmers. Farmers therefore often have to put in considerable effort to find out what the information that they receive actually means, or they consent to an agreement that they do not fully understand,

> I'm not sure like I signed up to (Brand Name), I don't know what exactly, not that I don't know what I signed up to but I tick the box and you know agreed to, I didn't, I wanted to know what do they do so that's what I actually... (Ireland, older tillage farmers)

> So sometimes it's easy, but sometimes you probably have, maybe you have a problem understanding the information. (..) I have to admit that some terms are [multi-, SvdB] interpretable, you can search information and understand other definitions behind it. But that's up to you to make it clear, to actually look for explanations. Yeah. (Young farmers, CEJA, Mid-West EU)

This lack of understanding of the information provided, raises questions about the type of information that farmers need and how it should be communicated. According to some it draws attention to the responsibility of information providers to make sure that farmers possess enough adequate information to make informed choices, such as the following researcher suggests.

> I think we have a huge obligation as kind of individuals and organizations involved in this whole digital industry to, to make people more informed of, of what's happening or what potentially is there. (..) it's our obligation to make people aware of why they should give us data and- I see that happening a little bit more in the 'I choose' model. Yeah. (Ireland, researchers)

Many participants in our focus groups were however also quite pessimistic about the possibility to inform farmers well, as the information that needs to be provided becomes very complex once the stage of collecting the data has ended and data have been processed, combined with other data in the network and interpreted. SMEs and researchers taking part in the focus groups told that information about what is being done with data is often voluminous and complex and they fear that not all farmers will take the trouble to read it.

> The I choose model assumes that everyone has read the conditions and the consequences of that which is never true (SAH, SMEs and researchers, SvdB, group 2)

> I think we're already overwhelmed. I mean, who of us keeps his password in his head? I mean, just an easy example; there's so much information that we cannot process this, transparency is totally useless because we cannot…we, as consumers, we cannot understand this. Although it would be all written in front of us, we cannot understand. (IOF, SMEs and researchers, SvdB, group 2)

These difficulties that participants in our focus groups bring forward suggest that more effort should go into the tailoring of information to the information needs of farmers, if the contract agreements are to be transparent and actually empower farmers to make a choice.

Unclarity about who has the right to decide about what data

During the focus groups we often observed that farmers and tech-businesses have differing ideas with regard to the type of data sharing activities they form agreements about. Tech companies often articulated their willingness to grant farmers the right to decide about the primary data that stem from their farms. However, they also argued that the tech-companies should have the right to decide about processed and interpreted data, as they spend time, effort and money to derive useful information from the primary data. Participants from tech-businesses therefore often observed that it would be unfair if farmers would be the only ones entitled to decide about these data in which tech-providers invested significant effort,

> (..) look, the paradox is that by sharing all that data, it's still the corporates who have the ability and the analysts and the hardware to do smart stuff with it and the rest of it is just flooded with three terabytes of open data and you can't do anything with it. (..) So, I think it is just fair that we are rewarded for the efforts we do. Without us, there would be no way for farmers to turn the data into something well, valuable for them. They get information, you know, knowledge. It is based on their data, yes, but ... it does not come falling out of the blue, so…(IOF, SMEs and researchers, SvdB, group 2)

Participants from tech companies often considered it fair to claim data ownership over the data resulting from their work. They readily granted farmers ownership over the primary data that stem

directly from their fields, crops, buildings or animals, but as soon as they used the algorithms that they developed on these data and combined them to the data stemming from other farms, to realize information and knowledge, they considered them 'theirs'. After processing and interpreting the data, they thought they should be able to decide about them.

> Like without transparency and trust there's going to be … the farmers are going to be reluctant to kind of essentially transfer ownership of the data. And then without ownership, you know, it can't really be monetized or value can't be put on it. And that's, I think, what kind of is the problem around this whole conversation where they say agritech businesses if they can't monetize and sell the data that's going to lead to less innovation and it's going to not drive the industry forward. (..)
>
> *Moderator: So you're talking about transferring ownership, so actually selling your data and then somebody else can do what he pleases with it?*
>
> Well, that's kind of essentially what's happening. If you're agreeing to let, whatever … if you're using this service from a company, if you're agreeing to let them collect data you're essentially saying, "Yeah, you own this." You know? (Ireland SME)

Participants from SMEs brought forward similar thoughts, suggesting that there may be a misunderstanding at play between farmers and tech-companies which leads to different expectations regarding the type of data (raw or processed and interpreted) they are shaping an agreement about. While farmers expect that shaping an agreement will give them full control over their data, SMEs explain that farmers get to decide only about their raw data. Their supposition is that the decision-making power of farmers is restricted to the primary data and that the tech companies who develop the data into information should get to decide about the data after they worked on them as at that point they are the ones who added value to that.

All in all, our analysis of the focus groups suggests that autonomy is a very important value for trust in data sharing. But different actors often have a different understanding of what respecting this value entails. While farmers, SMEs and researchers agree that farmers should be enabled to make an informed choice before entering into a data sharing relationship, they have different suppositions about the object of this choice; more specifically, they often disagree whether the choice concerns primary data or also processed, interlinked and interpreted data. If the object of the choice that farmers get to make is unclear, this can easily become a source of distrust.

Fair business collaboration

Farms and tech-providers are businesses and their primary relationship with other stakeholders in the data sharing network is business oriented. It is therefore unsurprising that a lot of participants in our focus groups focused on what would make this business relationship fair. While the value ' fairness' figured prominently in all focus groups, in remained quite unclear to many of them what this value means and therefore what it requires people to do or refrain from doing. (See also appendix 3)

> We think fairness is important, but choosing this card [with this value, SvdB] led to a whole lot of discussion... I think it would be good if we are paid for our data. But getting information that is really beneficial to your farm is good too. I don't know what you all think, but I think it would be good if someone told us, well, what we can request from tech providers in return for our data. (Young farmers, CEJA, Mid-East of EU)
>
> There are trade-offs, evidently (..). In our case, yes, in terms of fairness, a bit like you stated; if I contribute to the system, I want to get a fair share out of it in terms of knowledge or other benefits, value, payment and so on. That was it, I think. (..) The thing is, who decides what's fair? (IOF, SMEs and researchers, SvdB, group 2)

Based on a clustering of the codes that we connected to passages in our transcripts that concerned fairness, we identified two different understandings of this theme. Part of the reflections of participants focussed on fairness in relation to access to the data themselves and the information and knowledge to which they give rise; part of it focussed on the question who is entitled to benefit from these data, or earn money with them. In the following we'll explain what is involved in these discussions.

Fairness as a right to access and use data and information

A characteristic question asked during conversations in our focus groups about fairness was: who is entitled to access these data or this information? Farmers sometimes complained that it is not fair that they do not receive the data from their farm back after they have shared them with a tech company, whereas they consider these data their 'own' and therefore suppose that they should be the primary people entitled to access them and use them.

> At this moment, on my farm I see that in fact the market regulates lots of issues, including data, and we often have no access to this data, even our own data. Despite that storage systems exist and we know that our data is there and connected to databases. It is often difficult to get information from these databases even about my own farm, (..).' (Poland, older potato farmers)

> Well, I mean it depends partly how they want to use the data. I mean, if you find only big companies collect all the data maybe they will have all the information. But these, the farmers cannot take advantage of this data because finally they only will be in the big companies' hands. (Young farmers, CEJA, South Europe, Group 2)

Passages such as these suggest that farmers think that if they share data with tech companies, these companies should not be the only ones that are informed, but the farmers should get access to the information too. It would be 'fairer' according to them, if they could have insight into their own data, or into the information based on those data. Sometimes the term 'data sovereignty' is used to refer to farmers right to reclaim data and use them to inform themselves about their own farm. This perspective to data sovereignty is also encountered in workshops with SMEs and researchers. However, here it is also mentioned that giving farmers access to their raw data, or giving the raw data back to farmers to use them on their own farm, after they're being processed does not preclude others, such as tech companies, from using the processed data.

> .... it's sometimes very easy to define who owns the raw data coming out of the sensors. But as soon as that data is processed by some processing component, then some other data is generated and we don't need the raw data anymore. We can throw it away or give it back to farmers, whatever, just keep the processed data and they monetise the processed data. People who own the raw data are a little bit sceptical because somebody is making money with data. That is only possible if farmers provide their raw data but after they gave the data, they are just not involved in the process anymore. (IOF, SMEs and researchers, EO, Group 1)

We encountered however a lot of unease among farmers about the suggestion that data can be monetized by tech companies prior to and after they're processed. It gives rise to a second, related, discussion about 'fairness' that concerns the question who is entitled to the (monetary) benefits harvested with data.

Fairness and the trade of data

The other meaning of 'fairness' that we encountered in our focus groups related to the fair distribution of benefits harvested from data. Farmers suspect that they do not receive a fair share of the profits that tech-businesses (or other stakeholders in the value-chain with whom they share data) make, based on their data.

> (..) most of the companies are selling their data sometimes to other companies or to states or … I don't know. And we never get money, you know, back when we give them data. So there is something behind that because, I mean, the data come from our farms most of the time so …(..) There's value behind it … Monetary value. (Young farmers, CEJA, South Europe, Group 2)

> Farmers think that the value chain or their suppliers are taking advantage of them and they're not honoring their commitments in terms of data sharing. Well I think the farmers (..) just don't trust the system or if they're taking advantage of farmers because we see different (..) aspects, (Young farmers, CEJA, North EU)

On the other hand, representatives from tech companies are aware that if they sell processed farm data sets, this often causes farmer's distrust. In the following quote an SME from our Irish focus group explains that farmers think it is OK to give data to a company when they get information back, but their distrust stems from the fact that agtech companies develop other products on the basis of the data that farmers have provided them and sell those products,

> Just generally I don't think farmers in general have issues about being given information and stuff. I think more … At this moment in time I think some of the information is kind of getting used in terms of the commercial benefits of companies that are developing products in the back of the information given. (Ireland, SME)

In response to this distrust, participants from tech-businesses and researchers sometimes discussed the idea to give farmers a fair share of the profits, by offering them payment in return for their data. Given that tech businesses make money with data, they argue that farmers should be compensated for their contribution and receive some money too. Farmers participating in our focus groups seemed to be quite open to this idea.

> What was going on in my head…it creates added value for the farm and extra business, so farmers not selling only milk or potatoes but it's selling data now. .(IOF, SMEs and researchers, MJB, Group 1)

> I think farmers really need to see the benefit for themselves, of sharing their information. So they kind of need to see something back out of it, profits I mean. (Ireland, young farmers)

Offering payment for farmer's data, however, also leads to a lot of misunderstandings between farmers and tech businesses. Farmers start to think that their data can also be used as a kind of ' money'. For example, farmers sometimes give their valuable data for free, but subsequently refuse to pay for the service that the tech company is offering as they think they already paid for it by giving away their data. Tech companies, in turn, think this is unfair, as they have to spend time, money and effort to build the tech-service that offers valuable information to the farmer. Tech-businesses therefore argue that they should be entitled to profit from the tech-service that they develop and receive money from the farmer in exchange for the service.

According to our analysis, these misunderstandings suggest that there is a lack of clear and accepted guidelines that tell who is entitled to what benefit and why in data sharing practices. This lack of guidelines, or 'rules of the game' that all those playing with data should respect, causes uncertainty and distrust. Farmers distrust the tech companies that use their data. Tech companies, in turn, have a hard time figuring out what they can and can't do with data. While some participants from tech companies simply assert that they have the right to use and sell the processed and interpreted data that originate from farms, others are more cautious and question whether they are, or should be, allowed to sell data after they have been processed and call for more clear guidance telling them what 'data ownership' means and requires them to do or refrain from doing,

> So, I think defining data ownership in a transparent way is very important. (..). So, if you are gathering all this data to your IOT solution, that's fine. But now you have this amount of data that you didn't have before, can you use it for something else, can you monetise it further, can you sell it to a market place, even in an anonymised way so somebody else can use it? (IOF, SME's and researchers, EO, Group 1)

Fairness figured prominently in our focus groups and is therefore an important value in farm data sharing. Yet, given the many unclarities about the meaning of 'fairness' with regard to the access to data, as well as the 'fair' distribution of benefits, it is hard to tell precisely what rights and responsibilities fairness entails for the various contributors to the data sharing network. There is therefore a question here which deserves more attention from stakeholders.

Care for the commons

Participants in our focus groups often reflected on societal goals that they could serve with data and therewith showed their interest in caring for these goals. The vignette about the data library, but also about the value-chain, enhanced their reflection about this. In relation to the data library, some participants pointed out that farmers already have to share a lot of data to show that they conform to environmental regulation or regulation regarding animal health and wellbeing. In addition to sharing these data requested by law, however, participants also reflected on other public purposes that data sharing could serve. (See appendix 4)

Enhance public acceptance of food production

The primary reason why participating farmers (both older and young ones) have an interest in making data available to the wider public, is that they are interested to inform consumers and increase societal acceptance of food production. This is mentioned in relation to the library vignette as well as the value-chain vignette. SMEs and researchers, however, did not bring public acceptance of food production forward as a public goal that they considered worthwhile to share data for.

> Knowledge, or actually ignorance of consumers is so great that people are not aware what an organic apple looks like on the market. (..)Today there is social pressure to give up pesticides and stop using fertilizers and still produce potatoes that look perfect. Data could help to inform the consumer; show him what the effects are on the looks of the potato. (Poland, potato farmers)

> .... if for example in the dairy cooperative we work together with other farmers and we can improve our products and let consumers know how we make it, then I think we can ask a higher price. For the consumer will understand that we need to ask a higher price. Then we will get some extra value, we will make a better product that the consumer really wants….(Young farmers, CEJA, Mid-West EU)

Foster food safety

Farmers as well as SMEs and researchers are open to share data in order to protect food safety. For SMEs and researchers this is a reason they bring forward in conversations related to the public availability of data. They argue that making data public helps to foster food safety, which demands increased traceability that allows to trace the origin of unsafe food and deal with it there.

> Food safety requires traceability, so it's useful to share this type of data. (Italy, older farmers)

> (..) it is…yeah, interesting to know that what we're eating is not poisonous or not contaminated. I think it's quite interesting to have traceability of product treatment, for example. So, I would allow data sharing when we're talking about human safety. (IOF, SMEs and researchers, SvdB, group 2)

Support research and innovation

Research and innovation also came forward as an important public goal to serve with data. If data become more publicly available such as in a public library, farmers argued, research and innovation based on farm data would also be more accessible and useful for them. Understanding research and innovation as a 'common' goal, meant for them that the results would be shared with them and would make them smarter and more efficient.

> You can use knowledge based on the data of all of us to benefit other farmers (..). That can multiply the knowledge that we already have. If you use it in the university, in the research, it can be used in a positive way. So from our point of view it's important to create knowledge (..).' (CEJA, young farmers, South of Europe, Group 1)

Sharing data for research purposes was also a goal that researchers and SMEs were interested in. In the focus groups with these stakeholders, knowledge and innovation developed in the basis of data, figured prominently as one of the preferred goals.

> As a researcher getting data is half the battle. And if there's a public, if there's a public library there with big data sets, from a researcher point of view it's invaluable. Yeah. (Ireland, researchers)

> I mean, it's not only real-time data for supply chain management and so forth; you also want to be able to share historical data for research and new development, I mean for universities and research organisations. (..) Maybe it's worth a lot for them to have access to historical data, which is more and more valuable the longer it's saved. That's why I liked the library solution, so you can have one place where you can find the data you need, yeah. So, it doesn't necessarily mean it has to be free but it's available. (SAH, SMEs and researchers, SvdB, group 2)

Protect the environment

While many participants chose the card mentioning the value 'environmental sustainability', it was rare that participants reflected on what it would mean to share data for this purpose. Some farmers suspected this would make their data interesting for policy makers; or that it would help them point out that they do enough to protect the environment; SMEs and researchers often mentioned it in connection to other types of sustainability, such as economic sustainability and the sustainability of a data sharing model.

> I think if we can start to amass some climate data, then we will be very sexy for the politicians. The climate is a number one topic all over Europe, all over the world actually. So if we begin to amass a huge amount of data regarding the climate, we will be very interesting for the politicians I think. (Young farmers, CEJA, North of Europe)

> Everywhere, specifically in the developing countries under the pressure of climate change, you have way too low productivity in the agronomical sector. So, innovation is to be able to take the next step forward (..) It's absolutely crucial but it cannot be just a one-time bubble and something that works as long as you pump money into it or something but it has to be sustainable, it was to work long-term. (SAH, SMEs and researchers, MJB, group 2)

Apart from these public purposes that participants discussed during the focus groups, they also brought forward concerns about the situation when too many people would have access to their data too easily.

Misuses of (publicly) available data

With respect to the sharing of data for public purposes, however, farmers also mentioned that there is data that need to be protected. Many farmers mentioned finding the library vignette attractive because they figured that this would allow to have a library management that takes responsibility for the management of a data repository and protects it. Without such a library, for many of our participants it is hard to oversee the relationships in which they engage when they start sharing data in a network and consequently it is difficult to know who to address when something goes wrong.

> So, if (..) my data end up somewhere where I do not want them, what do I do? Who do I call? When there's a data library, at least there's a phone number I can call and there's someone who has to deal with my complaints or I will stop sharing my data. (Young farmers, CEJA, Mid-West EU)

> It is very important to be transparent, how that data is collected so we can trust the data and also it is very important how it is used by everybody so that people trust to share it (..). A library can help to make it transparent, as the library will have the same rules for data use everywhere. (IOF, SMEs and researchers, EO, Group 1)

Based on our analysis of the quotes in which participants express their expectation that data can be misused and that the library could adopt rules that prevent that misuse, we suggest that participants may be interested in the library vignette because they want someone to take responsibility for the misuses. Libraries have a management and they have rules for borrowing books, which those who want to read the books should respect. Just like libraries have conditions for lending books, many participants in our focusgroups started reflecting on the conditions that should apply to the use of data

stored in a data library, a repository or network. Some participants suggested that the management of the data library should adopt policy regarding what types of people are welcome to use the data, for what purposes they can use them and under what conditions they can use them. While some delegated the decisions about the policy that a library should adopt to the library management. Others told us that they preferred individual farmers to be in charge and that they should individually pick and choose who could use their data. Whether part of a library policy, or the object of individual choice, however, participants considered types of data misuse and the protective measures that they would like to have respected in a library.

Protection of competitive data

As participants in our focusgroups are to a large extent owners of (farm or tech) businesses, they frequently worry about their competitors having information that could harm their business. An important concern that they brought forward was that a data library would harm their competitive position. Remaining competitive as a business was a concern that farmers and tech companies share.

> I do not want to make my competitors wiser than they are today. The way in which I do my work is information that belongs to me. I don't want my competitors to know, for that could be bad for my business. (CEJA, young farmers, South Europe, Group 1)

> I think preference and reality are different things. It would be good if all of their data was available because everybody in general could … in theory would do better, but then you lose the competitive nature, I guess, so your competitiveness. If you have, especially if you've perfected a technique over 10 years and you give it away tomorrow how are you different to your competitor? (Ireland, SME)

With regard to sharing data, participants requested that their business interest would not be harmed, which is a consideration that should be leading in the development of playrules for a library. Harming business interests includes also, for example, the possibility that data would be used to de-value land. When the use of sensors would offer information pointing out that the level of nutrients in a piece of land is very low, then the price of that piece of land would go down and this could potentially harm the interests of a farmer willing to sell it.

Private data protection

Participants often requested protection of their private data. While some farmer-participants observed that their privacy is already lost, as a lot of data about their farm are already being collected, others called for more protection. It was however not always clear what data are private and therefore need protection. According to the GDPR, private data include data containing personal names, addresses, locations, which could be misused by third parties. Our participants, however, suggested that farmers have a broader understanding of private data, as farm data concern their farm business as well as their household.

> So, if you can share but it's not traceable back to you as an individual or me as a farmer, I do agree. But the thing is in farming, most farmers live on their fields at their housing or their stables, so if you know the location of a stable or a parcel, then you know which farmer it is. Privacy is a very difficult issue.(SAH, SMEs and researchers, svdb, group 2)

Farmer participants in our focus groups bring forward different possible examples of uses of data that they consider to involve 'privacy breaches'. These include, for example, the possible use by the government to blame farmers who did not pay their taxes, or by environmental protesters who could use data to shame farmers publicly. Furthermore, they consider the use of data for profiling and for selling products an unwanted privacy breach. (See quotes in appendix 4) Given these examples, many farmers require data that are used in a data library to be anonymized before they are re-used for public purposes:

> If there is a proper system of anonymization, and if there's very limited access, which is also a restriction, then you could share more, but then we need a system that codes it. (..) It is a layered

> perspective, like first you give a consent to one thing and then once it is anonymized then you could consent to other types of uses for research or for policies or for … controlling bodies or payment agencies (..). (Young farmers, CEJA, Mid-East EU)

Some researchers point out that they also have an interest in adequate privacy protection of farmers: if a data library does not protect the farmer's privacy adequately, farmers will stop sharing data and researchers will have a problem.

> In projects I work in a lot of data is confidential. We're very clear with the farmer what we're going to use the data for and we only use it for that purpose. So it is a very closed loop because a lot of it is damaging if it gets out. Also again, because we're a smaller industry and it's very … people are very identifiable. So you can talk about a strawberry grower in [name region]. That has actually only four growers. So you can … if you break it up by a geographic area it's very easy to identify people. (Ireland, researchers)

While the support we encountered in focus groups for the data library suggests that participants often support sharing data for public purposes, they also ask for data protection. While some think that having an individual choice about whether to share data and with whom will offer protection, others doubt that and call for a responsible and accountable management of data repositories, which is absent today. A lot of the discussion related to the data library as well as other vignettes, however focussed on who is to decide about the data sharing rules, as well as the rules for data protection.

Inclusiveness

In our focus groups we frequently encountered reflections about the inequality of negotiation power of the various stakeholders in the data sharing network. This unequal negotiation power of different stakeholders is explained by difference of expertise and different market positions. Some farmers observe, for example, that farmers do not have digital expertise and therefore engage too naively in collaboration with tech-businesses, not realizing that they're being taken advantage of. They therefore give their consent too easily.(See appendix 5)

> In my point of view, we should be more (..) mature about using the data Well, I mean, we can … I can agree that it can be good. But still today the major data collectors or data owners are still trying to keep them for themselves mostly and sell them and make money off them, so …(Young farmers, CEJA, South EU, Group 2)

Tech-businesses on the other hand point out that tech companies know the value of data, while farmers most often do not.

> The problem I think here is the data is originating from the farmers and it's data when it's on their side and when it comes to the company, they would transform that into information and somehow make profit out of it. So, the company has the whole and sole idea of what value it is. So, the farmers on the other hand, they don't know the value of the data because it's originating on their side. So, I think… (..) the farmers will never know what value their data has, actually. It's a disbalance. (IOF, SMEs and researchers, MJB, Group 1)

Next to differing expertise, participants in the focus groups also mentioned that the size of companies gives them different negotiation power. Large companies who possess a lot of the data have a lot more authority. If they get to defend their interests, this means that other smaller companies will have less chance to communicate their interests, including the farmers companies that are usually smaller.

> ....at one point in time, you'll get a bias, no? You'll get a collection of people or of companies…Or, I don't know when they'd have more data they'd have more to say, they put more weight in the scale, the same with number four [vignette four, SvdB], we organise collaboration in the value chain, the big ones that collaborate, push the small ones out. (SAH, SMEs and researchers, EO, Group 2)

Farmers as well as tech companies suspect that the conversation leading to some kind of 'playrules' for data sharing relationships, is therefore not always an open conversation in which everyone can influence the eventual outcome. Some participants expect strong players in the market to dictate the playrules that others would have to follow.

This perceived power difference, figures as a motivator behind the preference of many farmers and SMEs and researchers for the library vignette or the value-chain vignette, as both vignettes invite to think about decision-making power. In the value-chain, especially farmers already working in a cooperative suspect they will have more to say about the ' playrules' that govern their data. Other farmers who work alone, however, are often suspicious that other people in the value-chain will have more profit to gain from this vignette than they do.

A lot of the discussion about the data library focused on the question who should be in charge of the library and have the authority to set the 'playrules'. Some participants proposed the government to take this role, as it is considered to be a disinterested party that can pay for the maintenance and standardization of data, which fosters the development of data flows across the EU. Farmers from mid-east EU countries, however, objected that governments can be corrupt; participants from southern EU countries were against governments taking this role and memorized the 20th century World Wars during which governments misinformed people and they suggested that data can also be used for propaganda. While some participants suggested that companies would be more efficient managers of data than governments, most participants thought putting them in charge would be detrimental to farmer's trust. Alternative suggestions were to give farmers a central role in data library management as this would foster their trust in data sharing and make them more willing to share data in the library. As this would give farmers a very central position, other participants suggested that every interested party should be represented in the team that takes charge of the data libraries across the EU: SMEs, researchers, governments and farmers. These participants thought that every group should be represented in order to help solve the diverse perceived problems and realize acceptable rules that players in the data sharing game should respect.

4. CONCLUSION AND DISCUSSION

While the focus groups gave insight into a wealth of preferences and considerations, we conclude in this report that stakeholders value having individual control over data, but also plead for the use of data for public goals. Participants find it important to have autonomy in deciding to share data or not. But apart from having individual control, they also call for social values that govern the context in which the various actors are implicated and to which they have to conform. Fair access to data, fair distribution of benefits, data sharing for 'the commons' and inclusiveness, all call for 'playrules' that govern the behaviour of the various data sharers in concrete data practices and which –to some extent- define the game of data sharing, about which no one can decide individually.

This result comes forward in participant's preferences for vignettes, but also in participants' choices for values. Participants in abundance favored the first vignette that states that farmers should be enabled to choose with whom they want to share their data, based on information. Next to this vignette, there was also a lot of support for -and discussion about- the second vignette which proposed to develop a data library or repository, with a clear management and rules for users, just like different libraries have rules for the people who want to read books. Similarly, the values that are chosen and discussed most often in our focus groups include respect for autonomy which fits with the preference for the vignette favoring personal choice, but also values such as fairness, care for the commons and inclusiveness. These last three values are social values that call for more encompassing 'playrules' that define the data sharing practice, or interactive 'game', of data sharers and which data sharers do not choose individually, but to which they have to conform if they want to be part of data sharing activities.

In the left column of table 4 we summarized the values that our focus group participants brought forward. It mentions respect for individual freedoms, such as autonomy, but also values that govern

interactions between them such as fairness, care for the commons and inclusiveness, which transcend the individual and ask for more encompassing guidance of data sharing practices. This interest in values that protect the freedom to decide of individuals, as well as values that govern social interaction and which transcend the individual, confirm findings of other empirical studies carried out in different locations over the world. Concern about individual autonomy and control over data comes forward in studies that report lacking trust because of concerns about protection of private data and business data (Hoes et al 2017; Regan 2019; Fleming et al 2018; Ryan 2019), lack of transparency of data sharing practices that make it hard for individuals to oversee how data are being used and by whom (Regan 2019; Jakku et al 2019), and considerations about unequal access to data, data sovereignty and the unclarity of data ownership (Carolan 2018; Newton et al 2020; Ryan 2019; Jakku et al 2019; Regan 2019). Social values come forward in studies that analyze shifting power relationships or intensification of unwanted existing power relations in society (Bronson 2019), equity problems relating to benefits for experts and laymen (Fleming et al 2018) and the problem of the digital divide (Ryan 2019).

While some of the values that participants in our focus groups brought forward support values that other studies also identified, we believe that this study helped identify some of the reasons why participants feel so uncertain about data sharing. Wanting more control over data sharing is for example a common theme in the literature and we found it as well: farmers as well as tech companies seek control by claiming an individual right to decide about data or benefit from them, which is often referred to with the term 'data ownership'. According to our focus groups, however, there is a lot of uncertainty and unclarity about what this right entails for different people. It is for example unclear to a lot of farmers and tech companies what data they are allowed to control by means of their personal choice: is it raw data that stem directly from sensors on farms? Is it processed data which the tech business has combined with other data and transformed into information or knowledge? Different understandings and disagreements about who gets to say or do what with which data, stand in the way of the development of trust in data sharing. They hinder a proper understanding of what values such as autonomy or fairness entail.

Table 4. Overview over values and the questions they raise for further development of the 'playrules' for data sharing

Values	Questions
Respect for autonomy Provide farmers the opportunity to make an informed choice about whether to share their data or not. Communicate accurate, accessible and understandable information that allows farmers to make an informed choice about their data, including information about limitations of their control over their data.	• What level of control over data can farmers reasonably expect with their choice? Over what data can they exercise control? What are the limitations of their control? • What information do farmers need to make an informed choice? • What information can data collectors/users such as ICT companies or researchers be requested to provide? Are there limitations to the volume or depth of information that they can be expected to provide? (Therefore: are there limits to the level of transparency that can be provided about what happens with data?) • What does coercion and manipulation of farmer's choices mean? How can this be recognized and avoided?
Fairness 1	• Who have a right to data sovereignty in the

Data sovereignty Give farmers the right to access and use their own (primary) data for their own benefit.	data sharing network? Is it exclusive for farmers? Do others have this right too? Who? • About what data are we talking when we provide farmers (and perhaps others) the right to access and use data stemming from their own farm? (raw, processed, combined, interpreted) • If farmers withdraw their own data , does this mean that they no longer circulate in the system? • If farmers have this right, what does this entail for others in the system who use these data?
Fairness 2 **Fair distribution of benefits** Give all participants in the data sharing network a share of the benefits that they consider acceptable, or 'fair', and give consideration to the interests of each of them	• From what data do partners in the data sharing network have a right to benefit? (raw, processed, combined, interpreted) • What is the value of data? (monetary value, other values?) • Who in the data sharing network is entitled to benefit from what? And why? • What are acceptable criteria to distinguish between 'fair' and 'unfair' distribution of benefits? • How should we deal with differences of opinion about what constitutes ' fair'?
Care for the commons Keep data available and accessible to develop and expand knowledge and realize innovation that serves a shared interest, such as the health, safety and wellbeing of sentient beings (human beings, animals) and the environment	• What commons are most deserving attention? Based on what, should priorities be set? • What are purposes for which data cannot be used? • What rights do partners in the data sharing network have with respect to access and use of data for 'the commons'? And what responsibilities do these rights entail for everyone? • What managing mechanism should be developed to make partners in the data sharing network respect each other's rights and take their responsibility? • How should we deal with eventual conflicts between personal (or business) interests and common priorities? And related to the protection of data, which should probably lead to a new value called 'non-maleficence' • What are the possible harms of data sharing? (Eg. related to information provision, business interests or privacy) • Who is being harmed? By whom?

	• What are the best ways to avoid/mitigate harm? • Who should have the responsibility to implement those measures to prevent harm?
Inclusiveness Include different people in the conversation about what constitutes trust in data sharing, do effort to make them talk and take all viewpoints into account, fairly and equally	• What stakeholders in the data sharing network should be invited to the negotiation table? • What is the best way to enhance their reflection and dialogue? • What are fruitful ways to involve all relevant stakeholders into the conversation? • In what ways can viewpoints of different stakeholders be taken into account fairly and equally?

In addition to revealing uncertainties about familiar values, our focus groups also identified relatively 'new' values, such as 'care for the commons' and 'inclusiveness'. We did not see these described in previous empirical studies. In our focus groups, however, participants also talked about the shared goals they wish to serve with data; such as for research, for policy making, for showing their compliance with the law, to foster food safety and consumer's acceptance of food production methods. Many participants considered these common goods in relation to the vignette of the data library, which elicited reflection about the sharing of data as if they are a shared source of information or knowledge, similar to books. Like a library which has rules for its members, participants considered having rules for the use of data in a 'library-like' reservoir, and a library management that would take care of compliance with those rules. Many participants however also raised the question who should be entitled to manage the library and set the rules, and they considered different options such as the (EU) government, businesses, farmers, or a combination of those.

With respect to the choice of 'commons' for which data are shared, as well as while considering the question who should manage the data library, many participants considered their own (limited) negotiation power. We summarized these reflections about negotiation power -which farmers as well as agritech businesses brought forward- under the theme 'inclusiveness'. This value labels conversations in our focus groups about not knowing where to go if one wants to get information about data sharing, or if one wants to influence data sharing rules, or file a complaint about people who are 'misusing' data. Many participants considered the problem of the abstract nature of data sharing relationships, which would make already existing power relationships of people in society harder to mitigate. There were many concerns about differences between people with respect to digital expertise and competitive power, which raises questions about who gets to decide about who can use data, for which purposes and under what conditions. As many participants uttered concerns about stakeholders who have more negotiation power than others, such as stakeholders with digital expertise or with access to large data sets and markets, we chose to thematize this as an 'inclusiveness' problem. Under 'inclusiveness' we ordered all concerns related to questions concerning who will dominate the market and who will set the rules that everyone taking part in data sharing practices will have to respect.

The preferences for vignettes and values call for the further elaboration of the guidelines that are available at present to govern farm data. This implies an invitation for stakeholders to reconsider the principles, codes of conduct and codes of practice that have hitherto been developed to govern data sharing practices in the US, New Zealand, Australia and Europe and which all prescribe the formation of contract agreements prior to the sharing of data. These existing documents successfully attend to autonomy which is an important value that receives a lot of support from participants in our focus groups. The documents also succeeded to enhance discussion about several issues, for example about fairness with regard to data access, data use and the distribution of benefits harvested from data. But they also have limitations. They only attend to fairness issues in as far as individuals can decide about it. However, fairness is often not an issue that individuals settle in a contract agreement about data. Furthermore, as contract agreements become digital it will become less likely that data

sharing partners discuss data sharing issues. Nor do contract agreements usually attend to the other social values that participants in our focus groups addressed, such as care for the commons or worries about the uneven decision making power of different actors about the rules that govern data sharing. To think further about the further elaboration of these guidelines, principles and codes of conduct, we have included a list of questions in the right column of table 4. These questions imply an invitation for stakeholders to think beyond the shortcomings of these documents and expand and enrich current reflections about the ethics of farm data sharing. The list of values as well as the questions noted in table 4 suggests that forming agreements about data sharing is important, but more is needed to build a (morally) acceptable collaboration between data sharers.

Based on our focus groups we conclude that it is important to think beyond contract agreements. More serious thought should go into the development of playrules for data sharing practices, which does not depend on the decisions of individuals, but concerns the constitution of acceptable relationships between them. Just like other contracts (such as, employment contracts, purchase contracts, cooperation contracts) are not shaped in a social void, but are always embedded in a wider social context of interactions that are already governed by do's and don'ts, contracts about the sharing of farm data also need to be embedded in data sharing practices that already respect some norms and values. In our vignettes, these data sharing practices are imagined to be as 'a library', as 'a market' or as a 'collaboration in the value-chain', but there are probably also other possibilities that are more suitable to the developing variety of data networks or 'data spaces'. What we take from our focus groups is however that if data networks or data 'spaces' are to inspire more trust, we need to not make the individuals the only ones responsible for making the right decisions about their own data sharing, we also need to think about what makes the relationships that come about between them acceptable. A focus on these social values in addition to the individual values could help to foster trust.

Our study is -to our knowledge- the first of this size which engages a combination of farmers, tech providers and researchers in a reflection on the data sharing future across the EU. It responds to a call to adopt a responsible research and innovation approach to digital farming, as digitalization of farms is understood as a development with profound societal and ethical implications (Eastwood et al. 2017; Rose and Chilvers 2018; Van der Burg et al 2019; Klerkx et al 2020; Bronson 2019). There are however also limitations to this study. We succeeded to involve a large number of farmers and innovators in a reflection, but sometimes had to work within limited timeframes and therefore sometimes we could not always finish all three conversation rounds of the focus group. Finishing them all could have led to a broader and richer reflection. Also, we worked with a large number of facilitators with different expertise which all have different styles and a slightly different focus in the way they enhance the reflection of participants. While we trained everyone prior to doing a focus group, the transcripts reveal that each facilitator pursues the reflections of participants in a different way. This has obvious advantages, as there was no chance that the interest of one facilitator dominated the focus groups and created a bias in the results. It also has disadvantages as sometimes interesting topics that come forward in focus groups are not elaborated further, as the facilitator was interested to pursue different topics.

Other limitations lie in the selection of participants and in the language barriers we encountered. Sometimes it proved difficult to involve farmers: in the Netherlands and Italy there were significant difficulties to get people interested in joining a focus group. Given these difficulties, we were very happy to be able to join meetings to which farmers would attend anyway, such as the annual meeting of the young farmers at CEJA. This may however have created a bias, as young representatives of their countries are relatively well informed and highly educated in comparison to their peers. Furthermore, originally we planned to do a regional comparison, but the amount and diversity of stakeholders involved in Ireland does not compare to the ones we succeeded to involve in Poland or Italy. While the separation of CEJA members in regional groups suggests regional differences, these are very rough and based on this we cannot do more than indicate that there are regional differences of opinion that deserve further elaboration in future studies. Lastly, there is language problem. The focusgroups with SMEs and researchers, with young farmers and with the Irish researchers, SMEs and farmers, were carried out in English, but -apart from the Irish participants- there was only a slight minority of native English speakers. The types and levels of English spoken was diverse, which may have influenced their capacity to articulate their thoughts, as well as our capacity to understand. Similarly, focusgroups in Poland and Italy were carried out in

Polish and Italian and were subsequently translated and subtleties of their considerations may have been lost in translation.

While we recognize these limitations, we do think that our results are valuable. Given the number of focus groups that we did and the number of people we involved, we think this research offers quite a reliable overview of visions on the data sharing future at this moment across the EU. These inputs from European participants give a starting point to start developing additional playrules that will support the development of trust in the data sharing future.

5. LITERATURE

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APPENDIX 1

Trust in farm data sharing

Our focus groups offered us a wealth of qualitative data, but we realized that including too many of them in the report would make the text too long and hard to read. Therefore we decided to make a slightly wider set of quotes available in these appendices.

Table 1. Selection of quotes showing the importance of trust in farm data sharing

Type of stakeholder	Quote
Reasons to consider trust of crucial importance	
Farmers	I chose trust. Trust because mainly you are in a system that is not well known until now. I don't know if there's this comprehension of what is going on in the big data circuit. So you need to create trust between the provider of data, the user of data, so the main industry. (..) So trust is the, was the main pillar of my reasoning. (CEJA, young farmers, South of Europe, group 1) So of course everything can be there for everybody, it could to be a public library, but still if there will be a public library, the first and foremost important thing is trust. If you, if everybody within, who has access to that public library trusts each other, a lot of problems are solved just by that. You won't have to worry about things because you trust each other. (CEJA, young farmers, North of Europe) So we put a lot of time together, but we thought that, yes, trust. We agreed on that, that was the main thing. (CEJA, young farmers, North of Europe) "Well, what's in it for me to share that data?" And so as long as we don't have that trust level, and we are not there at all, I'm not willing to give data away. (CEJA, young farmers, South of Europe, Group 2) ....in some countries the trust between the people and the government is really good and in some there is like no trust so it's then it's really hard. And if you're … you have a … or a farmer is producing a lot of data and just sharing it to, I don't know, to government and then you don't know what you're getting back it's really risky. (CEJA, young farmers, Mid-East of Europe) A If the trust is there that they are going to be transparent with you you'd have no problem sharing the data. A Or you are not going to give them your data unless you trust them. A But this doesn't always happen, in life (..) (Ireland, sheep farmers)
SMEs and researchers	And the first and foremost important thing was to have transparency and trust. So we kind of categorize them as … although there's two we categorize them as equally important at the top. (Ireland, SME's) Trust, actually we chose trust because it incorporates many other things that were involved here, as fairness and so on and so forth, transparency. So, if there is trust between all the parties involved, so there is a big chance the transaction of the data would get monetary value and everybody would trust the system so the system would work. Without trust, there is no system of working. (IOF, SMEs and researchers, MJB, Group 2) Then, of course, we were also very interested in trust, transparency and others but we felt these are really not the values of this, these are critical success factors. If you are not having this, you have nothing. So, we try to unravel it a little bit like that to say what is the top value, what are the most important things to go after in order

	to increase that value or safeguard it and then we say what can we really not overlook. But, it's not a value per se in this context, it's just without it, you cannot do anything. …(SAH, SMEs and researchers, MJB, Group 2) So we put at the head of the pyramid, pretty similar to Ann, we put trust as kind of the central point of data. So data providers and data users have to trust each other. They have to trust that the data is used to the best benefits of all involved (..). (Ireland, researchers) I think the trust one was obviously a key one. Whenever data is supplied there has to be an element of trust there from the owner of the data that the person taking it is going to use it for the … in the way it was intended and that they're not going to abuse that data, and particularly as you deal with more sensitive data. (Ireland, researchers)

APPENDIX 2

Support for autonomy

Table 1. Quotes showing support for ‘ autonomy’ in the relationship between farmers and SMEs

Type of stakeholder	Quote
Autonomy is important for trust	
Farmers	Maybe just to explain also why I chose autonomy is we kind of feel like farmers are insecure in terms of the more technology, the less, I don’t know, overview and insider capability I have to run my own farm. So, my dependency on third parties increases. (..) I feel a small repository for farmers to collect their own data is a means to solve the issue of autonomy because they feel the autonomy decreases, that’s why there’s less trust. And you can think of different types of solutions to make sure that a farmer feels he is empowered and his autonomy stays in tact or even is improved. (SAH, SMEs and researchers, MJB, Group 1)
SMEs and researchers	Trust is really the basis, (..) because the farmers don’t have trust. We want them on a voluntary basis to share data (..) They will have the right on the data and therefore it gives them, a number of them, a bit more negotiation power (..) The contract’s in any case there but they should be formed in such a way following code of conduct that it’s clear for farmers what their added value et cetera is…safeguarding. (IOF, SMEs and researchers, SvdB, group 3)
Reason: It is self-evident to ask farmers for their choice to share data or not	
Farmers	For me it's the point number one. Because data is a thing of my farm and I want to have the right to decide who's going to work with it. (Young farmers, CEJA, Mid-West EU) So I think you need to combine a personal choice with any of the other options. Without a personal choice, in my view, I think the other options are bad choices. (Young farmers, CEJA, South EU, group 1) I think that the first model "I choose, I decide" is best. What data I collect, how I store it, how I use it and who I give it to should be my decision. (Poland, older dairy Farmers) I think if I were to choose one I probably would choose the ‘I choose’ model. I think especially talking with farmers and experience that I've had with them, I think they need to know whether or not their data is going to be shared or not, and whether they're happy enough to go forward with that. Their … Farmers are very private people and they, sometimes they don't want to share their information. And I’ve found that with past experiences, so I think they should be able to choose whether or not they should go forward. (Ireland, young farmers)
SMEs and researchers	I would say for this model since it states very clear that data…(..) they have the freedom to choose the type of services they would like to buy into, improve their farming practices but just through buying the service that has used their data, it provides the service they’re looking for. (SAH, SMEs and researchers, EO, Group 2) I’ve picked number one because it’s the one I’m most familiar with in terms of data, like, you know, it gives the power to the use, the generator of the data, (..) I think as part of what I choose, I can also…I can choose, like, to share data in a certain way but I could also choose it to be part of a public library, in a way, with constraints that I put around it. (IOF, SMEs and researchers, SvdB, group 2) In which way is it your own data that you can decide who is using your data and in what

	circumstances. And (..) it is important to know what people are going to do with your data that you can, at that moment, can make a decision, will I do that or will I don't, who gives the permission. (IOF, SMEs and researchers, SvdB, group 1) .... it should be, like, a voluntary collaboration between parties, it can be voluntary if people are allowed to choose and if it's transparent. (SAH, SMEs and researchers, EO, Group 2)
Reason: Having a choice provides farmers a sense of control over the safety of their data	
Farmers	For me I choose the first model or something like that because I would like to have a little bit restriction on this data...(..)' (Young farmers, CEJA, Mid-East EU). (..) I chose the 'I choose' model as a default position. If farmers think that the value chain or their suppliers are taking advantage of them and they're not honoring their commitments in terms of data sharing. Well I think the farmers are going to want to make the 'I choose' model the default because they just don't trust the system (..) (Young farmers, CEJA, North EU) I'd agree with number one as well, you've control -or I've control- you can choose to read the terms and conditions. If you don't agree with them then you know you don't have to go ahead. (Ireland, older sheep farmers) However, at present it is safest to choose the first model "I choose" because then I decide specifically with whom I share the data. As unfortunately we are so closely monitored by various institutions or companies. Everyone wants to get our data everywhere. (..) You must first secure the gates, create a security mechanism for data protection, and then the technology for data processing. (Poland, older potato farmers) Because it's in your hands. You can decide everything, like you can decide who you want to give the information to and you're entitled to access it. It also means if you do decide to give it to outside parties it's your choice, like.....you can always, like if it's in the right hands they can do something with it. (..) (Ireland, older tillage farmers) And I suppose in terms of certainly the first model, I think in terms of the trust and then the farmers can decide what to do with their data and that will empower them. Then if they give their data to someone to use it- (Ireland young farmers) 'data ownership' is a key point. 'Transparency', as well. I give you my data, but I need to understand well what you do with it. (Italy, older farmers)
SMEs and researchers	So, for instance a slaughterhouse can be a data originator because they produce specific data in the processes, which is their secrets. Why should they choose to share some of that, and less when there is a kind of added value to it. So, that's your role and then also the right connected to it. We still believe in that but probably it needs to be worked out, of course, I think that's the first stop. (IOF, SMEs and researchers, SvdB, group 3) I think that the first scenario, the 'I choose' model is based on safety so I'm protecting my data, I would like to keep it safe and as soon as I trust somebody, I will share it. And we think that trust is the building block of sharing, whether it is the government or any other company and it's a kind of goal to be at trust so that we can innovate and build something fun or something profitable. But everything is based on the other one, safety, because if I don't feel safe then I will not share my data, very basic. …(SAH, SMEs and researchers, EO, Group 2) I think that transparency and the trust is the basis to get…no, that sounds wrong if I say to get to the data but to have people share the data, and once you have the data being shared, that's when you can start building on top of it and get the innovation, get the shareholders, get the…Value. …(SAH, SMEs and researchers, EO, Group 2) But trust is really the basics, and safety, security. If I don't feel safe, I won't do anything (..)So I need transparency to establish trust and start sharing and then there is value that would need to be shared. …(SAH, SMEs and researchers, EO, Group 2)

	Maybe just to explain also why I chose autonomy is we kind of feel like farmers are insecure in the terms of the more technology, the less, I don't know, overview and insider capability I have to run my own farm. So, my dependency on third parties increases. I feel that data ownership, for instance, is deteriorating (..) they feel the autonomy decreases, that's why there's less trust. This is a source of concern, for without their cooperation we cannot proceed. And you have to think of different types of solutions to make sure that a farmer feels he is empowered and his autonomy stays in tact or even is improved. (SAH, SMEs and researchers, MJB, Group 1)

Table 2. Quotes showing challenges to the realization of autonomy in relationships between tech-providers and farmers

Farmers feel pushed to make a choice	
Farmers	… well for that yield map, I clicked No for (Brand Name) to have access to it. And within a couple of days I got a couple of phone calls from (Brand Name) to say oh we can't see this, we can't access this, we can't look at this. (Ireland, older tillage farmers) ...a lot of times you have to tick yes. (laughing) you have no choice, for otherwise you cannot use the service. (Poland, older potato farmers)
SMEs and researchers	Yeah, so a lot of it comes down to the ability to exercise your ownership, so…(..) because I don't know what it means and if I say no, I'm out. So, in the case in which you are downloading an app and you have to comply with the privacy rules for otherwise you cannot have it....well you're almost forced into complying. Your arm is twisted on your back and you said yes. So, empowerment is needed for everyone involved, including the farmer, to exercise that ownership. *Moderator: and what would you do to foster empowerment?* Well, that's the tricky part, that's ... a good question. (IOF, SMEs and researchers, SvdB, group 2)
Difficult to understand/provide adequate information	
Farmers	I'm not sure like I signed up to (Brand Name), I don't know what exactly, not that I don't know what I signed up to but I tick the box and you know agreed to, I didn't, I wanted to know what do they do so that's what I actually... (Ireland, older tillage farmers) So sometimes it's easy, but sometimes you probably have, maybe you have a problem understanding the information. (..) I have to admit that some terms are multi-interpretable, you can search information and understand other definitions behind it. But that's up to you to make it clear, to actually look for explanations. Yeah. (Young farmers, CEJA, Mid-West EU) Transparency is so important because farmers should know .... Do you think they know? I think not. They are just offered an interesting service, they accept it and do not realize that their data are being collected and used by this company. Farmers need to know. We need transparency about that. (Young farmers, South EU, group 2) And the thing about what John reads and what I read, and what he takes from it and what I take from it could be different, what we both understand from that – it could be different as well. So you have to take a moment and question that sort of model. (Ireland, older tillage farmers) Realistically [farmers] shouldn't (..) part with that data unless they know where that's

	going to be used, the transparency point of view, unless they trust the user of it. (Ireland, young farmers)
SMEs and researchers	So like 'I choose' model I would not agree with that completely because farmers might not know about the data completely. Like, what data you're using and how are you using? Like, they might not know the technicality of it so I'm not sure about that. (Ireland, researchers) I think we're already overwhelmed. I mean, who of us keeps his password in his head? I mean, just an easy example; there's so much information that we cannot process this, transparency is totally useless because we cannot…we, as consumers, we cannot understand this. Although it would be all written in front of us, we cannot understand. (IOF, SMEs and researchers, SvdB, group 2) The I choose model assumes that everyone has read the conditions and the consequences of that which is never true (SAH, SMEs and researchers, SvdB, group 2) Or I limit to a maximum what I give away but transparency doesn't help me because it's so complex, the whole universe, that we don't get it. I don't believe that transparency would help a normal person. (IOF, SMEs and researchers, SvdB, group 2) Yeah, but if it's just that, like if you say, look here's a contract, for example, and it says here's what we're going to do, here's what we're going to do, you go okay, I'm happy with that, that's trust, yeah. So, you trust but there's no means of monitoring that that [what was agreed to in the contract, SvdB] was implemented in any way. Because oftentimes, you know, what you see on the front side of a website, is here's the policy, it's as vague as hell, nobody knows what it means half the time, nobody reads it half the time...(IOF, SMEs and researchers, SvdB, group 2)
Unclarity about who has the right to decide about what data	
SMEs and researchers	(..) look, the paradox is that by sharing all that data, it's still the corporates who have the ability and the analysts and the hardware to do smart stuff with it and the rest of it is just flooded with three terabytes of open data and you can't do anything with it. (..) So, I think it is just fair that we are rewarded for the efforts we do. Without us, there would be no way for farmers to turn the data into something well, valuable for them. They get information, you know, knowledge. It is based on their data, yes, but ... it does not come falling out of the blue, so…(IOF, SMEs and researchers, SvdB, group 2) That's, of course, they have the right to decide to give or not to give the data but what I see is that transparency is very important and defining who's the owner of the data or…(..) I think what happens on the farm level, the data ownership is still rather simple. But then the further the data travels and (..) data transforms on the way, often there's different players adding to data on top of it, because, like, now we're not talking anymore about data but refined data or knowledge. So, it's getting even more and more valuable. The more the data travel, the more people have a, kind of, ownership on it, maybe that…on one ownership because there's metrological algorithms that run on it and produced part of the knowledge. There was an agronomic algorithm running on it, putting some part of the knowledge in it. (IOF, SMEs and researchers, EO, Group 1) (..) it's sometimes very easy to define who owns the raw data coming out of the sensors. But as soon as that data is processed by some processing component, then some other data is generated and they don't need the raw data anymore, they can throw it away, just keep the process data and they monetise the process data and people who own the raw data are a little bit sceptical because somebody is making money with data that is only possible with their raw data but they are just not involved in the process anymore. (IOF, SMEs and researchers, EO, Group 1) Yeah, from a market perspective it's difficult because it's like, how do I maintain my competitive advantage (..) Yeah, I mean, at the end, of course, yeah, the minority of the users or stakeholders might be really interested to dive deep into what's behind the data but, yeah, just having that possibility would, yeah, … it benefits all the whole system. In agtech, businesses are building their business based on the model that they have a

	unique access to data and a unique access to models, which is contributing to distrust. (SAH, SMEs and researchers, MJB, Group 1) Like without transparency and trust there's going to be … the farmers are going to be reluctant to kind of essentially transfer ownership of the data. And then without ownership, you know, it can't really be monetized or value can't be put on it. And that's, I think, what kind of is the problem around this whole conversation where they say agritech businesses if they can't monetize and sell the data that's going to lead to less innovation and it's going to not drive the industry forward. (..) *Moderator: So you're talking about transferring ownership, so actually selling your data and then somebody else can do what he pleases with it?* Well, that's kind of essentially what's happening. If you're agreeing to let, whatever … if you're using this service from a company, if you're agreeing to let them collect data you're essentially saying, "Yeah, you own this." You know? (Ireland SME) I think that transparency and the trust is the basis to get…no, that sounds wrong if I say to get to the data but to have people share the data, and once you have the data being shared, that's when you can start building on top of it and get the innovation, get the shareholders, get the…Value. …(SAH, SMEs and researchers, EO, Group 2) I can see the advantages in the 'I choose' model, definitely. And in an ideal world being able to just … the farmer to have complete control over who gets data and what, how is data useful at the time of supply and in the future. You know, that's the ideal. (..) But in this whole area, like in the whole digital area, you know, you have so much innovation happening, so many new players coming in, so many different ways of looking at data and analyzing it that you'll never be able to keep up. (..) You know, so there needs to be an element of openness, I think, and trust there to allow data to be shared for new players in this whole area to use that data in innovative ways to drive benefits at farm level (..). So that's the only issue I have with the 'I choose' model. I just think it's too restrictive. There's too much of a straitjacket there. And that might seem to be giving great benefits to the data owner initially, great control or full control really but I think that kind of limits the innovation that can take place with the data. And so that's the issue that I have with that. (Ireland, researchers)

APPENDIX 3

Fair distribution of benefits

Table 1. Quotes showing unclarity about what ' fairness' requires/means

Type of stakeholder	Quote
Unclarity about what ' fairness' means	
Farmers	We think fairness is important, but choosing this card [with this value, SvdB] led to a whole lot of discussion... I think it would be good if we are paid for our data. But getting information that is really beneficial to your farm is good too. I don't know what you all think, but I think it would be good if someone told us, well, what we can request from tech providers in return for our data. (Young farmers, CEJA, Mid-East of EU) If the tech companies paid me for my data, this would be good. This is extra business for me. But .... [person's name] said if they pay for it, they own it, the data. That, that made me think. I don't find that idea ... I don't find it very, well, attractive, for what will they do? It is still data about my farm. (Young farmers, CEJA, South of EU, group 2) The fourth model "Supply chain" is the one which is the closest to our situation. We exchange data with each other, our partners, e.g. McDonalds, because we are connected in one chain and these data should generally not go beyond our chain. However, then the problem relates to our business relationships: who owns a given company? And who owns then the data? It is difficult to judge here. (Poland, older potato farmers) One point I would also like to make: 'sharing' means that each actor involved in sharing brings something in exchange, otherwise it's just a 'splitting' what is now mine. (Italy, older farmers)
SMEs and researchers	There are trade-offs, evidently (..). In our case, yes, in terms of fairness, a bit like you stated; if I contribute to the system, I want to get a fair share out of it in terms of knowledge or other benefits, value, payment and so on. That was it, I think. (..) The thing is, who decides what's fair? (IOF, SMEs and researchers, SvdB, group 2) Other thing, we need a system of control (..). A watchdog, yeah, regulatory body. *Moderator: and it should control…?* That every party gets what he puts in; money-wise, not data-wise. *Moderator: Yeah, do you want to add something about it?* A proper distribution of value. *Moderator: A fair, may I say fair?* Yeah. (IOF, SMEs and researchers, MJB, Group 1) So, justice usually means one person is right and this time, this is very absolute. Fairness is something different; fairness is everyone is a bit right because ...you have to agree on it, to negotiate, and it has to be sustainable for everyone. *Moderator: You're not meaning sustainability as a possible goal?* No, sustainability in terms of that I can further operate this way, so that I'm as a company being economically sustainable, that I can prolong that so there's a fair exchange, so you getting a bit out of it but I'm getting also a bit out of it so that we can maintain the whole thing to be working. So, that's what we thought. (IOF, SMEs and researchers, EO, Group 1) It is fair when you have a balance between what I give and what I receive and it depends according the use cases, according to the people involved, according to data. But if it's fair, data sharing is no issue. Yeah, there's not only a fairness between what I give and what I take but also what I get and what others get. So, in

	the beginning, the use case or the value of this data may not be clear, so it's just giving data every year, maybe. But then suddenly someone discovers the use for this data and it might be a profit or a benefit. And then, we need to agree on what is fair, yeah as a farmer, I do want to receive a fair share or a benefit and be part of these, yeah, benefits that come out of it eventually.(SAH, SMEs and researchers, EO, Group 2)

Table 2. Quotes showing that a fair distribution of benefits is important for trust

Type of stakeholder	Quote
A fair distribution of benefits is important for trust	
Farmers	I suppose linked to the trust elements is the whole area of transparency and how that information is being used and who's benefiting from us. And how much of that benefit is flowing directly back to me as the owner of the data and how much is coming to other people generally. (..) And it's given me as an owner of the data something that allows me to either keep up with those other individuals. I'm thinking I suppose it would be benchmarking, I don't know. That there's benefits to both me and the industry. But I'm more important than the industry, from my perspective. The industry may benefit, but if it's benefitting and I'm not benefiting, well, there's not an awful lot of advantage there. (Ireland, young farmers) Farmers think that the value chain or their suppliers are taking advantage of them and they're not honoring their commitments in terms of data sharing. Well I think the farmers (..) just don't trust the system or if they're taking advantage of farmers because we see different (..) aspects, (Young farmers, CEJA, north EU) Farmers trust their own community (..). *Moderator: for a tech-business to become part of that community, what would he have to do?* Come to the farm, look around, talk to the family, and then if I trust him, I do business with him. *Moderator: Would you say you need to meet face-to-face before trusting a business partner?* Yes. *Moderator: And if you trust this company, what do you do? And what does the company have to do to continue to be trusted by you?* It means I will not talk bad about this company to outsiders and I will do my best to protect his interests – and he will do the same for me. (CEJA, young farmers, Mid-East EU)
SMEs and researchers	Data is not just fun but there has to be a benefit for the farmer and trust is the framework or the precondition, a very important precondition if data is generated anywhere at the farm, the farmer has to trust his farm management system or the tractor producer or the machinery producer or the advisor that he give access to…just for this data to someone else, right, yes, fun. But the fun factor comes in if there's a good trust equation and he's able to get return on investment and there is (..) peace of mind. (SAH, SME, EO, Group 2) So we put at the head of the pyramid, pretty similar to Ann, we put trust as kind of the central point of data. So data providers and data users have to trust each other. They have to trust that the data is used to the best benefits of all involved (…). (Ireland, researchers)

Table 3. Quotes showing reflections about 'fairness' related to access to data, information or knowledge

Type of stakeholder	Quote
Fairness means fair access to data, information or knowledge	
Farmers	At this moment, on my farm I see that in fact the market regulates lots of issues, including data, and we often have no access to this data, even our own data. Despite that storage systems exist and we know that our data is there and connected to databases. It is often difficult to get information from these databases even about my own farm, (..).' (Poland, older potato farmers) Well, I mean it depends partly how they want to use the data. I mean, if you find only big companies collect all the data maybe they will have all the information. But these, the farmers cannot take advantage of this data because finally they only will be in the big companies' hands. (Young farmers, CEJA, South Europe, Group 2) I believe that if someone makes data available to a company, i.e. this company draws from this data, they should return copies of the data to the farmer and then I decide whether I want to share (..). (Poland, older potato farmers) Because if we have the ownership of the data we can use it for our benefit. And when we use for our benefit we can make innovation. We can listen to the market so we can wait for a new priority or whatever. (..) We develop our knowledge and we become more efficient. …(Young farmers, CEJA, South EU, Group 1) Because one very important thing I think is that even if we work with a lot of new data in smart farming, we have to make sure that we are still autonomous. So that we are not dependent of some big companies which have a lot of data that we could need to work with, but they won't share it with us. (Young farmers, CEJA, Mid-West EU)
SMEs	Farmers should be able to access their own data, of course they should. And that is easy. We can give them their data back after we processed them and then they can use them for themselves. There's no problem about that. (IOF, SMEs and researchers, MJB, Group 2) We thought in that, again getting back to the points that were made earlier, the supplier of data needs to know they're going to get something back. So there has to be an element of "I supply this and as a result of that ... through analyzing that with other data sets to give a context and whatever .... that I'm going to get some information back that will benefit me and benefit my business. (Ireland, researchers) .... it's sometimes very easy to define who owns the raw data coming out of the sensors. But as soon as that data is processed by some processing component, then some other data is generated and we don't need the raw data anymore. We can throw it away or give it back to farmers, whatever, just keep the processed data and they monetise the processed data. People who own the raw data are a little bit sceptical because somebody is making money with data. That is only possible if farmers provide their raw data but after they gave the data, they are just not involved in the process anymore. (IOF, SMEs and researchers, EO, Group 1) Lack of data or lack of knowledge returning to the farmer is a service. If you pay the farmer only for the data, you don't return anything except the money. That does not really help the farmer, eventually....yeah, lack of return of knowledge. (IOF, SMEs and researchers , MJB, Group 1) (..) look, the paradox is that by sharing all that data, it's still the corporates who have the ability and the analysts and the hardware to do smart stuff with it and the rest of it is just flooded with three terabytes of open data and you can't do anything with it. (..) So, I think it is just fair that we are rewarded for the efforts we do. Without us, there would be no way for farmers to turn the data into something well, valuable for

	them. They get information, you know, knowledge. It is based on their data, yes, but ... it does not come falling out of the blue, so…(IOF, SMEs and researchers, SvdB, group 2) Just generally I don't think farmers in general have issues about being given information and stuff. I think more … At this moment in time I think some of the information is kind of getting used in terms of the commercial benefits of companies that are developing products in the back of the information given. And I suppose to echo what [inaudible 00:06:24] said in relation to all they really want is the value back in terms of that they see a benefit in giving their information, and that there's transparency. It's used correctly and not purely for commercial benefit. I don't know how you get it. (Ireland, SME)

Table 4. Quotes showing reflections on ' fairness' related to the trade of data

Type of stakeholder	Quote
Fairness means a fair trade of data	
Farmers	I think farmers really need to see the benefit for themselves, of sharing their information. So they kind of need to see something back out of it, profits I mean. (Ireland, young farmers) A I think farmers just need enough to get by, they don't need big money in the bank, but at the moment we are not getting by with it. A No, no. A You see that comes under fairness you see. If users of data give you something back, that is fair. A That's right. (Ireland, older sheep farmers) But in the farmer perspective, the most important for the future of agriculture is the farmer's profitability. Right now, the farmer does not earn much on all these innovations; it is mainly the suppliers of these new technologies who make big profit. (Poland, older dairy farmers) Well they want to know about us in that but that's coming across to me, they want to know about us what we are making and what we are doing. But I'd like to know what's going on in their...(..) Like is there any benefit to us, all the data we give them? Are we getting anything out of it? I know they are getting something out of it. (Ireland, older sheep farmers) (..) most of the companies are selling their data sometimes to other companies or to states or … I don't know. And we never get money, you know, back when we give them data. So there is something behind that because, I mean, the data come from our farms most of the time so …(..) There's value behind it … Monetary value. (Young farmers, CEJA, South Europe, Group 2) Farmers think that the value chain or their suppliers are taking advantage of them and they're not honoring their commitments in terms of data sharing. Well I think the farmers (..) just don't trust the system or if they're taking advantage of farmers because we see different (..) aspects, (Young farmers, CEJA, North EU)
SMEs and researchers	What was going on in my head…it creates added value for the farm and extra business, so farmers not selling only milk or potatoes but it's selling data now. .(IOF, SMEs and researchers, MJB, Group 1) A good thing what I think is that farmers get paid for something. *Moderator: Farmers get paid?* Yes. *Moderator: Okay.* So, they give their data and they get in return money which is, I think, a good thing. If you don't get anything, then it won't be good. (IOF, SMEs and Researchers, MJB, Group 1)

	So, I think defining data ownership in a transparent way is very important. And defining these data driven business models of who is doing what and to gain what and that, propagating that benefit also down the stream, then showing farmers how could they benefit from sharing their data (..). So, if you are gathering all this data to your IOT solution, that's fine. But now you have this amount of data that you didn't have before, can you use it for something else, can you monetise it further, can you sell it to a market place, even in an anonymised way so somebody else can use it? (IOF, SME's and researchers, EO, Group 1) Yeah, from a market perspective it's difficult because it's like, how do I maintain my competitive advantage? (..) Yeah, I mean, at the end, of course, yeah, the minority of the users or stakeholders might be really interested to dive deep into what's behind the data but, yeah, just having that possibility would, yeah, …benefits all the whole system. In agtech, businesses are building their business based on the model that they have a unique access to data and a unique access to models, which is contributing to mistrust. (SAH, SMEs and researchers, MJB, Group 1) If I'm giving my personal data, as opposed to anonymized data, to somebody who might benefit from it, they're not … there should be some economic benefit. Yeah. (..) So if there's not an economic benefit to the farmer for that and if he or she engages with her organization, well, there's a payback. We get there could be an agreement but it's my data. (..) (Ireland, Agricultural scientists) And I know it's out there and it's well-established at this stage, but I think it just creates this knowledge or this idea that this is something that, you know, has a value. And, okay, I accept that it has a value, but it only has a value really when it's given context and analyzed. And I think in some areas this is seen as another way of monetizing something. That I'm being able to benefit financially from actually supplying the figures rather than the benefits that are going to flow out of the figures being analyzed and the knowledge that comes back. So that, that whole phrase around ownership I think needs to be defined or refined. Or, or, or it's probably too late to kind of rephrase it at this stage because it's so well-established. (Ireland, Researchers)

APPENDIX 4

Table 1. Quotes revealing commons that participants want to share data for

Stakeholders	Quotes
Farmers are already obliged to share data by law, which serves the common good	
Farmers	There is a trade-off between the need to keep your data to yourself and the need for knowledge. Private vs public good, regulation takes different paths: if there is a public interest, eg. food safety problem, the public interest must prevail over the private interest, and the State can intervene by forcing the sharing of data. (Italy, older farmers) It is so that in Europe the emphasis is on producing safely, and producing a lot. Now nitrogen regulations were introduced, in two years they will throw in the phosphorus and potassium, and will have us under control and so on and so forth. And we need to feed 80% of all humanity. (..) But it doesn't translate into money/income. And we must earn a living, support our families and children. (..) (Poland, older dairy farmers) Government uses [data, SvdB] for monitoring, maybe it could be more about not about controlling but about teaching, being a coach, being a, like that. The information that they're using for monitoring is not about hitting you with a stick like that, bad farmer. But it can be about like, “Stop trying to do it differently.” (CEJA, young farmers, North of Europe) Because there’s already like a lot of, like use of medicine, use of antibiotics. It's already collected in a data bank by the government. You have to like have a document on what fertilizer and what pesticides you use. So the government could just shape data banks and just give the public data. Just like offer me to, like they want the government to get the farmer to share the data so that’s what the people want the government to do. So like a lot of activists addressing to the government, get the farmers to share the data. But the farmers, they don't want to share the data concerning some things. They do want to share some data but not to the extent others want to. (Young farmers, CEJA, Mid-West EU) A: The ownership of the data on the use I make of pesticides is mine, but citizens/society has the right to know how much pesticides I distribute in my vineyard. B: most of that data is already shared. (Italy, older farmers) If we want to manage it in a reasonable way that we do not emit nitrogen, nitrates into the water, it is impossible to manage it, let's not fool ourselves, in the business model because there will always be cash first and then other consequences, etc. Business itself it is not to feed, it is to make money. To be clear, I think that there must be a "public and market" combination; there has to be regulation, but it must be regulated so that those who produce can make a reasonable profit as part of the business world. (Poland, older potato farmers)
SMEs and researchers	There is the public good for data which is important, and regulation, I think, should take care of that. You know, I prefer food safety and so on. That should not be discretionary. In businesses, you know, you're prone to auditing and you have to provide information to the revenue and so on. You just have to do this in health safety, food safety. You don't have a choice. You have to be very regulated if you're in business. So I think there’s public good which is nondiscretionary. (Ireland, Agricultural scientists)
Data can inform consumers and foster societal acceptance of food production	
Farmers	(..) by 2050 people will be so curious about the information from what we produce, what we spend, etc. ... (..) People are already acquiring this information because they want to know what this Mr.-manufacturer has done to make it. And let's be honest, we have to share this data, because in a moment we will no longer sell this product.

	(Poland, older dairy farmers) Knowledge, or actually ignorance of consumers is so great that people are not aware what an organic apple looks like on the market. (..)Today there is social pressure to give up pesticides and stop using fertilizers and still produce potatoes that look perfect. Data could help to inform the consumer; show him what the effects are on the looks of the potato. (Poland, older potato farmers) You know the Irish consumer doesn't have that knowledge. The consumer doesn't know what to look for. So they need to have more knowledge. And once they have that they can trust what they're buying. That means they're trusting the supplier, they're trusting the shop, they're trusting the farmer. And that's transparency as well. That's trust building. (Ireland young farmers) If there's an incentive there for farmers to use it and then you can spin that and then from the public eye point of view, you can see that farming in Ireland is actually, it's genuine and sustainable. And it's probably one of the best countries in the world from an environmental point of view in what we can produce. And then the farmer is also getting paid out of that. It's a win-win for everyone. (Ireland, young farmers) .... if for example in the dairy cooperative we work together with other farmers and we can improve our products and let consumers know how we make it, then I think we can ask a higher price. For the consumer will understand that we need to ask a higher price. Then we will get some extra value, we will make a better product that the consumer really wants.…(Young farmers, CEJA, Mid-West EU) ...a basic consumer also knows basic information: where the product is from, how it's done. So that's it. The consumer should have more information about how food is produced. (Young farmers, CEJA, Mid-East EU)
Data sharing should foster food safety	
Farmers	In the case that people point to us and say, "The food is not produced in a safe way and it's not healthy." We can give them, or we can show them the data. (..) we can say that the, show that it's produced safely. (Young farmers, CEJA, Mid-West EU) And we also chose to focus on food safety because it's [data sharing, svdb] is one of, probably one of the ways to manage food safety better and also to bring a better trust from consumers around that. (CEJA, young farmers, South of Europe, Group 1) We selected the following values: health comes first. The second value is harmonious development, and third is of course the safety. (Poland, older dairy farmers) We need knowledge and, of course, health, and if health means that we produce well and produce safely so that we will eat it ourselves. (..) We would be interested in the second and third [vignette, SvdB], i.e. the library model combined with business, because this knowledge needs to be acquired somewhere. Unfortunately, the easiest way to get it is in the library, because if this data is there, except for sensitive data, then you can use it to get knowledge and to show that our product is healthy, it is a good product. (Poland, older potato farmers) Food safety requires traceability, so it's useful to share this type of data. (Italy, older farmers)
SMEs and researchers	(..) it is…yeah, interesting to know that what we're eating is not poisonous or not contaminated. I think it's quite interesting to have traceability of product treatment, for example. So, I would allow data sharing when we're talking about human safety. (IOF, SMEs and researchers, SvdB, group 2) For example, a pig company told me there was a problem many years back with contamination of the feed. (..) The source was a small company supplying to a few farmers, but the source was not known so they had to close all their factories to figure out if they have one of these problems. So, food safety for the public and for the companies is very important. That was one of the reasons for collaboration. We work

	with feed companies that want to track and trace, that's why they come to us to guarantee safety, not only for the public but also for production. (IOF, SMEs and researchers, SvdB, group 3) There was this example, I think three or four years ago with the E.coli in Germany, an outbreak, I don't know if you heard of it but so many people died. Lots of producers went bankrupt because of it, so yeah. (..) And it turned out that it was something in the harbour of Hamburg, when the products fell to the floor and they put it back in the boxes and that's where they got the bacteria that contaminated the whole process. Maybe if we had the idea or the data to trace where this exactly happened, we could have stopped this earlier. (SAH, SMEs and researchers, SvdB, Group 2)
Data can be used to foster and innovation research (create more knowledge)	
Farmers	You can use knowledge based on the data of all of us to benefit other farmers (..). That can multiply the knowledge that we already have. If you use it in the university, in the research, it can be used in a positive way. So from our point of view it's important to create knowledge (..).' (CEJA, young farmers, South of Europe, Group 1) '(..) So we believe that the data that we possess as farmers, as consumers it's knowledge. It's raw data that is untreated. (..) That will promote some sort of innovation that (..) we'll need to create effectiveness to us farmers, us consumers and to try to earn the money that we get from our products and lower our expenses. So as a farmer point of view I think this is what we need to focus on. We need to believe that the data that we are going to give away to the scientific community or to the EU will benefit us. (CEJA, young farmers, South of Europe, Group 2) we could call it a library or some sort of (..) cloud where I say, "I hereby agree that my data is available for research purposes." End of discussion. And then if you use it for anything else, then you have breached the terms of agreement. It's simple as that. (CEJA, young farmers, North of Europe)
SMEs and researchers	Well, from my experience the data, data analysis says to me and from my point of view I would like that the data will be public. Of course, sensitive information as for example fertilizer and spray quantities should be anonymous because I understand that that's sensitive information. But I really think that research is important for farming and we need to have some kind of access on some kind of data. So I think it probably is the best from my point of view. (Ireland, agricultural scientists) As a researcher getting data is half the battle. And if there's a public, if there's a public library there with big data sets, from a researcher point of view it's invaluable. Yeah. (Ireland, researchers) Well, it's more knowledge accessible to you if it's all centralised, that you don't have to…(..) You have all the data together and then you can develop more knowledge. (SAH, SMEs and researchers, SvdB, group 2) I mean, it's not only real-time data for supply chain management and so forth; you also want to be able to share historical data for research and new development, I mean for universities and research organisations. (..) Maybe it's worth a lot for them to have access to historical data, which is more and more valuable the longer it's saved. That's why I liked the library solution, so you can have one place where you can find the data you need, yeah. So, it doesn't necessarily mean it has to be free but it's available. (SAH, SMEs and researchers, SvdB, group 2) The main duty of utilisation of data is to actually acquire knowledge. Without knowledge, data is useless. (SAH, SMEs and researchers, MJB, Group 2)
Society should know about the burden of farming on the environment	
Farmers	I think if we can start to amass some climate data, then we will be very sexy for the politicians. The climate is a number one topic all over Europe, all over the world actually. So if we begin to amass a huge amount of data regarding the climate, we will be very interesting for the politicians I think. But not until then they, they don't care if

	the cow has yielded 45 kilograms of milk of 46 kilograms of milk. They don't notice. They have some politics things to do, not cows. (Young farmers, CEJA, North of Europe) And I think it's like if we can collect data and do something with the data it can help agriculture become more sustainable. I think that is good. (CEJA, young farmers, South of Europe, Group 1) The outputs of the data you use should actually bring a more sustainable economic model of the farming. It shouldn't be more costs than benefits, as sometimes go. And the same, there should be a big social benefit which should make the farmer's life better and the life of the rural areas better. So it's kind of a soft infrastructure based on data sharing. And we always need to focus on environmental sustainability. So every model or every instrument you use in improving farming should deliver definitely also for the environmental goals. So sustainability has a very broad meaning. (Young farmers, CEJA, Mid-East EU)
SMEs and researchers	We, kind of, saw that this is the base line of what you do with the data. It needs to be secured, it needs to be trustworthy, it needs to be transparent, it needs to be fair, it needs to be fair. It's kind of like a catch-all for all of the things…(..) It should be sustainable with the environment in mind as well, then it takes globally everything into account. (..) (SAH, SMEs and researchers, EO, group 2) Everywhere, specifically in the developing countries under the pressure of climate change, you have way too low productivity in the agronomical sector. So, innovation is to be able to take the next step forward (..) It's absolutely crucial but it cannot be just a one time bubble and something that works as long as you pump money into it or something but it has to be sustainable, it was to work long-term. (SAH, SMEs and researchers, MJB, group 2)

Table 2. Having a library fosters trust, as there is a library management that can set the playrules

Stakeholder	Quote
Farmers	It's necessary that there is a system that everybody understands and this helps to trust it. So, and like the library system you go there, you ask somebody and then this person helps you to get the right information. (Young farmers, CEJA, Mid-East EU) It depends on the group of people that you're sharing this data with, the people around the table that you know really well and you know there's not going to be a problem. But if it's 200 farmers and they get really a lot of information and how are you not going to know a lot of the group and is that safe then (..)? So yeah, I lean towards two [the data library vignette] for then the library will make sure that nothing strange will happen. You know, there are rules for the use of a library. (CEJA, young farmers, North of Europe) So, if (..) my data end up somewhere where I do not want them, what do I do? Who do I call? When there's a data library, at least there's a phonenumber I can call and there's someone who has to deal with my complaints or I will stop sharing my data. (Young farmers, CEJA, Mid-West EU)
SMEs and researchers	Yeah, and also if it's stored at one place, so to say, it's easier to be transparent because you always know where to go and where to ask what happened to my data, what will happen in the future and when do you delete them or how do you merge them. I think it's easier than if you have to go to ten different companies and corporations and so on. Accountability is clearer. Yes, so there is more trust. (SAH, SMEs and researchers, SvdB, group 2) It is very important to be transparent, how that data is collected so we can trust the data and also it is very important how it is used by everybody so that people trust to share it (..). A library can help to make it transparent, as the library will have the same

	rules for data use everywhere. (IOF, SMEs and researchers, EO, Group 1) But some people should be denied access to the data based on maybe their political ideas, I mean if it's a public library it should be accessible to everybody once they fulfil certain criteria, registering. (SAH, SMEs and researchers, EO, Group 2) With this abstract figure of the market no-one is to blame, if something goes wrong… That's right. Yeah, there's nothing to do. (SAH, SMEs and researchers, SvdB, Group 2)

Challenges

Table 3. Quotes revealing the need to protect certain data

The need to protect competitive data	
Farmers	I do not want to make my competitors wiser than they are today. The way in which I do my work is information that belongs to me. I don't want my competitors to know, for that could be bad for my business. (CEJA, young farmers, South Europe, Group 1) So if [a company,svdb] has (..) all the information globally then they have a way better look into the market than I would have with my cows because my cows can be increasing in their production at the same time. And so if you just leave it to the markets then they can also use that data in their own business model, which won't always benefit the farmers by definition. On the contrary, we have seen in the past that very often it does the opposite. (Young farmers, CEJA, South Europe, Group 2) Regarding innovation, if the model chosen was the public one, as a private person I would have no interest and would not invest in innovating. I'm referring to private innovation, if it is not adequately protected, there is no incentive to innovate. If you use a 'public library model', entrepreneurs' investment would stop. (Italy, older farmers)
SMEs and researchers	I think preference and reality are different things. It would be good if all of their data was available because everybody in general could … in theory would do better, but then you lose the competitive nature, I guess, so your competitiveness. If you have, especially if you've perfected a technique over 10 years and you give it away tomorrow how are you different to your competitor? (Ireland, SME) I think what two [the data library vignette, SvdB] does not see is that we use data to shape our business model. If our data is available to everyone, then we lose that. (SAH, SMEs and researchers, SvdB, Group 2)
Prohibition to use data to devalue land	
SMEs and researchers	I know some of the projects I work on if that data got out and was used by the market that could be used by people selling land to devalue people's land because of problems associated with it. So I don't like three because you could make money off it. (Ireland, Researchers)
Privacy needs to be protected	
Farmers	We (i.e. our group) assumed already at the start that privacy no longer exists. If you wanted to be really private, then you would have to get rid of the phone, computer etc., but it is impossible to live and work without them at this moment. Privacy is completely gone from our lives. (..) (Poland, older dairy farmers) Field photos are taken every day and the law does not prohibit it, we have no influence over it (..) Continuous monitoring of fields via satellites (..) everything that will happen in our fields, every single field trip will be recorded. (..) (Poland, older potato farmers)

	Moderator: And what kind of data do you think they will never share? *P*: If it's really personal about yourself or… *Moderator*: And that's where privacy comes in. *P*: Yeah, (CEJA, young farmers, North of Europe) If it is properly anonymized then the anonymization is one of the restrictions [on the data in a library, SvdB]. If there is a proper system of anonymization, and if there's very limited access, which is also a restriction, then you could share more, but then we need a system that codes it. (..) It is a layered perspective, like first you give a consent to one thing and then once it is anonymized then you could consent to other types of uses for research or for policies or for … controlling bodies or payment agencies (..). (Young farmers, CEJA, Mid-East EU)
SMEs/researchers	So, if you can share but it's not traceable back to you as an individual or me as a farmer, I do agree. But the thing is in farming, most farmers live on their fields at their housing or their stables, so if you know the location of a stable or a parcel, then you know which farmer it is. Privacy is a very difficult issue.(SAH, SMEs and researchers, svdb, group 2) In projects I work in a lot of data is confidential. We're very clear with the farmer what we're going to use the data for and we only use it for that purpose. So it is a very closed loop because a lot of it is damaging if it gets out. Also again, because we're a smaller industry and it's very … people are very identifiable. So you can talk about a strawberry grower in [region A]. That has actually only four growers. So you can … if you break it up by a geographic area it's very easy to identify people. (Ireland, researchers) So let's say my location, my personal email address, my personal mobile number that would be categorized as I choose. And then let's say my planning of how I actually farm. I'm planting in March, I'm harvesting in September. That kind of information is in a library freely available. Maybe within a value chain there's more detail. But I would like to see a combination of that so that if I'm a new entrant there's no restrictions for me. I can get access to information. (Ireland, Agricultural scientists) Public library, yes, but then you have certain problems of curating the data, maintaining the servers, all the costs of the structure. Also the privacy issue, if it gets broken how do you restore it (SAH, SMEs and researchers, svdb, Group 2)
Data should not be used to penalize farmers	
Farmers	There's too much room for abuse in that system too I just think. (..) Protesters, be it vegans or environmentalists or whatever it is, you know. There's things we wouldn't want them to see. (..) If you are recording 24/7, there always going to be something that someone can use against you. no matter what you do. (Ireland, older tillage farmers) What I do not want is that names of farmers who used too much fertilizer or something, are put on a website for everyone to see. Then the public will think....all these farmers they don't care about the environment, which is...Farmers have their own story to tell about that and this story you don't see. This would be really not good. (CEJA, young farmers, Mid-East EU) However, if that data becomes public, open for authorities, (..) then I'm not confident that at a certain moment we will have the government with some biologists and the welfare who say, "All those farmers who have problem with their hoofing they're not taking care of their animals. We're going to penalize them on the data they have provided us." And I say, "Well, what's in it for me to share that data?" And so as long as we don't have that trust level, and we are not there at all, I'm not willing to give data away. .(Young farmers, CEJA, South Europe, Group 2)
SMEs and researchers	But privacy is number one. You know, (..) the latest tax defaulters list is out in Ireland

	today. I just saw it in the news and media. And then one of the headlines is "Farmers-one of the biggest cohorts," and that 21 farmers are the tax defaulters. So then they published the names of … You know, this kind of name and shame policy. But that's data. And obviously the whole trick there is that you give up your right to privacy if you're tax defaulting, if you're not playing by the rules. (..) neutral management [of data, SvdB] is a big part of this. And is that going to be used against farmers? Will they be publishing a list of "These farmers have exceeded their …" (..)There are monetary mechanisms to force people to comply with different rules and regulations. But I think where privacy fits into that is hugely a part how we end up with other scandals in 10 years' time where people's data has impinged on their privacy. (Ireland, SME) The other one is privacy because as a farmer you don't know what's going to be done with your data, what kind of applications and for example, I could imagine that there will be some kind of societal organisation on animal welfare that is going to find out which farmer is treating his animals according to their principles of that. And then they can find where the farmer is and sue him or something like that. (IOF, SMEs and researchers, MJB, group1) The farmers, they are confronted with so much paperwork and so many regulations (..) and we do know that the farm, it's a living system. So, to apply all the rules, it's nice, but reality comes with a different set of challenges and that means that many times, farmers have to, yeah, let's say break the rules or to curve the rules and make it happening. On paper it looks nice, in reality they have to make it happen. That's something where I sometimes fear the interpretation of data. (IOF, SMEs and researchers, EO, Group 1)
Data cannot be used to sell products to farmers	
Farmers	(..) each of us had a situation that he was called by a dealer, shopkeeper, sales representative, who had our contact details (e.g. phone number) yet this person did not know from what source. I do not want such situations. (Poland, older Dairy Farmers) Participant 1: Say the 100 farms using farm plan, and you are inputting data into that, fertiliser, sprays, and yes you think that's not but you put up those 100 farms into that dataset. All of a sudden they have got a very interesting data range of what chemicals people are buying, when they are buying, what fertiliser companies are supplying more fertilizer than the others etc. etc. All these datasets become very interesting. (..) Participant 2: (..) Yeah it has a value I suppose that is what they use or whatever, the likes of amazon and all the rest are dying to get their hands on…(..) They always seem to find some value out of it or for advertising or whatever. (Ireland, older tillage farmers)
SMEs/researchers	Because something that when I spoke to farmers before, something that they were worried about in terms of the privacy and maybe fairness was that if this data gets to a fertilizer company or to a tools company or a machine company that the company then knows in a targeted way that "I should sell X amount of this product to that farmer." And the farmer may not have signed off for that type of marketing approach. (..) And that was sort of the fear around privacy as well, at least with the names and farm locations anonymized the company could find out interesting things. (Ireland, Agricultural scientists)

APPENDIX 5

Table 1. Quotes showing challenges related to unequal negotiation power

Stakeholders	Quotes
Unequal negotiation power because of unequal expertise	
Farmers	In my point of view, we should be more (..) mature about using the data Well, I mean, we can … I can agree that it can be good. But still today the major data collectors or data owners are still trying to keep them for themselves mostly and sell them and make money off them, so …(Young farmers, CEJA, South EU, Group 2) Everyone subconsciously thinks this way. I will gladly give something, but I want something in return. But there are people who do not want to give anything back. They would like to download everything (Poland, older potato farmers) I think that this data has already been circulating but we are not aware of how much data is taken/collected from us. (Poland, older dairy farmers) So, from a farmer's point of view I think this is what we need to focus on. We need to believe that the data that we are going to give away to companies, to the scientific community or to the EU will benefit us. You have to understand that if there should be a way to go on then there has to be a path that (..) will help all of us so we [farmers, SvdB] don't stay in the woods. (CEJA, young farmers, South of Europe, group 1) I started an ICT course, just to understand a little better ... All of these data become available. I don't want to miss ...I would not like to lose the information I can derive from that for my own farm. (CEJA, young farmers, North of Europe)
SMEs and researchers	The problem I think here is the data is originating from the farmers and it's data when it's on their side and when it comes to the company, they would transform that into information and somehow make profit out of it. So, the company has the whole and sole idea of what value it is. So, the farmers on the other hand, they don't know the value of the data because it's originating on their side. So, I think… (..) the farmers will never know what value their data has, actually. It's a disbalance. (IOF, SMEs and researchers, MJB, Group 1) I haven't met a farmer that has had hands on experience with a block chain solution. Often, farmers feel like they are offered advice through a black box, so they have some data, it went somewhere, some people did something and it comes back and they rather look at it intuitively (..) based on experience and intelligence that they have. We're still in an era where farmers feel like I'm not quite sure if I can trust. (SAH, SMEs and researchers, MJB, Group 2)
Unequal negotiation power because of different sizes of companies and data repositories	
SMEs and researchers	....if you go with the market one [vignette, SvdB] at one point in time, you'll get a bias, no? You'll get a construction of people or for companies…Or, I don't know when they'd have more data they'd have more to say, they put more weight in the scale, the same with number four, we organise collaboration in the value chain, the big ones that collaborate, push the small ones out. (SAH, SMEs and researchers, EO, Group 2) If we leave it to the market, nothing will change in the sense that most of the value coming from agriculture data will be available to the happy few and not to the many farmers. (SAH, SMEs and researchers, MJB, Group 1)

	The critical thing is that at this moment, the market is creating closed channels. For instance, John Deere is the only one accessing the machine data and then offering it for a price. So, who's benefitting? It's John Deere. (SAH, SMEs and researchers, MJB, Group 1)

Table 2. Reflections on who should be involved in managing data repositories, such as data libraries

Stakeholders	Quote
Data library should be governed by the (EU) government	
Farmers	It should be like a public library: the government should have to pay for it and make the system work. But then (..) again we're talking about the I choose model, you choose what you want to, like put it up in the library. But again if it's about food safety, food security, you need to share it. And that would probably be by law. (CEJA, young farmers, North of Europe)
SMEs and researchers	There is role for government in some of these stuff as well, in terms of having setting up the data flows. Definitely, and also to look for ecosystem services or benefit or things like that. So, that's actually a negative reason why I would…first or the second…they have a market orientation which I think is not necessarily always good. I mean, obviously it should be there and has benefit but…(SAH, SMEs and researchers, EO, Group 2) For standardisation of data, I do see a role for governmental bodies to set, let's say, the legal framework of guidance for overall frame for data, for data exchange. If it's on data ownership, I would really go back to the farmer and say the farmer should be the owner of the data. (SAH, SMEs and researchers, EO, Group 2) Data should be FAIR. (..) The central system might be better to organise things than if you decentralise it. So, it might be more efficient, there will be more data, so that's better for food safety and it might be more sustainable and more knowledge would be accessible as well. Yeah, and more transparent. (SAH, SMEs and researchers, SvdB, Group 2) By having an accountability that is acknowledged at central level, by maybe the European Union or an association at European level, I feel like you create the trust because you entrust a body that is serious enough, that is transparent enough. I don't want to entrust my data to Facebook because they're private focused and I don't want to entrust the data to any private sector company. So, for me, it was really this idea of accessibility and trust, at least you get that immediately by working at central level with a body, maybe the Commission, maybe something else but certainly not private sector. *Moderator: And why should it be the European Commission and not a local government?* Then I lose the knowledge. You said the aggregation of knowledge, this is the power of this thing; if it's central at European level, then I get a lot more knowledge, it's just the coverage, I think. If it's just one state like the Italian government, then you only get the Italian data, it's a pity, you could get it on a wider scale. (SAH, SMEs and researchers, SvdB, group 2) so, sometimes I think a national database is a more appropriate approach, but not all the time. I'll give you an example. In grass measurement in Ireland, we're encouraging our farmers to measure grass. But now we see a huge…a lot more applications that we can use. We can do grass evaluation, evaluate varieties on farms. So, we think there's massive application for this. If that was owned by a private entity, it would make it much more difficult to do it; you could be held to ransom, you couldn't build a breeding programme on it. So sometimes you need both and you need the private to feed into public but you do need the public government type system as well. (SAH, SMEs and researchers, EO, Group 2)
Reasons to doubt whether the government should be in charge of the library	
Farmers	But if you have some corruption in the country or government it's very hard. Like, we

	have the problem last year in Slovakia. A journalist looked about the carousel systems- these are systems with the European money- they just shoot him. See, that it is important saving yourself. But if that government commission checked and stopped the corruption we can enable these values, all of them, you know. We are European. We're thinking we are European. We are all the same but … (..) At the moment it's difficult to talk about one really same system, the same model in every countries. Yeah. (Young farmers, CEJA, Mid-East EU) We're not sure about the government's role in managing the library. (..) This is one of the main things that happened during pretty much all of the wars (..). And it's not like it started in the First World War, it started way back. One of the main ways in which you can deceive the population, is by giving them wrong information. Now, consumers need to be informed. If you don't give them information, then you don't expect them to be informed about it. So they will believe what you present to them. (Young farmers, CEJA, South Europe, Group 1)
SMEs and researchers	Accountability, I just want to point out that it's very relevant. But the question is: is trust there for private sectors of for public sectors? Because if the government starts to change, what do they do with the data? (..) That's why I prefer a supranational rather than a national government because the national government will change every four years and it's ridiculous but at least the supranational, maybe there's a little bit more continuity and stability. (SAH, SMEs and researchers, SvdB, group 2) For farmers, this is really scary to share it with the government or to share it with other data everything is gathered around. And I think even as a consumer, I'm not so glad if all my data is with European Commission. There's also a bit of a Big Brother is watching you feeling. (..) Having one database or one warehouse where you can save your data, in efficiency terms, that's quite okay, but then you still…I would like to have an opt- out because it's still my data, it's my life, I'm not owned by the European Commission. (..) (SAH, SMEs and researchers, svdb, group 2) There is a thin line between that Big Brother thing, you know, it's a thin line. I think in Ireland and the UK, certainly there's a healthy mistrust of government in that, kind of, regard. We generally don't trust government with anything like that. …(IOF, SMEs and researchers, SvdB, group 2)
It is more efficient if commercial parties are in charge of the data	
Farmers	Maybe knowledge belongs to the public government. Yeah, but innovation and efficiency maybe it's more with the market. Because finally we saw the public governments they don't give enough innovation. They are really slow. And efficiency always comes from the big companies and the private companies. CEJA, young farmers, South of Europe, Group 1)
SMEs and researchers	I think if data is settled by the markets, there is much more creativity and I'm much more in for co-creation, so open data, open source in that respect. I think in the end, you have to fix something together in this kind of agreement, if it is limited to the market or to the project or open it to the market as well.(SAH, SMEs and researchers, MJB, group 1)
Farmers should have a role in the library management	
Farmers	So the farmer can actually educate the data collectors of what information they can't share, what potential information they could share. So it's trying to balance the two, I suppose (...).Yeah. And then that, I suppose that improves the trust and the transparency as well. If the farmer is not aware exactly where his data is going so that through education then he will trust where that data is going on. And I suppose that opens all the channels then. (Ireland, young farmers) (..) We met someone in France, he said, "You have to take care of the data business because if you don't someone else will do it for you." That's why we want the governance. Because, you know, someone, and it's already done, someone is taking care of our data. There is data of a farm everywhere. So we need to have the

	governance of an entity who will gather the data. Because people want it and we give it and we don't know we give data. So we need to … We need the governance of the data because of it. (CEJA, young farmers, South of Europe, group 2)
SMEs and researchers	In health, they are experimenting with things like health data co-operatives where they actually…the co-operatives say…but linked to a cancer patient organisation becomes the, sort of, owner of the…or the governing party of the library, so to speak. You could think of something similar here: farmer's cooperatives could own the data library. This would be neither commercial, nor the government. Like a co-operative or a…yeah, public entity. (SAH, SMEs and researchers, EO, Group 2) We talked about, what if the government is the owner of the data? We said no. If the government is the owner of the data centre, theoretically we have this conflict between I'm the owner but the government theoretically can interpret this data too and… I think the government only should pay for this but it should be led by farmer units. …(SAH, SMEs and researchers, EO, group 2) What I'd be interested in is having a group of farmers look at the data set and kind of tell me, what is the scope of use here? If I was to completely make it open what are the consequences of it? (..) So if somebody could reassure me and say that there's no real risk to sharing this data that would be fantastic reassurance to know what the consequences are. (..) Yeah, for somebody to be able to look at various data sets, say like soil results or whatever and say, "Okay, if we… Here are your options and here's what could go wrong."(..) It's like a vulnerability data scan. (..) And then a farmers' cooperative would be better placed to be able to identify what are vulnerable data. Yeah. (Ireland, SME)
Data library should be governed by a combination of actors: farmer's representatives, businesses and governmental actors	
Farmers	'Well, it depends. I think that the companies already generate big data by themselves and they usually, companies already take that data and they reuse it. It's like it's a product to them. So small and medium farmers we don't have those kinds of resources. So I guess that we don't have the means to do it by ourselves. So there's only two ways: or it's like in the value chain and we give it to them, or it's by the scientific community to be able to treat us. And you have to keep in mind that the small and medium farmers are very much like 80% of the EU, if not more.' (CEJA, young farmers, South of Europe, Group 2) We have three possibilities (..). First was the government, second was a private company and third was the customers, like the public. I divide public and the government because (..) there are countries with trust and there are countries with no trust because of the corruption of government. So it's important that you can have some period of time when there's good government and after sometime we can revert to having a bad government. And to precede of these situations it's good to have the public with the (..) control mechanism (..).' (Young farmers, CEJA, mid-east EU)
SMEs and researchers	My colleague said (..) with respect to the library there has to be a public mission that partners on the market agree on. The government should not do it by itself but there should be a mission, funded by public money as a public service, which is carried out by independent farmer unions. (..) The farmers can then steer data access within this library for external groups.(SAH, SMEs and researchers, EO, Group 2)