ECOSYSTEM DATA GOVERNANCE AS A CRICITAL FACTOR FOR DATA PLATFORM PARTICIPATION

A BWM APPROACH TO DETERMINE THE RELATIVE IMPORTANCE OF ECOSYSTEM DATA GOVERNANCE TO IOT DATA PROVIDERS

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Executive Summary

The Internet-of-Things has grown much in popularity over the past years, leading to the gathering of large amounts of pervasive and detailed data. This same trend is seen in the agriculture industry, where a lot of data can be collected on the cultivation methods. The agriculture industry is considered to be a strategically important industry for the Internet-of-Things by KPN, the company that commissioned this research. Despite the rapid data collection, businesses rarely exploit the full potential value of the IoT data. One of the methods of value creation with IoT data is to share the data with other parties. Data platform ecosystems make the sharing of data possible, but require the participation from all sides of the platform, especially the data providers, to be successful.

Platform sustainability is an important research topic within Information Systems research. However, it still remains unsure how the participation of data providers can be ensured. Furthermore, Information Systems researchers have often stressed data governance to have an important role in the success or effectiveness of data platforms. This research aimed to explore how important ecosystem data governance is relative to other relevant factors for the participation willingness of IoT data providers. This knowledge can consequently be used to develop data platforms which IoT data providers are more prone to participate in. Due to the limited time to complete this research, it was decided to focus on the Dutch horticulture sub-sector within agriculture. This sub-sector is considered to be the most advanced Dutch agricultural sub-sector in terms of digitalisation and Internet-of-Things adoption.

Following the research gap, three research questions were formulated to close this gap and be able to achieve the research objective: 'Formulate recommendations to KPN to improve the willingness of data providers to participate in an IoT data platform ecosystem by analysing the relative importance of ecosystem data governance to the willingness of Dutch horticulturists to participate in an IoT data platform ecosystem as a data provider'. The first research question, 'What is the relative importance of ecosystem data governance to the willingness of IoT data providers to participate in an ecosystem data platform?', was formulated to gain quantitative insight in the relative importance of ecosystem data governance. The second research question, 'What concerns, related to the relevant factors for ecosystem data platform participation, do IoT data providers in Dutch horticulture have?', was formulated to gain qualitative insight in the concerns related to the relevant factors that Dutch horticulturists might have. This knowledge was used to gain a better understanding of the relative importance of the factors. The third research question, 'What do we learn by analysing the results of the previous research questions with the aim to provide recommendations to improve the data platform participation of data providers in Dutch horticulture?', was formulated to combine the gained knowledge from the previous research questions in order to make recommendations to KPN to improve the participation willingness of IoT data providers.

To answer the first research question, a conceptual model was created from literature. This model consists of three contexts (Technology, Organisation, and Environment) in which 19 relevant factors are categorised. This model was subsequently tested in the Dutch horticulture sub-sector. An online survey designed for the Best-Worst Method, a Multi-criteria Decision Making tool, was completed by 30 Dutch horticulturists. By processing the data according to the Best-Worst Method, an overview of the factors with their assigned relative weights was derived. To answer the second research question, six face-to-face semi-structured interviews were conducted with Dutch horticulturists. The horticulturists were asked to elaborate on their choices in the online survey whilst completing the survey and discuss any concerns related to the relevant factors. The third research question was answered by analysing the information gained from the previous methods to form recommendations to improve the data platform participation of data providers and close the research gap.

The survey results show a low spread of the factors in terms of weight, indicating that Dutch horticulturists do not base their participation decision on just a few decisive factors. The complete picture is more important, although a slight preference towards several factors can be noted. The benefits of participation are considered the most important, relative to all the other studied factors. This factor is considered around five times more

important than the external pressure, the least important factor. The internal human and technological readiness follow as the second and third most important. The security and complexity of the data platform complete the top 5 of most important factors. Ecosystem data governance ranks 7th among the studied factors, and can be considered half as important as the benefits of participation and almost three times as important as the external pressure. The lowest ranking factors are the scalability, costs of participation, compatibility of the data platform, regulation, and external pressure.

By means of the interviews, several concerns related to the studied factors were identified. The main concerns are a lack of benefits, a complicated to use data platform, low reliability of the data platform, a lack of internally sufficient technological and human resources, misuse of data by the application user, unfair distribution of value generated with the data, and the loss of ownership and control of own data. The horticulturists consider their IoT data to reflect their cultivation methods and company strategy, which gives them their competitive advantage. The largest concerns are related to the horticulturists fearing to lose their competitive advantage, to be unable to participate and materialise the benefits, or having to invest too much effort and time in the participation. In the interviews, ownership and control of the data was stressed as being very important to deal with concerns about misuse of their data.

Although the benefits, human readiness and technological readiness are weighted higher, KPN is recommended to focus on the factors that can be directly influenced by them. This will enable KPN to direct their development time and resources more efficiently. The recommendation to KPN is therefore to focus on developing a data platform with a high level of security and a low level of complexity. These factors are both considered to be relatively important for IoT data platform participation by Dutch horticulturists. Furthermore, the ecosystem data governance should be another focal factor as appropriate ecosystem data governance can likely eliminate barriers related to several other factors that are considered important such as the benefits of participation, safety of data, and the trust in and readiness of other participants. The concerns regarding the misuse of data, unfair distribution of generated value, and the loss of ownership and control over own data, can all be addressed in the ecosystem data governance.

As for other researchers, it is recommended to test the conceptual model for completeness and apply the model in other industries to gain more insight on the generality of the model. This research has proven ecosystem data governance to be considered important to the data platform participation willingness in the Dutch horticulture sub-sector, making it plausible that the factor is considered important by data providers in other industries as well. It is also recommended to further study the requirements regarding the governance mode and governance domains to stimulate the data platform participation of data providers. Furthermore, this research has focused on the perspective of data providers to analyse the relative importance of the factors. However, for data platforms to be successful, participation of all sides is required. Therefore, it is advised to research the relative importance of the factors to other platform participants, such as service providers and application developers.

Contents

Abbreviations

ξ^L .... BWM consistency indicator

4V .... Volume, variety, velocity, and value

AHP .... Analytic Hierarchy Process

API .... Application Programming Interface

BWM ...... Best-Worst Method

CIA .... Confidentiality, Integrity and Availability

DOI .... Diffusion of Innovation

EDI .... Electronic Data Interchange

EDG .... Ecosystem Data Governance

FTE .... Full-time equivalent

GPS .... Global Positioning System

GSR .... Goods, Services, and Revenue

IOR .... Inter-organizational Relations

IOS .... Inter-organizational Information Systems

IoT .... Internet of Things

IS .... Information Systems

IT .... Information Technology

MCDM .... Multi-criteria Decision Making

MOT ...... Management of Technology

MSP .... Multi-sided platform

NAO .... Network Administrative Organization

ODE .... Open Data Ecosystem

PEST ...... Political, Economical, Social, Technological

RFID ...... Radio-frequency identification technology

SDK .... Software Development Kit

TAM .... Technology Acceptance Model

TOE .... Technology, Organization & Environment

TPB .... Theory of Planned Behaviour

UTAUT ... Unified Theory of Acceptance and Use of Technology

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1 Introduction

"The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it."

This statement was made by Mark Weiser in his paper on the 21st century computer that was published in Scientific American in 1991 (Weiser, 1991). He is believed to have been the first to put forward the concept of ubiquitous or pervasive computing: the inclusion of a computer in almost every object. In his paper, he envisioned the connection of objects by wires, radio waves and infrared technology, in such a way that it would become invisible to common awareness. The Internet-of-Things (IoT) enables this vision of Mark Weiser (Mattern, Floerkemeier & Friedemann, 2010). Over the last decade, IoT has drawn significant attention from both the academic and industrial world (Li, Xu & Zhao, 2015; Madakam, Ramaswamy & Tripathi, 2015). The term Internet-of-Things was first coined by Kevin Ashton in 1999, who used it in the context of connecting radio-frequency identification technology (RFID) to the internet (Ashton, 2011). Thereafter, many different definitions for the term IoT, often discordant, have been introduced (Madakam et al., 2015). Most definitions share common features such as global network connectivity, the inclusion of all physical objects and autonomy of IoT objects (Atzori, Iera & Morabito, 2017; Gubbi, Buyya, Marusic & Palaniswami, 2013). Computing systems are subsequently able to use IoT devices to monitor the physical world or manage actions of the connected objects (Gubbi et al., 2013; Li et al., 2015; Madakam et al., 2015; Mattern et al., 2010). For the purpose of this research, a definition for IoT will be used that is derived from the work of Minerva, Biru and Rotondi (2015). With the word “Thing”, Minerva et al. (2015) refer to “any physical object that is relevant from a user or application perspective”.

"A network that connects uniquely identifiable “Things” to the internet. The “Things” have sensing/actuation and potential programmability capabilities. Through the exploitation of unique identification and sensing, information about the “Thing” can be collected and the state of the “Thing” can be changed from anywhere, anytime, by anything."

Over the last decade, IoT rapidly gained ground and Gartner (2016) predicts that by 2020 there will be over 20 billion connected devices in the IoT network. The embedding of IoT devices in the environment around us has consequently led to the gathering of large amounts of data that are the primary value of IoT (M. Chen, Mao & Liu, 2014; Gubbi et al., 2013; Noronha, Moriarty, O’Connell & Villa, 2014). In our modern society, data has become increasingly more valuable and often drives innovation. Data is defined as “symbols that represent the properties of objects and events” (Ackoff, 1989). These massive data streams give rise to new problems such as how to store, manage and analyse the data so that useful insights can be extracted (F. Chen et al., 2015; M. Chen et al., 2014; Khan et al., 2014; Sicari, Rizzardi, Cappiello, Miorandi & Coen-Porisini, 2018). The potential of data to create value for both enterprises and consumers is believed to be huge, but data can only be transformed in valuable insights by analysing the data (Lavalle, Lesser, Shockley, Hopkins & Kruschwitz, 2011). The captured data can be analysed and processed into useful insights to monitor or optimise business processes, implement different business models involving connected objects and associated services, or lead operational transformation (M. Chen et al., 2014; Mattern et al., 2010; Noronha et al., 2014). A business model is a conceptual tool that allows companies to describe and express their logic of generating revenue and creating value (Osterwalder, 2004).

In 2020, IoT is expected to account for 4.4 zettabytes, or 4.4 trillion gigabytes, of data which is about 10% of all the existing data on the planet (Turner, Gantz, Reinsel & Minton, 2014). The total global amount of data is expected to even grow to 163 zettabytes by 2025, a ten-fold of the existing data in 2016 (Reinsel, Gantz & Rydning, 2017). Simultaneously, the share of data generated by embedded devices will increase to 20% of the total amount of data, making IoT one of the four major contributors to the paradigm of big data. Big data is a term that is widely used to describe vast data-sets, but the concept also has some distinct features that differentiates it from terms like 'massive data'. Although there is not a single agreed upon definition, the following features, also called the 4V's, are recurring: volume (large amount of data), variety (of modalities), velocity (rapid generation of data), and value (huge value with a low density) (M. Chen et al., 2014).

1.1 Creating value with IoT

Although IoT is gaining popularity in both the academic and industrial world, researchers often focus more on the technological aspects rather than value creation with IoT. In order to successfully adopt and use IoT, an organisation must understand how IoT can be utilised to create or increase value (I. Lee & Lee, 2015). Several researchers have attempted to identify the methods that can be used to create and capture value with IoT, often by proposing business models that can be implemented or frameworks to (re-)design business models in the context of IoT (Bucherer & Uckelmann, 2011; Leminen, Rajahonka, Westerlund & Siuruainen, 2015; Leminen, Westerlund, Rajahonka & Siuruainen, 2012; Vermesan et al., 2016; Westerlund, Leminen & Rajahonka, 2014). These business models are based on one or multiple enterprise applications of IoT. I. Lee and Lee (2015) have categorised the applications of IoT for enterprises based on technology trends and literature review, resulting in three different categories: (1) monitoring the physical world and controlling connected devices, (2) big data and business analytics, and (3) information sharing and collaboration. Information is defined as processed data with the aim to increase its usefulness, or in other words, information is data with context (Ackoff, 1989). Nevertheless, not only processed data may be shared by companies but also the raw data that can still be analysed. In this research, the focus will be on data rather than information. The category of monitor & control is currently the most used application category for IoT devices, whilst the other two categories can also include large amounts of value (Mineraud, Mazhelis, Su & Tarkoma, 2016). Multiple applications can be utilised with a single IoT device simultaneously to increase the aggregated value of the IoT device. The latter two categories require more advanced capabilities of the company to create useful value with IoT (Jernigan, Ransbotham & Kiron, 2016). The data flows that arise from IoT solutions can be extensive and can require new ways to manage, coordinate and analyse the data.

The *first* category describes applications that mainly collect observational data of the physical world such as equipment performance or energy usage. Furthermore, the collection of the data can result in additional insights such as observing patterns in operations or locating areas for potential improvement. The connected devices can often also be controlled remotely or operate autonomously. An example of control would be to allow users to adjust a connected light bulb's intensity from their smartphone or computer. This category is seen as the most basic application for IoT devices.

The *second* category describes applications that generate big data and include business analytics to generate insights that can be used to resolve business issues. Organisations that have the ability to extract value out of data can gain competitive advantage by means of increasing efficiency and effectiveness, improving and automating decision-making, and accelerating innovation (Mcafee & Brynjolfsson, 2012). Advantages include for example predictions of customer behaviour, production output, or market conditions. Depending on the vast amount of data and the complexity, these applications may require strong data analytics capabilities to successfully extract the value (Jernigan et al., 2016). Specifically, handling and analysing the data from IoT devices are considered the most important abilities. Organisations that have prior strong developed analytical capabilities are believed to be leveraging their IoT devices better (Jernigan et al., 2016). Big data analytics are increasingly considered a disruptive technology by both innovation management and information systems researchers (van den Broek & van Veenstra, 2018).

The *third* category stipulates the sharing of information or data generated by IoT devices and the collaboration between people, people and things, or between things. The sharing of information or data can occur within an ecosystem between any number of ecosystem participants. An ecosystem in the context of businesses is defined as a network of economic actors that coordinate their business activities around a platform and are collectively responsible for the outcome of the complete ecosystem (Muegge, 2011). The concept of ecosystems will be further elaborated in section 2.3. Digital platforms enable business ecosystems to share data and collectively create value with the data (van den Broek & van Veenstra, 2018; Yoo, Boland, Lyytinen & Majchrzak, 2012). Being able to derive business value from IoT involves both managing relationships as well as device management equally (Jernigan et al., 2016). Moreover, the creation of business value from IoT is strongly associated with the sharing of data or information with other organisations.

Platforms are able to stimulate innovations that go beyond the original use-case of the product (Wareham, Fox & Cano Giner, 2013). In the case of data, this refers to new innovative applications for the original data. Take for example an IoT sensor that is connected to the windscreen wipers on a car. The sensor will be able to advice the car owner when to replace their windscreen wipers based on how many times they have been used; this is a form of predictive maintenance. However, when the car owner would share the data of the real-time state of the windscreen wiper together with the car's GPS data on a data platform, the value of the data could be enhanced. When for example a weather station would link the real-time data, they can more likely confirm whether it rains at that exact location. This does raise questions such as what is in it for the car owner to share this data and what exactly happens with this data as the GPS data is, in this case, privacy sensitive to the car owner.

Sharing data requires capabilities such as managing new organisational inter-dependencies with partners or other stakeholders. The value of data is often very subjective as some users may consider it worthless while others can extract valuable insights from the data (Tallon, 2013). This information asymmetry makes it difficult for organisations to have a clear understanding of the value of their data and can result in reluctance to share the data. Moreover, IoT often results in fine-grained, continuous, and pervasive data acquisition. Data with those characteristics are often considered proprietary data and are very commercially sensitive to the data owner (Bertino, 2016). There are three distinguishable classifications of data, namely human-sourced data, process-mediated data, and machine-generated data (UNECE, 2013). In this research, the scope will be limited to machine-generated data originating from IoT devices. IoT data can be generated in any business process in which IoT is being used. Therefore, a further distinction will be made such that only IoT data that is generated in operational business activities is considered to be within the boundaries of this research. Porter and Millar (1985) describe the business activities as the technological and economical activities a company performs to do business. Operational business activities are defined as the primary activities related to the manufacturing or assembly of products (Porter & Millar, 1985). The transfer and processing of the large amounts of data calls for proper data governance from a strategic point of view (Cheong & Chang, 2007; Kravets & Zimmermann, 2012; Sicari et al., 2018) to prevent misuse of the data on a platform.

1.2 The role of IoT in agriculture

The potential value of IoT in agriculture is believed to be large, yet the level of implementation is still low (Manyika et al., 2015). Making use of IoT in agriculture, also known as smart farming, is considered to be one of the solutions to the global problem of food shortage. The shortage of food is expected to continue to grow in the coming years as the population keeps growing as well (Allemang & Teegarden, 2016; IOF2020, 2011). The use of IoT can increase production efficiency to allow farmers to produce more food with less resources. Sharing agricultural IoT data can additionally help farmers increase the value of the data generated by their IoT devices and provide new insights. It is worth noting that data sharing in agriculture is not limited to improving primary production, but can also result in large benefits throughout the entire agri-food supply chain, such as more efficient distribution of the produce (M. Chen et al., 2014; Wolfert, Ge, Verdouw & Bogaardt, 2017). Value extraction from IoT and a positive benefit-cost ratio are considered important drivers to the adoption of IoT in agriculture (Pierpaoli, Carli, Pignatti & Canavari, 2013).

This research is executed in collaboration with KPN, a leading IT-service provider in the Netherlands, which is interested in exploring the role of a platform provider. As KPN considers IoT to be a strategically important technological innovation, and the Dutch agricultural sector is considered to be a potential lucrative sector for IoT and data solutions, KPN requested to focus on the Dutch agricultural sector in this research. Sharing IoT data in Dutch agriculture is still rare (BO Akkerbouw, 2017; WUR, 2017), although it is believed that data sharing is important to the success of IoT in agriculture as more value can be extracted (Wolfert, 2017). Gaining a better understanding of what Dutch farmers consider important in their decision about data platform participation as a data provider, will contribute to realise a situation in which more agricultural IoT data is shared.

To be able to complete the research within the limited time available, it is important to define the scope of the research. The scoping includes confining this research to one sub-sector of agriculture, as the agriculture sector in the Netherlands itself is too large to study in this research. Scoping is essential to know what is studied and what is not, and to ensure narrow enough defined research objective and questions for the research project to remain feasible (Sekaran & Bougie, 2016; Verschuren, Doorewaard & Mellion, 2010). Within the Dutch agriculture sector there are many different sub-sectors to be distinguished, such as arable, horticulture, and livestock (CBS, 2017).

The Dutch horticulture sub-sector is relatively advanced in terms of digitalisation as sensors and IoT have found their way into greenhouses over the past decades (de Ruyter, 2016; Voorn, 2017). Most horticulturists have some form of data-collecting devices within their greenhouses. The most common device is a temperature and humidity measuring and controlling system, also known as climate control. Furthermore, several initiatives, such as LetsGrow and Glas4.0, exist in the Dutch horticulture sector to stimulate the collection, use, and exchange of IoT data. Therefore, the horticulture sub-sector is chosen to be the focus of this research. The participation rate of Dutch horticulturists on current existing data platforms is believed to still be low, albeit slightly higher than other sub-sectors of the agriculture sector. Only 7% of vegetable horticulturists share information with their value chain. This percentage is slightly higher for plants (14%) and flowers (24%), but still indicate a very low information sharing rate within Dutch horticulture (Bondt, Robbert, Lan, Linda & Cor, 2016). Within the horticulture sub-sector, labour and energy make up for the largest part of the costs. New insights in the use of labour and energy during production could help horticulturists to produce more efficiently. The Dutch horticulture sub-sector will be further elaborated on in section 2.1.

1.3 Problem statement

Enterprises often still remain unsure on how to create and extract value from IoT in order to leverage the full potential of IoT. IBM concluded from case studies that almost 90% of the data generated by IoT is being left unused (Green, 2016). Furthermore, IoT device owners rarely explore the value that the IoT solution can generate beyond its original use-case (J. Lee, 2016b; Manyika et al., 2015; Mineraud et al., 2016). Many organisations currently do not share their IoT data with other organisations, such as suppliers and competitors (Jernigan et al., 2016). It is estimated that by 2025, the potential economic impact of IoT can be increased from $3.9 trillion to $11.1 trillion a year by leveraging the full potential value of IoT applications (Manyika et al., 2015). The average amount of IoT data with potential value that is currently not exploited is significant, leaving businesses with large amounts of hidden and unused opportunities to create value and revenue. Big data is inherently based on data maximisation, meaning that through combining available data-sets to create new data, the value of the data can be increased (Madaan, Ahad & Sastry, 2017; Van den Broek & Van Veenstra, 2015). Specifically in the application of sharing the data with other parties, it is uncertain why organisations leave this value unexploited. Exploration of more value creation and new innovative use-cases for IoT applications can be an important driver to differentiate and stay ahead of the competition (Amiot, 2015).

The research problem is twofold as two problem owners can be identified: IoT data platform providers and horticultural firms. From the perspective of IoT data platform providers, high data sharing activity and wide-spread IoT implementation is desired as this offers large business opportunities. The IoT data platform provider is able to play an important role in the governance of the data on the platform. The initiation and acceleration of IoT data sharing is highly desired. To realise this, knowledge is needed on which factors are critical or important to the willingness of IoT data providers to participate in a data platform. From prior internal research at KPN was concluded that data governance is likely to play an important role in IoT adoption in agriculture but it is still uncertain how important this aspect is in the context of sharing the IoT data.

From the perspective of horticultural firms, the full potential of possible business opportunities with their IoT is often still left unleveraged. Although IoT can enable both incremental and radical business changes, most data resulting from IoT is left unused. Exploring the potential value of IoT data can result in more value creation and new innovative use-cases for the IoT data, enabling the business to stay ahead of the competition. Participating in a platform ecosystem to share IoT data will enable the horticulturist to stimulate innovations that go beyond the original use-case of the IoT data, therefore increasing the value generated with their IoT devices.

1.4 Research objective

The objective of the research will be formulated with the goal to address the aforementioned knowledge gap and to express a concrete deliverable that will contribute to solving the practical problem. The research objective is formulated as follows:

> Formulate recommendations to KPN to improve the willingness of data providers to participate in an IoT data platform ecosystem by analysing the relative importance of ecosystem data governance to the willingness of Dutch horticulturists to participate in an IoT data platform ecosystem as a data provider.

In other words, the research will aim to identify the relevant factors that influence the willingness of horticulture companies to participate in a data platform ecosystem for IoT data, and to identify the relative importance between those factors. This will be achieved by analysing the importance of the data governance of the platform ecosystem relative to the other relevant factors. Concerns related to the relevant factors could prevent organisations from sharing IoT data, subsequently leading to a lack of value creation with IoT. An organisation first needs to be willing and able to share IoT data before it can leverage this enterprise application of IoT to create value. One could compare this to the desire to win the Tour de France without first willing to or being able to ride a bicycle. Gaining insight in the relevant factors and the relative importance of the factors, will contribute to what is necessary to improve the situation. Therefore, this research will be of problem-analysing practice-oriented nature to achieve the research objective.

1.4.1 Academic relevance

The academic contribution of this research is to gain more insight into the relative importance of data governance on the participation willingness of IoT data providers in a platform ecosystem. As mentioned before, digital platforms enable business ecosystems to share data and collectively create value with the data. A multi-sided digital platform (MSP) facilitates the interactions between participants in an ecosystem (S. U. Lee, Zhu & Jeffery, 2017). For a data-based ecosystem and the related multi-sided data platform to be successful, the participation of data providers is essential. Platforms are characterised by network effects, indicating a strong correlation between participation of end-users and the input from another side of the platform (de Reuver, Sørensen & Basole, 2017; Schreieck, Hakes, Wiesche & Krcmar, 2017). When more data is provided to the platform, more end-users will likely participate and adopt the platform as the platform becomes more valuable. Therefore, the offering of data on the platform is highly relevant for the sustainability of the platform. Research on platform sustainability is an important research topic regarding digital platforms (de Reuver et al., 2017). Participation of all sides of the platform is needed to realise a sustainable platform, and it is yet uncertain how participation can be ensured. Insight in what data providers consider to be important to join a data platform and provide data to share with the ecosystem can contribute to knowledge on how to ensure the participation of data providers. Platforms usually desire 'generativity', referring to the platform being a self-contained system such that it can be used to create new output, structure, or behaviour without needing input from the system's originator (Tilson, Lyytinen & Sørensen, 2010). However, uncontrolled creative output does not always lead to a desirable or positive outcome for the ecosystem itself (Wareham et al., 2013).

The transfer and processing of the large amounts of data calls for proper data governance from a strategic point of view (Cheong & Chang, 2007; Kravets & Zimmermann, 2012; Sicari et al., 2018). Data governance and IT governance within a single organisation has often been the main research area in information systems research (S. U. Lee et al., 2017; Van den Broek & Van Veenstra, 2015). From the perspective that considers a single organisation, data governance refers to the decision rights, roles and accountabilities concerning data within the organisation (Khatri & Brown, 2010; Tallon, 2013). However, data governance in the context of a network of organisations requires a more holistic approach, dealing with people, data, and systems (Kravets & Zimmermann, 2012; Van den Broek & Van Veenstra, 2015). This is often referred to as the data governance of a platform ecosystem, and the focus is on the structure or configuration of governance, the governance processes, and the actors with their accompanying roles concerning the data in the ecosystem (Kravets & Zimmermann, 2012). This addresses questions such as who owns the data, how can the data be processed, who has access to the data, and under what conditions is access granted (Markus & Bui, 2012). These questions are related to the governance concepts of roles, trust and control to coordinate the use of data within the ecosystem or platform (S. U. Lee et al., 2017; Schreieck, Wiesche & Krcmar, 2016). The concept of data governance will be further addressed in section 2.6. The governance of data within an ecosystem is considered a subset of platform governance. In order to work towards ensuring all sides of the platform to participate, there is a need to understand the role and importance of platform governance (de Reuver et al., 2017), or data governance in the case of a data platform. The behaviour of participants in an ecosystem is impacted by the governance, or the rules of engagement (Jacobides, Cennamo & Gawer, 2018).

The need for proper data governance to put data to use within an organisation has been confirmed by many researchers (Sicari et al., 2018). Limited research has been conducted on data governance in the context of an ecosystem with multiple different parties that play a role in producing, processing and using the data. Digital platforms are a relatively new research subject and they are expected to disrupt existing industries and practices (de Reuver et al., 2017; Schreieck, Hein, Wiesche & Krcmar, 2018). This requires a deep understanding of the mechanisms of digital platforms and the important factors. Although platforms for IoT are growing in popularity and are expected to have a large potential impact on society, there is little research available on the governance of IoT related platforms (Schreieck et al., 2017). Moreover, the sustainability of digital platforms is another important research topic as it is not yet understood how participation of all sides on a digital platform can be ensured or increased (de Reuver et al., 2017). This leaves researchers wondering which factors are critical for the participation of data providers in a platform ecosystem, indicating a research gap. Deeper understanding of the role of governance in a platform and incentives to participation are required. Since the governance of platform ecosystems that revolve around data is a relatively new research topic as well, this research will aim to discover the relative importance of data governance to the willingness of data providers to participate in a data platform.

The context of IoT data resulting from operational activities is considered to play an important role in the data governance and willingness to share the data. The competitively sensitive nature of the IoT data will likely increase the importance of trust between the involved parties and the governance of the data to prevent data from being improperly used (Schreieck et al., 2017). Moreover, IoT ecosystems have several other unique characteristics such as the heterogeneous composition of actors, the unusual large number of 'sides' in the platform, and the possibility of platform-to-platform partnerships (Schreieck et al., 2017).

1.4.2 Practical relevance

Little is known about why companies fail or refuse the attempt to exploit the full potential of IoT, especially by sharing the data (Gubbi et al., 2013; J. Lee, 2016a, 2016b; Manyika et al., 2015; Mineraud et al., 2016; Noronha et al., 2014). Knowledge of which factors are important will help in ensuring participation of data providers. The participation of data providers will subsequently have a positive influence on the sustainability of the data platform as it is characterised by indirect network effects. As a result, sustainable data platforms can be realised for IoT data exchange when (potential) platform providers, such as KPN, have knowledge on how to ensure data provider participation.

This will additionally help businesses to create value with the quickly growing amount of IoT data that is being generated. Business value from IoT is strongly associated with sharing the IoT data with other organisations (Jernigan et al., 2016). Leaving a large amount of potential value unleveraged within a business is considered to be unwanted as value creation is a driver to stay ahead of competition. More value creation with IoT data is also associated with the adoption of IoT devices (Pierpaoli et al., 2013).

1.5 Research questions

In order to achieve the research objective, the necessary knowledge will be gained by answering the research questions. The research questions will steer towards acquiring knowledge of problem-analysing nature.

The first research question is the following:

RQ1: What is the relative importance of ecosystem data governance to the willingness of IoT data providers to participate in an ecosystem data platform?

The knowledge necessary to answer the first research question will be gained by answering several sub-questions which are derived from the first research question. The first sub-question will provide an overview of theoretical frameworks that can be used to analyse the relevant factors to Inter-organisational Information Systems (IOS) adoption. The second sub-question will provide an overview of the factors that are considered relevant to IOS adoption decision-making in the context of an ecosystem data platform. The third sub-question will provide an overview of the relative importance of each of the previously as relevant identified factors according to IoT data providers in Dutch horticulture.

SQ1a: What theoretical framework is suitable to analyse the factors relevant to ecosystem data platform participation according to scientific literature?

The second sub-question will further refine the research perspective, or conceptual model, in the context of Dutch horticulture regarding sharing IoT data on an ecosystem data platform.

SQ1b: What factors are relevant to analyse the willingness of data providers to participate in an ecosystem data platform according to scientific literature?

The third sub-question will gather quantitative insight about the relative importance of each of the identified relevant factors according to Dutch horticulturists.

SQ1c: What is the relative importance of each of the identified relevant factors to the ecosystem data platform participation willingness according to IoT data providers in Dutch horticulture?

The second research question will gather qualitative insight on potential concerns that horticulturists could have related to the relevant factors. This information will be used to be able to further explain the results of the first research question.

RQ2: What concerns, related to the relevant factors for ecosystem data platform participation, do IoT data providers in Dutch horticulture have?

The last research question will aim to analyse the results from the prior research questions to be able to provide recommendations to KPN to improve the willingness of data providers in the Dutch horticulture sector to share data within data ecosystems. These insights can provide better understanding into the conditions that resulted in the knowledge gap that is being analysed in this research.

RQ3: What do we learn by analysing the results of the previous research questions with the aim to provide recommendations to improve the data platform participation of data providers in Dutch horticulture?

1.6 Research design

The conceptual model will first be derived from literature by answering the research questions SQ1a and SQ1b. This conceptual model will subsequently be tested in a quantitative manner to answer the research question 1C, whilst additional insight will be gathered by employing a qualitative research method. The design of this research is therefore twofold whereas it consists of a qualitative part and a quantitative part. This is also known as mixed-methods research (Venkatesh, Brown & Bala, 2013). The conceptual model will be used in a quantitative survey, whilst several respondents will be selected to participate in qualitative concurrent interviews to gain a deeper understanding of the same phenomenon. This type of mixed-methods research is called complementarity, and has been applied in Information Systems (IS) research more often (Venkatesh et al., 2013). The quantitative and qualitative methods will be employed in parallel such that the data will be collected and analysed concurrent rather than sequential. This is also known as a concurrent mixed-methods design (Venkatesh et al., 2013). In addition, by using two different approaches, both methods can compensate for the weaknesses the other. The qualitative approach will for example help to offset potentially small sample sizes. Whereas the quantitative approach will increase the external validity that could not be achieved with the qualitative approach. However, the quantitative part of this research is considered the dominant study. Both methods do not have to be treated equally in the research for a mixed-methods research design to be beneficial (Johnson & Onwuegbuzie, 2004; Johnson, Onwuegbuzie & Turner, 2007; Venkatesh et al., 2013).

1.6.1 Research framework

In order to structure the research and to visualise how the research will be conducted, the following research framework in figure 1.1 has been constructed. In step (a), a literature review will be conducted on several core concepts and Inter-organisational Information Systems (IOS) adoption. This will lead to the conceptual model of this research. Thereafter, the conceptual model will be tested in both a survey and by means of interviews in step (b). The analysis of both methods will be compared with each other and literature on IOS adoption in step (c) to draw conclusions, and ultimately be able to provide recommendations in step (d).

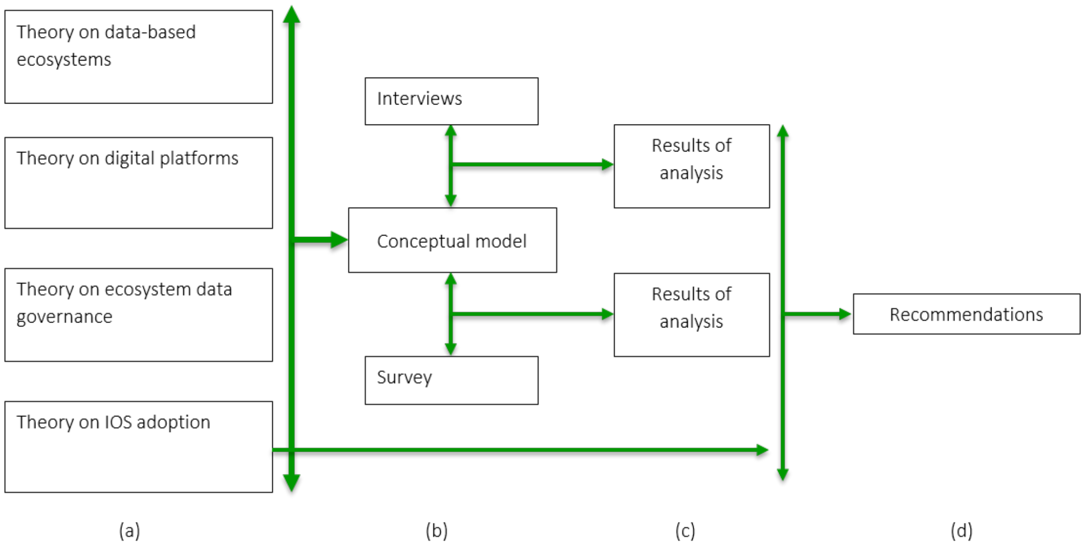


Figure 1.1: Research framework

1.7 Thesis structure

In the following chapter, a literature review is provided on the core concepts in this research to provide necessary background information on Dutch horticulture, 'ecosystems', 'data-based ecosystems', 'digital platforms', and 'ecosystem data governance'. Each concept is defined and discussed to provide enough context to continue with the research. Moreover, this helps to further refine the scope of the research.

In chapter 3, the methodology of this research is elaborated on and choices for the chosen methods are argued. It is described which methods were chosen to answer the research questions and what the limitations of those methods are. Also, attention is paid to which materials are used in this research and how research participants have been selected.

In chapter 4, the research sub-questions 1a and 1b are answered to form the conceptual model. First, a suitable framework is chosen to analyse the participation willingness. Subsequently, relevant factors to ecosystem data platform participation are identified that will be placed within the framework. This chapter concludes with the resulting conceptual model.

In chapter 5, the results of the Best-Worst Method (BWM) survey and analysis of the results are presented. Both research sub-question 1c and research question 2 are answered in this chapter. First the BWM results are presented, including an analysis of these results. Thereafter, the insights resulting from the interviews are presented, as well as a synthesis of the findings.

In chapter 6, the results of the previous chapters are discussed and juxtaposed with each other to be able to answer the last research question. The limitations of the research are discussed and recommendations for further research are provided. Moreover, recommendations are presented to solve the practical problem for KPN. This chapter is concluded with a reflection of the research and the relevance of the research to the Management of Technology (MOT) MSc program at the Delft University of Technology.

In chapter 7, an overview is made of the answers on each of the research (sub-)questions and conclusions of this research are presented.

2 The core concepts

In this chapter, the relevant core concepts will be defined and discussed to provide more insight into the context of this research. First will be addressed what is understood to be the Dutch horticulture sub-sector, which firms are considered to be the research subjects and what characterises this sub-sector. Secondly, it will be discussed how the participation in a data platform will be conceptualised for this research to help identify other relevant core concepts. Thereafter, the identified relevant core concepts will be elaborated on, starting with business ecosystems. The concept of business ecosystems will be defined and discussed, as well as platform ecosystems and why these are relevant to this research. Additionally, it will also be explained how they differ from traditional value networks and how value can be created in an ecosystem. Afterwards, the composition and requirements of a data-based ecosystem and the concept of digital platforms will be addressed. At last, focus will be given to ecosystem data governance, including the governance domains and governance modes.

2.1 Dutch horticulture

In section 1.2, the choice for this research to focus on the Dutch horticulture sub-sector was briefly discussed. In this section, the sub-sector will be further elaborated on to better understand the research and project context. There will also be clarified which firms are considered to be within the research's boundaries as the research subjects.

The horticulture sub-sector is defined as agricultural activities within greenhouses, such as growing fruits, vegetables and ornamental plants. The horticulture sector is in the Netherlands the largest sub-sector in agriculture in terms of average revenue generated per firm and the second largest sub-sector in terms of total production value (CBS, 2018). Over the last decade, the number of horticultural firms has been declining, whilst the average growth acreage per firm simultaneously grew (see table 2.1). A shift is noticeable towards firms with scaled production in horticulture. The competitive situation in the Dutch horticulture requires firms to operate more efficient (Bondt et al., 2016). Consumers require cheaper high quality produce as well as a larger product range and government legislation is expected to continue to increase rather than decrease. The Dutch horticulture sub-sector is experiencing more competition from international companies with lower wages and production costs, therefore threatening the competitive position of Dutch horticulturists. This requires Dutch horticulturists to keep improving, increasing their efficiency, and to create more value (Bondt et al., 2016).

Table 2.1: Dutch horticulture: number of firms, total acreage, and average acreage per firm

		Year						
	Type of crop	2000	2005	2010	2014	2015	2016	2017
Number of firms*	Total	10,727	8,351	5,612	4,264	3,967	3,667	3,324
	Flowers & plants	6,503	5,028	3,231	2,348	2,156	1,972	1,751
	Tree nursery	1,417	1,264	892	709	680	604	533
	Fruit	31	30	24	22	21	21	21
	Vegetables	3,265	2,420	1,687	1,371	1,305	1,255	1,182
Total area (m2)	Total	104,434,443	104,679,391	102,372,635	94,317,079	91,305,929	91,713,338	89,697,539
	Flowers & plants	59,119,860	56,101,416	47,721,411	41,358,524	39,123,801	38,131,498	35,896,522
	Tree nursery	3,611,711	4,298,362	4,905,834	4,680,884	4,717,209	4,568,132	3,984,620
	Fruit	40,010	66,848	81,849	67,999	75,192	76,234	152,369
	Vegetables	41,662,862	44,212,765	49,663,541	48,209,672	47,389,727	48,937,474	49,664,028
Average acreage per firm (m2)	Total	9,736	12,535	18,242	22,119	23,016	25,010	26,985
	Flowers & plants	9,091	11,158	14,770	17,614	18,146	19,336	20,501
	Tree nursery	2,549	3,401	5,500	6,602	6,937	7,563	7,476
	Fruit	1,291	2,228	3,410	3,091	3,581	3,630	7,256
	Vegetables	12,760	18,270	29,439	35,164	36,314	38,994	42,017

*Number of total firms deviates from the sum of firms per crop as some firms grow multiple types of crop
Source: CBS (2017)

Besides a growth in acreage per firm, the horticulture sub-sector has also seen a similar growth in number of full-time equivalent (FTE) employees per firm. This is visualised in figure 2.1.

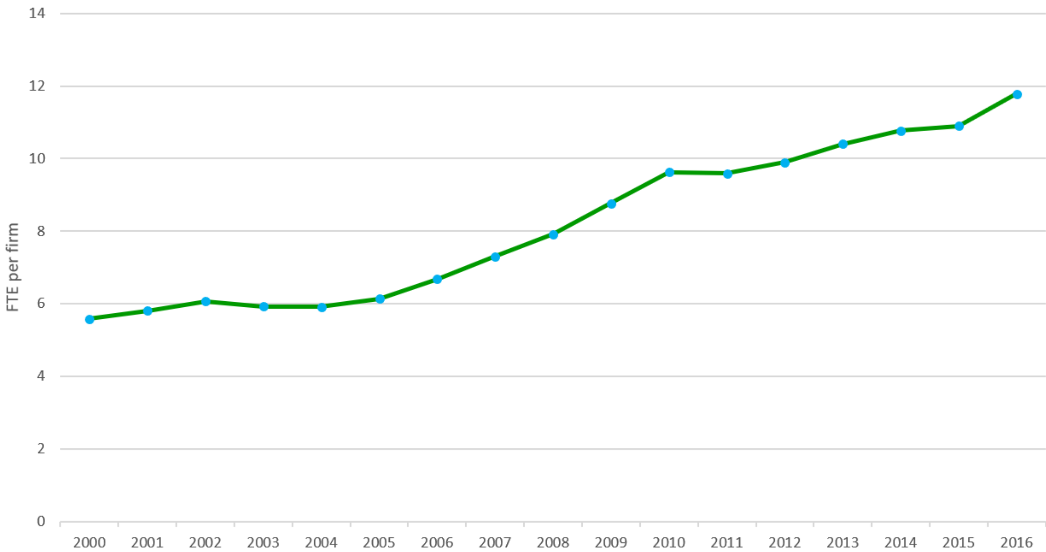


Figure 2.1: Number of FTE employees per firm 2000 - 2016
Adapted from Wageningen University (2017)

Furthermore, the financial state of horticulture firms in the Netherlands has improved over the last years as well (Wageningen University, 2017). The average balance sheet for horticultural firms in the Netherlands from 2001 to 2016 is visualised in figure 2.2. In 2016, the average balance sheet of horticulture was 3.3 million euro. The solvency of horticulture firms had increased for the third year in a row to 52% in 2016. The economic crisis in 2008 had large consequences for the value and demand of land. In the period between 2013 and 2016, the average equity grew with almost 700,000 euro to 1,731,200 euro. Within the horticulture sub-sector, greenhouse vegetable firms had the highest average balance sheet with 4.3 million euro in 2016. These firms are also the largest in the sub-sector in terms of average acreage. Furthermore, 83% of Dutch horticulture firms had sufficient liquidity and gross investments were on average 134,100 euro per firm in 2016.

Although IoT devices are more often used in horticulture, the data is not used effectively to extract potential value of the IoT data (de Ruyter, 2016). Examples of collected data in greenhouses are the air temperature, air humidity, soil humidity, or the sap streams of crops. By combining these types of data, a lot of information can be gained about the cultivation methods or strategy of the horticulturist. The topic of data resulting from IoT devices remains sensitive as the cultivation strategy is often what gives the firm its competitive advantage.

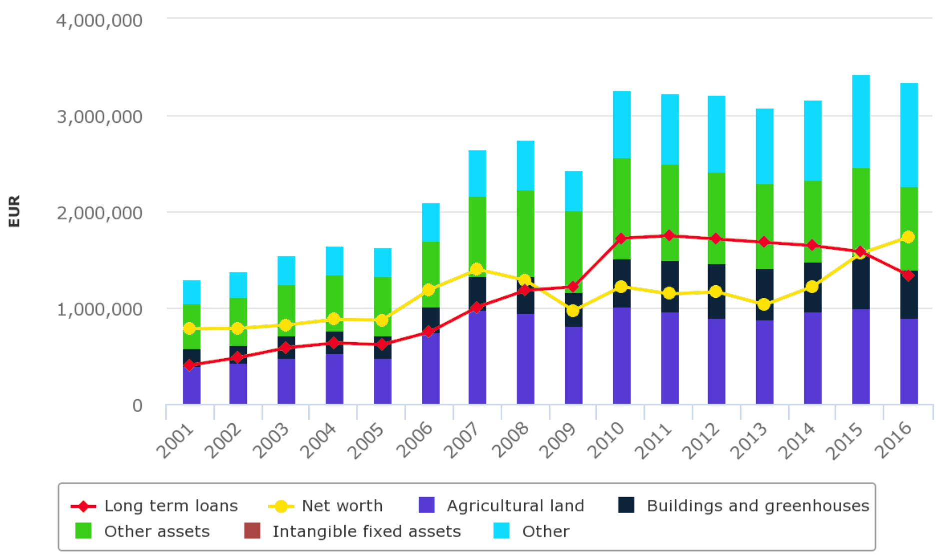


Figure 2.2: Balance sheet horticulture 2001 - 2016
Adapted from Wageningen University (2017)

2.1.1 Horticulture value chain

Within an agricultural value chain there are many different parties involved, which each could in theory generate and provide IoT data to an ecosystem. The different main stakes in an agricultural value chain are typically: providing farm inputs, farming, processing, distribution, wholesale & retail, and the consumer (AIOTI, 2015; Stirling, Kruh, Proudfoot, Claydon & Stott, 2013). In this research, the horticulture firms who actually plant, grow and harvest the product are considered as the data providers, fulfilling the farming role in the value chain as seen in figure 2.3. A data provider is defined as the party that generates the data and provides the data to the data ecosystem (Immonen, Palviainen & Ovaska, 2014).

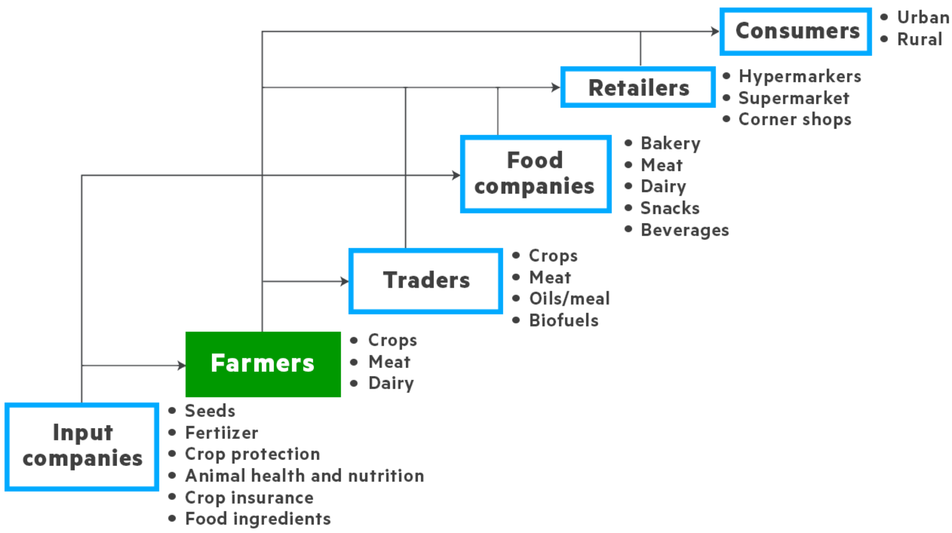


Figure 2.3: Agri-food value chain
Adapted from Stirling, Kruh, Proudfoot, Claydon and Stott (2013)

2.2 Conceptualising data platform participation

The sharing of data or information between organisations has been studied often in Information Systems (IS) literature under the term Inter-organisational Information Systems (IOS). The term IOS was introduced in the early 1980s by Cash and Konsynski (Bouchbout & Alimazighi, 2008) and is defined as "automated information systems shared by two or more companies". These systems were designed to enable organisations to link business processes (Praditya, Janssen & Sulastri, 2017). Organisations can exchange data or information between each other by means of IOS, as is for example the case with Electronic Data Interchange (EDI) systems. As a result, the organisations can reduce transaction costs and improve their operational efficiency (Yoo et al., 2012). Many IS researchers that research IOS, focus on how and why organisations adopt and develop inter-organisational information systems (Bouchbout & Alimazighi, 2008; Chwelos, Benbasat & Dexter, 2001; Kuan & Chau, 2001; Lippert & Govindrajulu, 2006; Rui, 2007; Zhu, Kraemer & Xu, 2006; Zhu, Xu & Dedrick, 2003).

Researchers stress that IOS are more and more often considered a digital platform to provide a business ecosystem rather than just being a tool to minimise transaction costs between organisations (van den Broek & van Veenstra, 2018; Yoo et al., 2012). Digital platforms provide a new and more flexible method of coordinating inter-organisational relations (IOR) by including tools and coordination for development in a multilateral configuration in an ecosystem. This extends the goal of traditional IOS to only support a firm's value chain such that they can increase their competitiveness. Instead of a dyadic configuration such as with traditional EDI systems (Praditya et al., 2017), a platform enables a multilateral connection between both cooperative and competitive entities. A digital platform can also serve as the technological infrastructure to support a data marketplace, and additionally provide rules and services to facilitate the transaction of data between multiple parties (Zuiderwijk & Loukis, 2014). However, this is only focused on linking parties to make a transaction, whereas in a data platform companies and individuals can create complementary products, technologies and services together on a digital platform in an ecosystem (Muegge, 2011; Schreieck et al., 2016; van den Broek & van Veenstra, 2018).

In contrary to traditional IOS, digital platforms have a much more distributed nature and can support inter-organisational relations in a new and more flexible way (de Reuver et al., 2017). Digital platforms replace the monolithic approach of traditional IS artefacts with modularity. The modularisation enables cross-module and core-module independence such that the sub-systems in a platform ecosystem can evolve independently (Tiwana, Konsynski & Bush, 2010). Digital platforms used to exchange IoT data are called data platforms and enable big data collaborations in an ecosystem. Digital platforms will be further elaborated on in section 2.5. The sharing of data within an ecosystem requires organisations to deal with a more complex networked environment, with actors being both cooperative and competitive (Peltoniemi, 2004). This complex networked environment extends the need for proper governance of the digital platform and in the case of a data platform, data governance within the ecosystem.

In this research, a data platform is conceptualised as a specific type of IOS. Participation in a data platform is therefore considered as the adoption of an IOS such that there can be drawn upon existing literature on IOS adoption. However, due to the distinctive characteristics of a digital platform and differences with traditional IOS, the inherent concepts will be further explored to better understand the context and elements of a data platform. Hereafter, the core concepts of ecosystems, data-based ecosystems, digital platforms, and ecosystem data governance will be further elaborated on.

2.3 Ecosystems

The concept of business ecosystems was originally presented by Moore (1993). He argued that innovative businesses are unable to grow in a vacuum and are depended on different resources such as partners, capital and customers, to create cooperative networks. According to Moore, companies would co-evolve their capabilities in a business ecosystem around an innovation, both by working cooperatively and competitively, to work towards the next innovations. As more researchers studied the concept of the business ecosystem, new definitions arose that were formed with a technological component in mind.

More recently, a business ecosystem is often described as a network of economic actors that coordinate their business activities around a platform and are collectively responsible for the outcome of the complete ecosystem (Muegge, 2011). Researchers and practitioners generally agree that entities are interacting in both a cooperative and competitive manner around a platform in a business ecosystem. The number of participants in a business ecosystem revolving around IoT are plentiful as it includes all entities that can interact such as people, organisations and devices (Mazhelis, Luoma & Warma, 2012; Schreieck et al., 2017). Taking the context of IoT in consideration, Mazhelis et al. (2012) define an IoT business ecosystem as follows:

"A special type of business ecosystem which is comprised of the community of interacting companies and individuals along with their socio-economic environment, where the companies are competing and cooperating by utilising a common set of core assets related to the interconnection of the physical world of things with the virtual world of internet."

Platform ecosystems focus on how the associated parties organise around a platform (Jacobides et al., 2018). The connected parties are able to create complementary innovations on a platform. However, a distinction can been made between an ecosystem-as-affiliation and an ecosystem-as-structure (Adner, 2016). The first considers ecosystems to be communities of connected actors based on their networks and platform affiliations. However, due to the focus in this perspective on the general governance of the ecosystem and the enhancements of the community, there is limited insight in the details of value creations within the ecosystem. The ecosystem-as-structure perspective is more suitable regarding the data platforms that are considered in this research. Adner (2016) defines ecosystem-as-structure as follows:

"The ecosystem is defined by the alignment structure of the multilateral set of partners that need to interact in order for a focal value proposition to materialize."

In this definition, ecosystems are considered to be the configurations of the activity revolving around a value proposition. The partners require interaction to realise or materialise the value proposition. The ecosystem-as-structure definition in the context of a data platform is about associated parties together creating and materialising value propositions with the data on the platform. To be able to accomplish this, different types of parties are needed with different skills and contributions. These will be elaborated on in section 2.4 by looking at the composition and requirements of a data-based ecosystem.

Business ecosystems are often compared with value networks and show similar aspects such as both not being based on geographic aspects, but the two also have some distinguishing characteristics (Peltoniemi, 2004). A value network shows a co-operative structure in which members do not compete with each other. Actors collaborate to offer a specific service or product by means of tangible and intangible value exchanges (Allee, 2000). Each actor in a value network has a specific defined task to contribute to producing the product or delivering the service (Peltoniemi, 2004). In a business ecosystem, the actors are not restricted to one specific service offering (De Reuver & Bouwman, 2012), but the actors are organised around a shared platform. Competition in a value network only occurs at the moment when the members for a value network are chosen. On the other hand, a business ecosystem can have both cooperative and competitive participants in its composition (Peltoniemi, 2004).

2.3.1 Value creation in ecosystems

Due to the disruptive nature of IoT, a new approach is required for the creation and capture of value with IoT (Vermesan et al., 2016). Therefore, in the context of IoT, the focus on a business model of a single firm is shifting towards ecosystem business models, as IoT should be interpreted as a business or platform ecosystem instead of a technology platform (Westerlund et al., 2014). An ecosystem business model is described as a set of value pillars that are anchored in ecosystems. These pillars put focus on both the method of the business and any other part of the ecosystem to create and capture value (Westerlund et al., 2014). This entails that value and data exchanges between participants in the ecosystem are pivotal to the creation and capture of value. With the design of their business model tool, Westerlund et al. (2014) kept the ecosystem nature of IoT in consideration and focused on the dynamics between the components of the business model.

The value pillars as described by Westerlund et al. (2014) are: (*a*) value drivers; (*b*) value nodes; (*c*) value Exchanges; and (*d*) value extracts. The *value drivers* cover the individual and shared motivations of different participants in the ecosystem as well as the promotion of the establishment of an ecosystem in order to create value, innovate, and capture the value through generating revenue. Some examples of value drivers in an IoT ecosystem that Westerlund et al. (2014) provide are sustainability, cybersecurity, and improved customer experience. The *value nodes* comprise the actors, activities, or (automated) processes which are in connection with other values nodes to create value. These value nodes are not limited to people but can also include other connected things such as sensors or computing machines. All the participants in the IoT ecosystem represent a value node, either individually or grouped. Grouped nodes could be a complete organisation for example. The *value exchanges* are the exchange of value by all possible means. This can be by, among others, exchanging resources, knowledge, information or data. The exchanges of value, which are called value flows, are possible within and between value nodes. According to Allee (2000), there are three 'currencies' of value in value flows: (*a*) Goods, Services and Revenue (GSR); (*b*) Knowledge; and (*c*) Intangible benefits. Whereas the first two 'currencies' speak for themselves, the intangible benefits are for example a sense of community, customer loyalty, improved image of the organisation or new relationships with business partners (Kuan & Chau, 2001). The value flows, or exchanges, basically show the dynamics of the ecosystem. The *value extracts* represent the extraction of value, or the actual value that can be monetised, and the required value nodes and exchanges for the value creation and capture.

2.4 Data-based ecosystems

Data-based business ecosystems are created or joined by organisations that each have their own role and knowledge in the data-based business. A business ecosystem that is based on open or shared data from the business perspective shows a certain structure in composition and requirements (Immonen et al., 2014). Actors that participate in an open data ecosystem (ODE) each have their own motives and benefits to do so and each represent a value node as described in subsection 2.3.1. The businesses are formed around three core elements in an ODE: (*a*) data, (*b*) services, and (*c*) applications. The data is the input of the ODE on which the other two core elements rely. The data can originate from any source. The services are required to enable the link between data and applications. Services function as a facilitating role in order to enable the ODE to work. The applications are the purpose of the ODE and represent the value that is created within the ODE. The applications utilise the data through the services of the ODE to create value and put the data to use.

The three core elements result in the classification of six different roles for participants in an ODE: (*i*) data providers, (*ii*) data brokers, (*iii*) service providers, (*iv*) application developers, (*v*) infrastructure and tool providers, and (*vi*) application users. The composition of an ODE is illustrated in figure 2.4. This research will group several types of participants as enabling actors: the data brokers, service providers, application developers, and the infrastructure and tool providers. Therefore a distinction is made between three different types of ecosystem actors: the data providers, the data ecosystem enabling actors, and the application users. It is worth noting that any organisation or individual can take on one or multiple roles within an ODE. For each organisation that participates in a data ecosystem, the business model of that organisation should support the value proposition of that organisation within the ecosystem (Immonen et al., 2014).

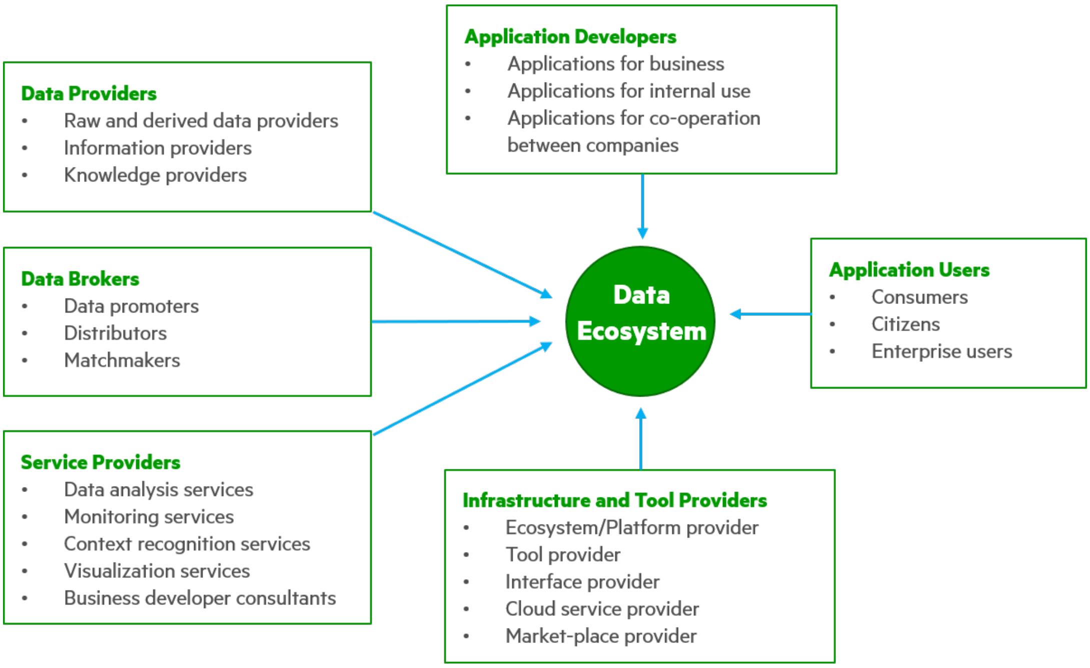


Figure 2.4: Roles within the ODE
Adapted from Immonen, Palviainen and Ovaska (2014)

2.4.1 Data providers

The *data providers* fuel the ODE and will interact with one or multiple other types of actors in the context of sharing data. There is no limitation in what kind of entity the data provider is, or where the data comes from. Examples are the public sector, individuals, organisations, or sensors. Data can either be provided for free or in return for value. Free access to data is often provided in the case of public entities. Data providers who provide access to data in return for value can obtain the value in different forms. Besides monetising the data by selling access to data, the data providers can request services, goods, knowledge, or use the access to data to build a relationship with another party.

2.4.2 Data ecosystem enablers

The enabling actors are the data brokers, service providers, application developers, and infrastructure and tool providers. These actors deliver services related to data that can enable the exchange and use of the data between the data provider and the application user.

The data that is provided can be promoted or distributed through *data brokers*. The data brokers can create a link between the data providers and any other actors within the ecosystem. Data brokers usually maintain information about who or what has which data available, and what the quality, price and licenses related to the data are. Furthermore, the data brokers are responsible for the communication and distribution channels of the data and applications within the ecosystem. The matchmaking of data providers and other participants is not only limited to the available data, but also extends to the demand of not yet available data.

Service providers deliver services related to data such as data analysis, data visualisation, business developing and data monitoring. A service provider does not necessarily have to offer a complete service but can also offer part of service chain.

The *application developers* are the participants that create the required applications for the data. Ideas for the applications can be provided by any actor. The applications result from combining the data and the services that are provided within the ecosystem. The provided applications can be used by other participants, the application developer itself or for co-operation between parties.

The *infrastructure and tool providers* deliver the technical aspects and tools necessary to realise the ecosystem. This can for example be the party that provides the digital platform for the ecosystem to operate and coordinate with. Such a platform would require maintenance and governance and can enable the exchange of data, applications and data services. Tools can also be provided to the platform users to develop or configure applications. The use of tools for development in an ecosystem will be further elaborated on in subsection 2.5.1. Furthermore, physical infrastructure, such as an internet connection, is required to be able to exchange data.

2.4.3 Data application users

The *application users* are those that consume or utilise the data by making use of the data-based applications and services provided by the ODE. The user can be any individual, public entity, device or organisation that makes use of the build application.

2.5 Digital platforms

As mentioned before, a data-based ecosystem operates with a data platform, which is a type of multi-sided platform. Digital platforms can either be defined as technical or sociotechnical artefacts (de Reuver et al., 2017; Schreieck et al., 2016). The first describes a digital platform as an extensible codebase that can be complemented by an ecosystem of third-party modules (de Reuver et al., 2017; Tiwana et al., 2010). The platform in a technological sense is often understood to be the set of technological components and complementary assets used by companies and individuals to create complementary products, technologies and services (Muegge, 2011; Schreieck et al., 2016). This is for example the case for the smartphone operating systems Apple iOS and Google Android. Application developers in the ecosystem can create applications, or third-party modules, that run on the iOS or Android platform.

The sociotechnical definition of a digital platform adds the presence of associated organisational processes and standards to the technical elements (de Reuver et al., 2017; Schreieck et al., 2017; Schreieck et al., 2016; Tilson et al., 2010). Inherently, digital platforms and ecosystems are very closely linked. The platform is often also called the core around which business ecosystems are formed (Mazhelis et al., 2012; Muegge, 2011) and it facilitates the interactions between participants in an ecosystem (S. U. Lee et al., 2017). In the context of IoT, the core can be interpreted as the link between the physical world and the virtual world of internet, the standards that enable this linkage, and the software and hardware platforms that are used (Mazhelis et al., 2012; Westerlund et al., 2014). The digital platform is understood to be integrating IoT devices and data sources to allow application developers and application users to have access to them. In this research, the sociotechnical view is adopted.

The concept of digital platforms is changing the IOS industry and the way organisations exchange data or information. Businesses that bring together multiple groups of entities in a platform ecosystem are the most influential in modern society (Schreieck et al., 2017). The governance of the platform ecosystem, such as managing collaboration between entities, has emerged as a key challenge in recent literature on digital platforms. The dynamics of a digital platform can be better understood by looking at the software tools and regulations, also called boundary resources, that are related to the digital platform (Ghazawneh & Henfridsson, 2010; Schreieck et al., 2017; Schreieck et al., 2016). Boundary resources typically are software development kits (SDK), application programming interfaces (API), or other software tools to facilitate platform users in application development. These boundary resources were previously mentioned in sub-section 2.4.2 as the tools that are provided to the ecosystem. The boundary resources can facilitate the use of the platform or can be used to create complementary products, technologies and services (Muegge, 2011). A digital platform that is used to exchange data is thus not just a knowledge-base any more, but includes tools for application developing as well.

Privacy and security of data is widely known as a critical issue in the context of sharing data (Du, Lai, Cheung & Cui, 2012; Sicari et al., 2018). Data confidentiality and integrity should be ensured when data is transferred across the organisational boundaries to prevent data from being intercepted and abused by other unauthorised parties (D. Chen & Zhao, 2012). Encryption standards, transport protocols and anonymisation of data, amongst others, can be technological aspects that enable the security of the platform. Moreover, the security of the platform also involves the mechanisms that restrict or control access to the platform, in order to prevent unauthorised access (Coetzee & Eloff, 2005; Yang & Maxwell, 2011). The boundary resources can also be used to govern the platform and control the development of applications.

2.5.1 Platform governance

The governance of digital platforms is important for the functioning of a digital platform and the balancing of the different interest of involved actors (Darking, Whitley & Dini, 2008; Schreieck et al., 2018). Platform governance is defined by Tiwana et al. (2010) as who makes what decisions about a platform. The platform governance reflects the (de)centralised organisation structure, available (boundary) resources like APIs or SDKs and restrictions to control the openness of the platform and to enable products and services development on the platform (Schreieck et al., 2018). Ghazawneh and Henfridsson (2013) argue that the boundary resources of a platform give better insight in the dynamics of digital platforms as boundary resources can be used to govern third-party development. The boundary resources facilitate the interaction between the platform provider and the platform users, or ecosystem actors. In addition to the previously mentioned forms of boundary resources, documents or data can also be used to address regulation-based control of a platform (S. U. Lee et al., 2017). The boundary resources therefore give shape to the interaction and behaviour of platform participants by governing the platform. Using boundary resources is about balancing between keeping control and stimulating external contributions to the platform (Ghazawneh & Henfridsson, 2010, 2013).

However, platform governance studies mainly focus on the conformance and monitoring aspects to avoid bad behaviour, ensure desirable outcomes and verify compliance by platform users (S. U. Lee et al., 2017). The focus of platform governance is not sufficient to cover all aspects concerning the use of data on a platform. Therefore, S. U. Lee et al. (2017) argue for the need of more comprehensive data governance for platform ecosystems.

2.6 Ecosystem data governance

Although various definitions of data governance exist, many researchers define data governance to refer to who holds decision rights and is accountable for the organisation's decision-making concerning its data (Khatri & Brown, 2010). This definition of data governance was built upon the framework for IT governance of Weill and Ross (2004). In their paper they differentiated between governance and management, whereas governance refers to the decisions to be made and by whom to ensure effective management, and management on its turn refers to the making and implementing of decisions.

The framework for data governance by Khatri and Brown (2010) stipulates five different interrelated decision domains: (*a*) data principles, (*b*) data quality, (*c*) meta-data, (*d*) data access, and (*e*) data life-cycle. *Data principles* are understood to establish the boundary requirements for the intended use of data and show the link with the business. Data sharing and re-use are also opportunities that are established in *data principles*. Furthermore, the usage of external data and compliance to the regulatory environment are also part of the *data principles*. The *data principles* will establish the standards for *data quality* in the organisation. The *data quality* can have impact on both operational and strategic level in an enterprise. The quality of the data refers to the ability of the data to satisfy its usage requirements and can be measured by its accuracy, timeliness, relevance, completeness, trustworthiness and contextual definition (Cheong & Chang, 2007). The *meta-data*, in its turn, indicates how data is interpreted. Khatri and Brown (2010) define meta-data as "data about data", which helps to interpret the meaning of data. *Data access* refers to how and when data is accessed by users. It specifies the access requirements of data and deals with guaranteeing safe access to data. The *data life-cycle* involves decisions regarding the production, retention and retirement of data, which is pivotal to operationalising the *data principles* into IT infrastructure.

Research on data governance in the context of inter-organisational data sharing or ecosystems is still in its infancy. Inter-organisational data governance is considered a sub-domain of inter-organisational governance or network governance and incorporates components of traditional intra-company data governance. In this research, the following definition from Van den Broek and Van Veenstra (2015) will be used for ecosystem data governance:

> *"Arranged institutions and structures to ensure that individuals behave in line with the collective goals, conflicts between individuals are prevented or resolved, and the effective and fair use of collective resources within the inter-organisational collaboration."*

S. U. Lee et al. (2017) have attempted to identify several critical factors for data governance of platform ecosystems when multiple parties participate in contributing, processing and using data. Aspects such as ownership, access, usage and profit sharing are vital to the data governance in a platform ecosystem. Data sharing can involve concerns about data abuse, privacy violation and unfair distribution of generated profit from the data. Therefore platform providers require proper data governance to guarantee the safety of their data. The governance concepts related to the governance of platform ecosystems should be implemented in data governance of platform ecosystems along key decision domains of data governance for individual enterprises (S. U. Lee et al., 2017).

In the context of data governance for data ecosystems, seven factors have been identified that collectively influence the two decision domains of (*i*) data ownership & access and (*ii*) data usage (S. U. Lee et al., 2017). The first domain involves who owns and is allowed to access and use the data in the ecosystem. The second domain is involved in how the data can be used and how this can be monitored and ensured. Table 2.2

Table 2.2: Ecosystem data governance domains and factors

Domain	Data Ownership /Access			Data usage			
Factor	Data ownership and access definition	Definition Criteria	Contribution Estimation	Data Use Case	Conformance	Monitoring	Data Provenance

*Adapted from S. U. Lee, Zhu and Jeffery (2017)

2.6.1 Governance domain of data ownership and access

Within the decision domain of data ownership and access, the following data governance factors have been identified: (*a*) data ownership and access definition, (*b*) definition criteria, (*c*) contribution estimation (S. U. Lee et al., 2017).

Factor (*a*) determines who owns the data when it is made available to the ecosystem, and who has access rights to use the data at which time and how. Definitions for data ownership and access are necessary to support revenue sharing and to remain control of the data flow. Unauthorised access to data can be prevented by well-defined data ownership and access. Factor (*b*) determines the main criteria on who gets ownership of newly generated data and is necessary to prevent unclear ownership of data. This can be achieved by e.g. implementing a decision model that determines the ownership of data based on legal aspects. Factor (*c*) is used to measure and define the user contribution versus the value creation by providing data to support revenue sharing and to encourage high quality resources. Low quality data and resources will decrease the value of the platform. Contribution estimation will therefore help maintain a platform with high quality resources, contributing to the sustainability of the platform itself.

2.6.2 Governance domain of data usage

Within the decision domain of data usage, the following data governance factors have been identified:(d) data use case, (e) conformance, (f) monitoring, and (g) data provenance (S. U. Lee et al., 2017).

Factor (d) partly supports the first governance domain of data ownership and access as well. This factor relates to how data in the platform ecosystem can be used. This is necessary to avoid wrong use of data and to avoid data providers to lose control of their data by sharing or selling data. Factor (e) is relates to the audit processes and rules to control for compliance. Data misuse or abuse are important topics that have to be addressed. Conformance checking will contribute to minimise unauthorised or unintended use of data. Factor (f) determines how the data can be monitored and traced to see who or what accessed or modified data. This could include data stewardship practices and reporting by data users to track all data related activities. Factor (g) relates to the resources to make the derivation history of data transparent in the platform ecosystem. Provenance is important as changes in data can have large impact on the value of data. Standardised meta-data could be considered a solution to keep track of information about the data.

2.6.3 Governance mode

Inter-organisational performance requires integrated governance to be effective and efficient. Provan and Kenis (2008) studied network governance configurations which take the structural patterns of relations within the network or ecosystem in consideration. They propose three different forms of network governance: (a) shared governance, (b) lead organisation governance, and (c) network administrative organisation (NAO) governance. The first form requires participants to collectively govern the network or ecosystem. This would require every organisation to interact with each other to govern the network, making this form highly decentralised. The other two forms describe a highly centralised form of governance. The second form requires one single organisation, which is also a participant in the network, to be responsible for the governance of the network. This organisation could be the keystone actor in an ecosystem, such as a platform owner. The last form requires a unique external organisation, a NAO, to govern the network. This is an organisation that does not participate in the ecosystem in any other way and is solely responsible for the governance. These governance modes are visualised in figure 2.5.

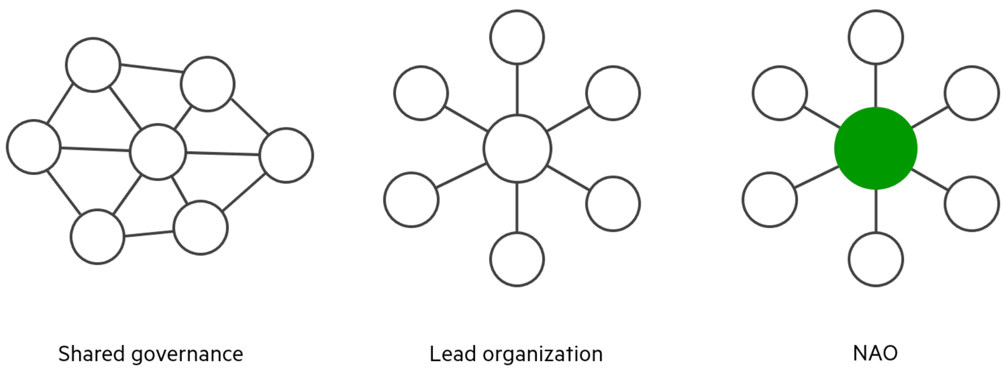


Figure 2.5: Network governance modes

Van den Broek and Van Veenstra (2015) studied the modes of inter-organisational governance in the specific context of data collaborations. They define the governance as the arranged institutions and structures that ensure the desired behaviour of organisations and prevent or resolve conflicts. The desired behaviour is reliant on collective goals. They applied four existing distinct archetypal modes of inter-organisational governance to data collaborations. These modes are: (a) market, (b) bazaar, (c) hierarchy, (d) network (Demil & Lecocq, 2006; Powell, 1990).

The first mode is based on dyadic contractual agreements, relies on incentives, and requires competition and a high level of autonomy from the involved parties (Demil & Lecocq, 2006; Powell, 1990). The parties can make use of a central pool of data such that the organisations share data by agreeing on contractual transactions (Van den Broek & Van Veenstra, 2015). However, high transaction costs can arise as short-term relationships are common in a network based on this governance mode. The second mode is not reliant on formal contracts nor high levels of trust (Demil & Lecocq, 2006). In this mode, intellectual property is less important. This mode regulates social control by transparency (Van den Broek & Van Veenstra, 2015) and is often the mode of governance for open data. In this mode the reputation and contribution of the parties are the most important incentive to contribute to a shared goal in the network. The first two modes are comparable to the shared governance as discussed before. In the third mode, formal relations between members are important and power is determined on ranking of the members (Powell, 1990). The higher the participants are ranked, the more formal power the have over lower ranked participants. Often there is one dominant organisation that governs the network. The social control is regulated by imposing sanctions and awarding rewards (Van den Broek & Van Veenstra, 2015). This mode is comparable to the lead organisation and NAO governance mode by Provan and Kenis (2008). The fourth mode is a hybrid between market and hierarchy. In this mode the governance relies on social contracts between participants which involve trust. Network activities are coordinated as a joint effort between the organisations in the network, leading to decisions based on consensus.

The governance of inter-organisational data collaboration is dependent of four aspects, namely the 'type of data sharing', the 'characteristics of data sharing', the 'coordination mechanisms', and the 'control over data' (Van den Broek & Van Veenstra, 2015). Furthermore, proper data governance is necessary in inter-organisational data sharing, especially when commercially sensitive data is to be shared. The choice for the mode of an inter-organisational governance arrangement is believed to strongly depend on the objective of innovation, the type of data being shared, and regulatory issues (van den Broek & van Veenstra, 2018).

3 Methodology

In this chapter will be elaborated on the chosen methods to answer the research questions, as well as why those methods are chosen. Furthermore, it will be discussed how these methods are being put to use, which limitations they have, and how materials are collected for this research. The participants for the research are addressed as well as how those participants are selected.

3.1 Methods

To be able to answer the research questions and corresponding sub-questions, as presented in section 1.5, several research methods have been chosen. In this section the methods and the motivation to use them will be explained. This research has a mixed-methods research design as was briefly discussed in 1.6. The conceptual model will be developed from existing academic literature. The relative weights of the factors will be derived from quantitatively collected data in a survey. A deeper understanding of the underlying reasons for the results of the survey will be gained by conducting concurrent qualitative follow-up interviews. Each of the chosen research methods will now be further discussed.

3.1.1 Literature review

To answer sub-question 1a, a literature review was chosen as the suitable research method. Several frameworks to analyse IS innovation adoption have been studied in IS literature. These frameworks will be discussed and compared in the context of this research so that a suitable framework can be chosen.

The same method, a literature review, will be used to answer sub-question 1b. Literature on IS and IOS innovation adoption will shed light on which factors are important to the decision to adopt an IOS. However, literature on traditional IOS adoption will not suffice for a complete model as digital and data platforms are a relatively new research topic within IS literature. These concepts have some distinctive features compared to traditional IOS, as discussed in chapter 2. Therefore, factors will be adjusted to the context of this research and additional context specific factors will be added from literature on data-based ecosystems, digital platforms, and ecosystem data governance.

Relevant and suitable literature was identified by consulting the online databases Web of Science, Scopus, and Google Scholar. The types of included literature are academic journals, conference papers, and research papers. The literature study was carried out between 16-04-2018 and 16-08-2018. Articles published after this date have therefore not been taken into consideration. Recent literature reviews on this topic were considered as the primary starting point. Subsequently, other relevant literature was identified by consulting the reference lists, also known as the backward snowballing method as described by Watson and Webster (2002). By first reading the abstracts, relevant articles were selected and those were thereafter studied in more detail.

3.1.2 Survey

To answer sub-question 1c, an online survey is used as the research method. Surveys are generally associated with breadth (Verschuren et al., 2010), which is preferred in this research to answer this sub-question as the aim is to achieve an overall picture of what the Dutch horticulture sub-sector considers important in their decision on data platform participation. Surveys are often characterised by a large number of research units, extensive data generation, and a random sample to generate quantitative data. Due to a larger amount of required data, the data has to be collected in a well-structured way, implying the use of closed questions. Consequently this also introduces a limitation to the use of surveys. As closed questions will be used, the respondents are not able to explain or motivate the answers chosen. More information on why respondents choose certain answers will contribute to gaining a deeper understanding of the results of the survey. This limitation will be attempted to be addressed by conducting additional qualitative face-to-face interviews. This will be further explained in section 3.1.5.

To design the survey, the method that is used to determine the relative weight of ecosystem data governance must first be chosen. In the survey, the participants are presented with a multi-criteria decision making (MCDM) problem. When the decision-maker has to make a decision between alternatives that are dependent on multiple criteria, this is called a MCDM problem (Rezaei, 2015). The decision-maker is challenged to consider the possible result each criterion can have on their decision $\{a_1,a_2,\ldots,a_m\}$. The alternatives are compared on several relevant evaluation criterion $\{c_1,c_2,\ldots,c_n\}$ by assigning a score, denoted by $\{p_{ij}\}$, to the performance of alternative i on criterion j. This can be interpreted as the following matrix:

$$A = \begin{array}{c} \\ a_1 \\ a_1 \\ \vdots \\ a_m \end{array} \begin{array}{c} \begin{array}{cccc} c_1 & c_2 & \cdots & c_n \end{array} \\ \begin{bmatrix} p_{11} & p_{12} & \cdots & p_{1n} \\ p_{21} & p_{22} & \cdots & p_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ p_{m1} & p_{m2} & \cdots & p_{mn} \end{bmatrix} \end{array} \tag{1}$$

In order to select the best alternative, the alternative with the highest overall value needs to be determined. Each criterion will be assigned a weight $\{w_1,w_2,\ldots,w_n\}$, for which $w_j \geq 0$, and the sum of all the weights equals 1. The value of alternative i, denoted as V_i, can be found with an additive weighted value function:

$$V_i = \sum_{j=1}^{n} w_j p_{ij} \tag{2}$$

This research not only aims to determine whether ecosystem data governance is important and whether it is more important than others, also known as ordinal ranking, but also to derive the relative weight of ecosystem data governance. This provides insight in exactly how much more or less important ecosystem data governance is in the decision-making process compared to the other factors. Several methods exist to determine the relative weight of the factors. The methodology used in this research is the best-worst method (BWM) that is recently developed by Rezaei (2015, 2016). This is a MCDM method that uses pairwise comparison to effectively compare factors and has been successfully applied to other MCDM problems (Gupta & Barua, 2016; Rezaei, Hemmes & Tavasszy, 2017; Rezaei, Nispeling, Sarkis & Tavasszy, 2016; Rezaei, Wang & Tavasszy, 2015). Compared to one of the most common used methods for deriving weights, Analytic Hierarchy Process (AHP), the BWM method requires less comparison data whilst still deriving highly reliable weights (Rezaei, 2015). The final weights are highly reliable due to BWM providing more consistent comparisons than AHP. Moreover, the method uses a positive scale with only integer values. Combined with less comparison data needed, this makes the method more user-friendly. The BWM method has also statistically proven to outperform AHP on minimum violation, total deviation, and conformity (Rezaei, 2015). The steps to use BWM will be further elaborated on in the next section (3.1.3).

The survey was designed according to the guidelines of BWM as described by Rezaei (2015). At first, the respondent was shown an introduction and instructions on how to fill in the survey. Subsequently, the respondent was presented with an overview of the categories containing all the relevant factors that are believed to influence their decision to participate in a data platform. The respondent was then presented with a hypothetical problem in the survey: imagine you are considering to share your IoT data with other parties on a data platform. The respondent was asked to indicate which factor he or she considers the most important in their decision on data platform participation. The chosen most important factor was then compared to the other factors and the other factors were compared to the chosen least important factor. This was done by assigning a number on the scale of 1 to 9 to each factor in the comparison. The meaning of these numbers are shown in table 3.1. These explanations of the numbers were also presented to the respondent in the survey. Classification data such as personal information and demographic questions were placed at the end of the survey as these types of data are more sensitive to respondents (Sekaran & Bougie, 2016). An example of the full survey can be found in Appendix L.

The survey was created with the software LimeSurvey, which is a free open-source software tool. The software for the survey was hosted on a private cloud server. In the design of the survey, focus was put on several aspects that are considered important for a suitable survey (Sekaran & Bougie, 2016). First of all, the language in the survey was adjusted in such a way that it is easy to understand for the respondents that belong to the population that is of interest in this research: Dutch horticulturists. This was confirmed with one horticulturist and a researcher within the horticulture sub-sector. The model was also translated to Dutch to suit the population. This was done to ensure that the respondents would understand and correctly interpret the questions. Whilst using easily understandable language in the survey, there was also aimed to ensure the appropriateness of the questions in the context of the research to the best of our ability. Furthermore, during the design of the survey another aim was to prevent the use of double-barrelled, ambiguous, emotionally loaded, socially desirable, or leading questions. A proper introduction to the survey was provided to clearly describe the purpose of the survey and research, to disclose our identity to the respondent and to ensure the confidentiality of the respondents' answers and information. Besides the wording in the survey, it is also important to pay attention to the look of the survey (Sekaran & Bougie, 2016). An attractive survey with appropriate introduction and instructions increases the chances of participation. Therefore, a custom design was created to brand the survey and give it a professional and trusted look. The survey was made accessible at a custom Dutch web-domain that is easy to remember and would create a higher sense of trustworthiness: www.datainglastuinbouw.nl. This web-domain translates to the English 'data in horticulture'.

Table 3.1: BWM ranking scale

Number	Meaning
1	Equally important
2	Somewhat between equally important and moderately more important than
3	Moderately more important than
4	Somewhat between 'moderately' and 'strongly' more important than
5	Strongly more important than
6	Somewhat between 'strongly' and 'very strongly' more important than
7	Very strongly more important than
8	Somewhat between 'very strongly' and 'absolutely' more important than
9	Absolutely more important than

Before the survey was sent to the population sample, interviews were held with 6 horticulturists which doubled as a pretest for the survey tool. A pretest is important when a survey is used to ensure that the respondents understand how to use the survey tool, how to interpret the questions, and to ensure that the wording or measurement don't introduce problems (Sekaran & Bougie, 2016). More details about the interview method will be disclosed in sub-section 3.1.5.

Survey responses were collected between 12-09-2018 and 06-11-2018. Responses were included in the research when they satisfied three criteria for inclusion: the firm uses IoT, horticulture is the respondents main occupancy, the respondent is involved in the decision-making regarding data. Additionally, the respondents were asked to disclose the title of their function. Respondents who answered the last two of those requirements positively were included unless their title function would suggest they are not likely to be in a position to make decisions on a firm level regarding data. Based on these criteria, one response was emitted due to the firm not using IoT in their operations. To stimulate participation and ensure the respondents would complete the survey, several 'prizes' with a total value of €730 were arranged, which were given away after the research to randomly drawn respondents. The 'prizes' were sponsored by KPN and consisted of a smartphone, tickets to a soccer match of the Dutch national team, and several books about Dutch soccer.

The collected data is processed according to the BWM method standards as will described in the next subsection. This is done with an Excel sheet that was adjusted to this specific research in terms of number of comparisons and number of factors within each comparison. This Excel sheet is based on a model linear BWM solving sheet as retrieved on 01-06-2018 from the website (www.bestworstmethod.com) of the original BWM paper's author (Rezaei (2015)).

3.1.3 Best-Worst Method

BWM is a method that makes use of pairwise comparison to establish the weights of the factors. In each comparison, the best and worst factors will be chosen from a list of factors and compared to the other factors on the list. The factors are required to be independent from each other. The weights of the factors can subsequently be derived by formulating and solving a maxi-min problem. The BWM always results in consistent, but not necessarily fully consistent, results (Rezaei, 2015). In the survey, the linear model of BWM will be used as it is preferred to reach a unique solution in this research. The non-linear BWM method could result in multi-optimality in some cases, meaning that different sets of weights for the criteria could result. The linear model obtains a unique solution which is very close to the centre of intervals when the non-linear model is used.

Whereas the non-linear model uses a consistency ratio to indicate the consistency, the value of the consistency indicator, ξ^L, will directly indicate the consistency. The consistency indicator therefore represents the reliability of the BWM results in linear BWM. A consistency value as close as possible to 0 is preferred as this indicates a higher reliability of the results. However, BWM does not include a threshold value for the consistency indicator. Often, other researchers have considered a value below 0.25 to represent low inconsistency, and thus good reliability of the result. Because the results of the BWM will be aggregated, higher values on the individual level will not degrade the results as long as the aggregate consistency can be considered good.

Linear BWM can be completed in five steps (Rezaei, 2016):

1. Determine the set of relevant decision criteria or factors. $\{c_1, c_2, \ldots, c_n\}$

2. Identify the best (e.g. most important) and the worst (e.g. least important) factors.

3. Conduct a pairwise comparison to determine the preference of the best factor over all the other factors by using a number between 1 and 9 (1= equally important, 9= absolutely more important). This results in the Best-to-Others vector:
$$A_B = (a_{B1}, a_{B2}, \ldots, a_{Bn}) \tag{3}$$
With a_{Bj} indicating the preference of the best factor B over factor j.

4. Likewise conduct a pairwise comparison to determine the preference of all other factors over the worst factor by using a number between 1 and 9 (1= equally important, 9= absolutely more important). This results in the Other-to-Worst vector:
$$A_W = (a_{1W}, a_{2W}, \ldots, a_{nW}) \tag{4}$$
With a_{jW} indicating the preference of the factor j over the worst factor W.

5. Calculate the optimal weights of the relevant factors $(w_1^*, w_2^*, \ldots, w_n^*)$ This is done by minimising the maximum absolute differences, with the non-negativity condition for the weights and the sum of all weights being

equal to 1 in mind. This means minimising the maximum values among $\{|w_B - a_{Bj}w_J|, |w_j - a_{jW}w_W|\}$. This results in the following min-max problem formulation:

$$\begin{aligned}
&minmax_j = \{|w_B - a_{Bj}w_J|, |w_j - a_{jW}w_W|\} \\
&s.t. \\
&\sum_j w_j = 1 \\
&w_j \geq 0, forallj
\end{aligned} \tag{5}$$

The min-max problem is then transferred to the following linear programming model:

$$\begin{aligned}
&min\xi^L \\
&s.t. \\
&|w_B - a_{Bj}w_J| \leq \xi^L, forallj \\
&|w_j - a_{jW}w_W| \leq \xi^L, forallj \\
&\sum_j w_j = 1 \\
&w_j \geq 0, forallj
\end{aligned} \tag{6}$$

By solving this problem, the optimal weights (w_1^*,w_2^*,...,w_n^*) and ξ^{L*} are obtained, whereas ξ^{L*} indicates the reliability of the weights based on the consistency of the comparisons. The closer this value is to zero, the higher the consistency of the comparison and thus the reliability of the result.

The most important factors factors can then be identified by comparing the global values of each factor. It is possible to use BWM with multiple layers by first comparing the groups in the top layer to each other, and thereafter comparing the factors within the groups (lower layer) with each other to derive local weights for the factors. Each comparison can consist of a maximum of nine factors. The global weights of the factors are derived by multiplying the local weight of the factor with the weight of the top layer group that it belongs to.

3.1.4 Mann-Whitney U test

Two-tailed Mann-Whitney U tests were performed using R-Studio to test the significance of the differences between two groups of respondents in the survey sample. The Mann-Whitney U test is a nonparametric test that is suitable to use with two categorical independent groups with non-normal distributions. This test explores whether there is a significant difference between two groups from the same population. The null hypothesis states that the distributions of the weights in both groups are equal. The confidence interval for the tests is 0.95. Therefore, when the p-value (two-tailed exact significance) is smaller than 0.05, the null hypothesis will be rejected. The data was analysed with regard to two different confounding variables extracted from the classification data provided by the respondents. The respondents: current data sharing activity and type of crop. This resulted in the comparison of the weights assigned by sharing and non-sharing horticulturists, and the weights assigned by horticulturists that grow vegetables and flowers or plants.

3.1.5 Interviews

To answer the research question 2, face-to-face interviews were chosen as the suitable research method. A total of 6 interviews were conducted with horticulturists at the interviewees' location. Each interview was done in Dutch and took between 30 and 60 minutes. The interviews were conducted between 12-09-2018 and 19-10-2018. Each interview was recorded with the permission of the interviewee after disclosing the purpose of the interview and the recording of the interview. The audio recordings were used to extract quotes from the interviews to use in the research.

The interviews were semi-structured as the respondents would answer questions about their choices they made in the survey. This means that the topics that were discussed were mainly the factors in the conceptual model that is tested in the survey. The factors that the respondents considered the most and least important were discussed for the most part. As these factors would differ between the respondents, the discussed factors also differed in each interview. During each of the interviews, the horticulturist was asked to fill in the survey. This gave the opportunity to ask questions and let the interviewees explain their choices in the survey. This contributes to getting a deeper understanding of the results in the BWM and a better understanding of Dutch horticulturists and the sector. These interviews are conducted before the survey is set out in order to also use the interviews as a pretest for the survey instrument as was described in 3.1.2. Appendix K list the important quotes from the interviews.

3.2 Participants

The participants for this research belong to the earlier defined population that is of interest to this research: Dutch horticulturists. To find participants for this research, several steps were necessary to build the correct network in order to approach the horticulturists for participation. Due to the sensitivity of the data-sharing topic in the Dutch horticulture sub-sector, the horticulturists needed to be approach through trusted parties. KPN considers the agricultural sector as a potential lucrative sector in the future for their IoT and data business. However, at the time of writing, KPN was not involved in the horticulture sub-sector. Therefore, no prior network or channels within the horticulture sub-sector were present to assist in finding participants for the research.

The first step that was taken towards building a network in horticulture was to contact Greenport Hub. This is an organisation that operates within the Centre of Sustainability, a cooperative of the University of Leiden, Delft University of Technology and Erasmus University Rotterdam. The main focus of Greenport Hub is circularity in the horticulture sub-sector so that the society will be able to feed a growing world population in the near future. One of the research themes that will help achieving their goal is the digitalisation in the horticulture sub-sector.

In addition, two horticulture conventions were visited at the beginning of the research. However, parties that were approached at the conventions were not willing to participate in the research. Lack of time and uncertainty whether the research was in their interest were reasons mentioned.

3.2.1 Interviewees

Greenport Hub was able to set up contact with several horticulturists within their network. The horticulturists were approached directly for participation upon which three out of five horticulturists agreed to participation. This is also known as convenience sampling (Sekaran & Bougie, 2016), as these were members of the population who were conveniently available to provide information. These interviewees were asked if they knew other horticulturists to approach for this research, also known as the snowballing method, which resulted in 17 referrals. From these 17 horticulturists, 8 agreed to participate in the research. Out of these 8 horticulturists, 3 agreed to an interview, whereas the others agreed to complete the online survey. The interviewees were also asked to complete the survey as was described in section 3.1.5, resulting in a form of double sampling (Sekaran & Bougie, 2016).

A total of 6 horticulturists were interviewed. The first three interviewees were chosen through convenience sampling as was described in section 3.2.1. The other three interviewees were found through the snowballing method and it was made sure that there was diversity in company size and type of crop among the group of interviewees. Table 3.2 shows the characteristics of the six interviewees.

Table 3.2: Interviewee characteristics

#	Data sharing	Crop	Crop acreage	Employees	Age	Job title
A	Not sharing	Flowers & plants	0 to 1 ha	2	46-55	Owner
B	Sharing	Flowers & plants	6 to 10 ha	26	36-45	Owner
C	Not sharing	Flowers & plants	2 to 4 ha	30	46-55	Owner
D	Sharing	Vegetables	2 to 4 ha	2	36-45	Owner
E	Sharing	Vegetables	50 ha or more	250	25-35	Manager Energy, Purchasing and Innovation
F	Sharing	Flowers & plants	2 to 4 ha	4	36-45	Owner

3.2.2 Survey respondents

For a survey, taking a random sample of the population of interest is a typical approach (Verschuren et al., 2010). Random sample selection is the best way to guarantee a representative group of research subjects. Random sampling means that the population to which all potential research subjects belong, have the same chance of being included in the sample, regardless of the research subject's characteristics. Sampling is needed as the total population is too large, making it practically impossible to collect data from.

Greenport Hub referred us to the Dutch horticulture interest group LTO Glaskracht. This interest group represents around 70 % of the total horticulture area in the Netherlands and is involved in coordinating national development concerning labour, energy, crop health, and water & environment in horticulture. LTO Glaskracht was convinced of the importance of the research for the sub-sector and agreed to make use of their communication channels to reach and approach potential respondents for the survey. The reach of their communication channels is over 2000 horticulturists. This group is considered the main sampling frame. Additionally, three large cooperatives within horticulture were approached to ask their members to fill in the survey. One out of the three cooperatives agreed to use their network and intra-net to find participants for this research. This resulted in another five participants.

A total of 30 horticulturists completed the survey. This group of respondents shows heterogeneity on several aspects such as current data sharing activity, number of employees, crop growing area, and the age of the respondent. In table 3.4, the frequencies of respondents. A full list with the known characteristics of the respondents are reported in Appendix I. A total of 19 out of 30 horticulturists indicated that they are currently sharing IoT data with others. Out of those 20 horticulturists, 18 of them make use of a data platform to share their IoT data. Out of the 10 respondents that are not sharing IoT data, 8 stated that despite they are not sharing IoT data, they are willing to do so. This shows that 66.7% of the respondents indicated that they are already sharing IoT data, a much larger share than the total population is expected to show based on literature and statements from interest groups in the sub-sector. In total, most respondents (93.3%) are either sharing IoT data or are willing to do so. These shares are possibly showing a selection bias being present. This distribution of respondents' data sharing activity could be attributed to data sharing horticulturists being more inclined to share information in general. Thus not only to share IoT data or information, but also information such as their opinion on this topic for the purpose of this research. Furthermore, because they might be more aware of the actual benefits and risks of data sharing, this group could be less opposed to disclose information about the topic.

The survey sample also shows a reasonably similar distribution regarding the type of crop as the horticulture population. As was shown in section 2.1, within the Dutch horticulture sub-sector, most firms grow vegetables or flowers and plants. In the sample, the group of horticulturists that grow flowers and plants make up for 50% of the respondents. The group that grows vegetables make up for 46.7% of the respondents. Only one respondent was involved in tree nursery (3.3%) and none of the respondents grew fruit. None of the respondents grew more than one type of crop that is differentiated between in this research. A similar trend is thus also seen in the group of respondents. The shares in type of crop of the sample are compared to the statistics on the sub-sector population in table 3.3 to indicate the representativeness of the sample.

Table 3.3: Share of crop type: population versus sample

Type of crop	Share in population*	Share in sample
Flowers & plants	53%	50%
Tree nursery	16%	3.3%
Fruit	1%	0%
Vegetables	36%	46.7%

*Shares add up to 106% as some firms grow multiple types of crop

Furthermore, the respondents gave an estimate of their total amount of employees, including themselves. Employees are defined as the number of full-time equivalents (FTE). Respondents were asked to disclose the crop acreage of their firm and their own age by selecting the applicable range. Whereas there is limited to no data available on the population regarding these aspects, there are averages available for the number of employees and crop acreage per horticulture company. The average number of FTE's in the population was 12 in 2016 and the average crop acreage in the population was 27 hectares in 2017. The characteristics of the respondents show slightly different trends. The sample mean of the average number of FTE's is 25. Table 3.4 shows how many times each range was chosen for the crop acreage.

Table 3.4: Sample characteristic frequencies

Characteristic	Category		Total
Crop	Vegetables	Count	14
		%	46.7%
	Flowers & plants	Count	15
		%	50.0%
	Tree Nursery	Count	1
		%	3.3%
	Fruit	Count	0
		%	0.0%
Data sharing activity	Sharing on platform	Count	18
		%	60%
	Sharing otherwise	Count	1
		%	3.3%
	Non-sharing	Count	11
		%	36.7%
Crop acreage	0 to 1 ha	Count	2
		%	6.7%
	1 to 2 ha	Count	2
		%	6.7%
	2 to 4 ha	Count	4
		%	13.3%
	4 to 6 ha	Count	7
		%	23.3%
	6 to 10 ha	Count	5
		%	16.7%
	10 to 15 ha	Count	5
		%	16.7%
	15 to 25 ha	Count	4
		%	13.3%
	25 to 50 ha	Count	0
		%	0.0%
	Over 50 ha	Count	1
		%	3.3%

Characteristic	Category		Total
Age	Under 25	Count	1
		%	3.3%
	25 - 35	Count	1
		%	3.3%
	36 - 45	Count	8
		%	26.7%
	46 - 55	Count	18
		%	60.0%
	56 - 65	Count	0
		%	0.0%
	Above 65	Count	0
		%	0.0%
Employees	1 - 5	Count	10
		%	33.3%
	6 - 10	Count	2
		%	6.7%
	11 - 20	Count	7
		%	23.3%
	21 - 35	Count	6
		%	20.0%
	36 - 50	Count	3
		%	10.0%
	51 - 75	Count	1
		%	3.3%
	76- 100	Count	0
		%	0.0%
	101 - 200	Count	0
		%	0.0%
	201 - 300	Count	1
		%	3.3%

Each respondent was additionally asked whether they are involved with decision-making about data within their firm and to disclose their function within the firm. Therefore, responses from decision-makers responsible for the use of the firm's data could be identified as valid responses. Based on these two questions, none of the respondents needed to be excluded from the research.

3.2.3 Macro business environment conditions

Organisations do not operate in a vacuum, but in a larger external context that can change spatially and temporally. All the respondents in this research have been selected around the same time and all operate in the Netherlands. Therefore, the respondents can be considered to deal with the same macro-environment situation or conditions which can influence an organisation's strategy. The macro business environment can be described by the acronym PEST which includes the political, economic, social and technological situation of an organisation (Gupta & Barua, 2016). The political factor refers to the impact of governments and politicians, and legislation; the economic factor refers to the macro-economic situation that the organisation deals with; the social factor refers to cultures and demographics; the technological factor refers to technological innovations external to the focal organisation. Researchers have often additionally considered environmental conditions referring to climate issues. It is important to note that these conditions are equal for the respondents at the time this research was conducted.

4 The factors relevant to data platform participation

In this chapter, literature will be discussed that will lead to the research perspective, or conceptual model. In chapter 2, participation in a IoT data platform is conceptualised as the adoption of a specific type of IOS. The relevant factors will be identified by means of a literature review. These factors will be structured and categorised by using a suitable framework. There is no universal list of factors that are important to IOS adoption. IS researchers adjust the list of factors to the context of the specific IOS. In this chapter, the same will be done by first looking at IOS adoption literature to distil the most common used factors. This list of factors will then be extended with possible relevant factors from literature on the core concepts of this research.

The resulting conceptual model will be essential to ultimately be able to determine the importance of ecosystem data governance relative to the other relevant factors. Within this chapter, the the research sub-question 1a will be answered first: *What theoretical framework is suitable to analyse the factors relevant to data platform participation according to scientific literature?* The most common used IS adoption frameworks will be discussed and the most suitable framework for this study will be chosen.

Thereafter, the relevant factors will be extracted from existing scientific literature on IOS adoption and the core concepts. These factors will be placed within the chosen framework. This will answer the the research sub-question 1b: *What factors are relevant to analyse the willingness of data providers to participate in a data platform according to scientific literature?* This chapter will be concluded with the resulting conceptual model.

4.1 IOS adoption frameworks

Within IS research on technology adoption, there are several different theories that aim to describe the adoption process of technology. The most common theories that are used are the technology acceptance model (TAM), theory of planned behaviour (TPB), unified theory of acceptance and use of technology (UTAUT), diffusion of innovation (DOI), and the technology-organisation-environment (TOE) framework (Oliveira & Martins, 2011).

In this research, the focus will be on the willingness to share data on a firm level, with data providing organisations as the unit of analysis. This only leaves the DOI and TOE framework as being applicable as the other frameworks are developed for analysis on an individual level (Oliveira & Martins, 2011). The decision to share data across the organisation's boundaries is a firm-level decision that is executed in an inter-organisational context. The TOE framework captures not only the technology and organisation context as discussed in DOI theory, but also the external environment or inter-organisational context, thus making it more complete. Furthermore, the TOE framework puts emphasis on the specific context in which the adoption process takes place. This framework has proved to provide a suitable theoretical perspective for both analysing the contextual factors and categorising these (Praditya et al., 2017; Rui, 2007).

The TOE framework has often been used in IS and innovation literature as a valuable framework to analyse the adoption of IT innovations at the firm level (Chau & Tam, 1997; Praditya et al., 2017; Rui, 2007). The framework has consistent empirical support and is tested and used by many researchers to study adoption in various IS domains: electronic data interchange (EDI) (Iacovou, Benbasat & Dexter, 1995; Kuan & Chau, 2001; Ramamurthy, Premkumar & Crum, 1999), e-business (Zhu et al., 2006; Zhu et al., 2003), inter-organisational information systems (IOS) (Grover, 1993), big data (Sun, Cegielski, Jia & Hall, 2016), RFID (Bhattacharya, Chu & Mullen, 2008), web services (Lippert & Govindrajulu, 2006), and open systems (Chau & Tam, 1997). However, the framework lacks the ability to provide a core set of factors or integrated conceptual framework to analyse IOS adoption. The important factors may differ for different kinds of innovations (Dedrick & West, 2004; Rui, 2007).

Consequently, IS researchers often use the TOE framework just as a taxonomy to categorise various contextual factors as it has been proven to be a useful analytical tool (Baker, 2012; Dedrick & West, 2004; Praditya et al., 2017). The framework provides the freedom to vary the factors to the context of the research as different types of innovations have different related factors that influence their adoption. This makes the framework very adaptable and popular amongst IS researchers (Baker, 2012; Dedrick & West, 2004; Rui, 2007). The high adaptability, allowance for contextual adjustment, and inclusion of the external environment context, have led to the decision to use the TOE framework as the theoretical foundation in this study in order to categorise the relevant factors.

4.1.1 TOE framework

The TOE framework is developed by Tornatzky and Fleischer in 1990 and provides a useful starting point to study the adoption of technological innovations (Baker, 2012; Praditya et al., 2017). A distinction is made between the following three aspects, or levels of analysis, of a organisation's context, to identify relevant factors: (a) technology, (b) organisation, and (c) external task environment.

The technology context refers to factors related to the technology or innovation that will be decided on for adoption. In the original TOE framework this includes the availability and characteristics of the innovation or technology. This context refers to the elements of the technological innovation itself.

The organisational context refers to characteristics and resources of the focal organisation. This context usually focuses on the organisation's availability of resources, processes, size, and capabilities. The organisation's processes in this context are related to the organisational culture and structure that influences successful adoption of innovation, rather than the willingness to adopt the innovation. In this research the focus is on the pre-adoption phase and therefore will only include factors in this context that are relevant to the willingness to adopt. The organisation's size is likewise a factor that is though to predict successful adoption. These factors reside from the diffusion of innovations theory, which studied factors that influence organisational innovativeness, rather than the adoption of a particular technology itself (Chwelos et al., 2001). Size is often also considered a proxy for the more detailed factors of the availability of technological, financial and human resources (Baker, 2012).

The external task environmental context in this research refers to the ecosystem and its actors, the presence or absence of technology service providers, and the regulatory environment of the organisation considering adoption. Organisations in the external task environment can influence other organisations to innovate or induce competition that stimulates the adoption of innovation (Baker, 2012). From now on, this category will be referred to as the 'environment'.

Figure 4.1: The three contexts within the conceptual model

4.2 IOS adoption literature

The literature reviews on IOS adoption by Bouchbout and Alimazighi (2008), Rui (2007) and Lippert and Govindrajulu (2006) served as the starting point for the snowballing method as was described in 3.1.1. In these papers, the researchers studied the adoption of IOS in a more generic matter whereas many other researchers have focused on adoption of one specific IS innovation, inherently adjusting the factors to the context of the studied IS innovation. Bouchbout and Alimazighi (2008) aimed to created a more generic model for identifying the critical factors affecting the decision on IOS adoption and use for supply-chain management within organisations. Their model was created by means of an literature review of the most used theories and models on IOS adoption. Rui (2007) likewise explored the most important factors having influence on a firm's adoption decision of general IS innovations. Based on the literature review of the most common used IOS adoption models in literature, Rui (2007) continued to develop a match-based framework for IOS innovation adoption. Lippert and Govindrajulu (2006) studied the influencing factors on IOS adoption in the context of web services. All three papers made use of the TOE framework to categorise the identified relevant factors.

4.3 Technology context

The technology context includes the factors related to the technology or innovation that are relevant to the firm in the adoption decision concerning the innovation (Baker, 2012). As discussed in section 2.2, the innovation that is considered in this research is a digital platform to exchange data within an ecosystem.

4.3.1 Benefits

The benefits of adoption is considered one of the most critical factors for the adoption process (Bouchbout & Alimazighi, 2008; Iacovou et al., 1995; Lippert & Govindrajulu, 2006; Rui, 2007). Many researchers studied and confirmed the importance of perceived benefits to the adoption of IOS technology (Chau & Tam, 1997; Chwelos et al., 2001; Iacovou et al., 1995; Kuan & Chau, 2001; Lippert & Govindrajulu, 2006; Mäkipää, 2006; Ramamurthy et al., 1999; Yang & Maxwell, 2011). The perceived benefits refer to the benefits that the adopting organisation believes to be able to achieve by adopting the technology. The benefits can be both tangible or intangible as was discussed in section 2.3.1 on how value can be extracted. Different researchers mentioned the relative advantage of the innovation instead of the benefits as an important factor (Rui, 2007). However, the relative advantage is expressed as whether the decision-maker perceives the innovation as being better than alternatives or the status-quo (Baker, 2012). This factor has been criticised as it can be interpreted as a "catch-all" variable in which any innovation characteristic can be placed. Therefore, the perceived or potential benefit of an innovation is considered to be more suitable for analysis as it is independent of the value conversion contingencies of the adopting firm (Rui, 2007).

4.3.2 Costs

Prior studies, especially in IOS and EDI adoption research, proved the importance of the costs of adopting the technology (Bouchbout & Alimazighi, 2008; Kuan & Chau, 2001; Premkumar & Ramamurthy, 1995; Rui, 2007). Investments may be needed to adopt the technology resulting in fixed and/or variable costs for the organisation. These costs could for example result from acquiring or improving hardware and software, training and educating personnel, paying for access to the platform or platform services, or the maintenance of technology (Bouchbout & Alimazighi, 2008; Kuan & Chau, 2001; Sun et al., 2016). The costs of adopting an innovation are subjectively-measured costs as these can be perceived different by different firms. Whereas to one firm the cost of adopting an innovation may be perceived as inexpensive, another firm they might consider the same costs as exorbitant.

4.3.3 Technology characteristics

Both the literature reviews of Bouchbout and Alimazighi (2008) and Rui (2007) mention that most researchers found the compatibility and complexity of the innovation to be significantly important. These factors, together with the previously mentioned relative advantage, originate from DOI theory (Dedrick & West, 2004; Rui, 2007). This theory mentions trail-ability and observability of the technology as well. However, Tornatzky and Klein (1982) showed that these two characteristics show no relevance to adoption behaviour.

The *compatibility*, or ease of integration, is an important factor for IS adoption. When little effort is needed to integrate the technology or way of working with current systems, organisations have been found to be more likely to adopt the technology (Bouchbout & Alimazighi, 2008; Kuan & Chau, 2001; Ramdani, Kawalek & Lorenzo, 2009; Rui, 2007). The compatibility refers to what extent the innovation is in line with the values or norms, and existing practices of potential adopters (Rui, 2007). Lippert and Govindrajulu (2006) mentioned the term deployability in their paper on web services adoption. With deployability they refer to the ease of integration of the system with current practices of the focal firm, which is equal to the compatibility referred to in other literature.

The *complexity*, or ease of use, of the technology is similarly considered important to adoption of IS innovation (Bouchbout & Alimazighi, 2008; Chwelos et al., 2001; Kuan & Chau, 2001; Ramdani et al., 2009; Rui, 2007). The complexity of the technology indicates how easy the adopter can use the technology, and therefore influences the intent to adopt the technology as easier to use technology is often more likely to be adopted by organisations.

More recent studies on IOS adoption also mention the *security* of the technology to be very important for the decision of the organisation to adopt the technology (Bouchbout & Alimazighi, 2008; Fu, Chang, Ku, Chang & Huang, 2014; Lippert & Govindrajulu, 2006; Yang & Maxwell, 2011). The importance of the security of data was previously discussed in section 2.5. Compromising the security of the platform and data can have large and costly impact on the adopting organisation, such as a loss of competitive advantage or damage to operations when data has been tampered with (Lippert & Govindrajulu, 2006). The security of data refers to the guarantee of the confidentiality, integrity and availability (CIA) of the data (D. Chen & Zhao, 2012).

The *scalability* of the technology is found important by Bouchbout and Alimazighi (2008) for IOS systems. The scalability refers to how easy it is to adjust the IOS in terms of system size, scope, and/or function. This can especially be important when taking in account how quick the global amount of IoT data and data in general is growing (see section 1). It will become even easier and cheaper for organisations to collect data in the future. Consequently, this could make the scalability a decisive factor in the decision of organisations to participate in a data platform.

In addition, the *reliability* of the technology is another factor that is considered to be important to the adoption of the technology by some researchers (Bouchbout & Alimazighi, 2008; Lippert & Govindrajulu, 2006). Bouchbout and Alimazighi (2008) refers to reliability of the network of the IOS in their paper. Network reliability has been found to be critical to organisations that are involved in B2B electronic commerce over the Internet. Within the context of a data platform, the reliability will not only refer to the network, but the platform itself as well. The reliability can be interpreted as the trust an organisation has in the technology or innovation to be available at all times and to function properly. Resolving both security and reliability issues are considered key in the adoption of web services (Lippert & Govindrajulu, 2006).

4.3.4 Conclusion

In literature, the following factors related to the technology were identified to be relevant to the adoption of the technology: benefits, costs, complexity, compatibility, reliability, scalability, and security. In the context of this research each of these factors are added to the technology category in the conceptual model.

Table 4.1: Factors within the Technology context

Technology		
Factor	Description	References
Benefits	Benefits that can be achieved by the organisation by adopting the data platform	Bouchbout and Alimazighi (2008), Chau and Tam (1997), Chwelos, Benbasat and Dexter (2001), Iacovou, Benbasat and Dexter (1995), Kuan and Chau (2001), Lippert and Govindrajulu (2006), Mäkipää (2006), Ramamurthy, Premkumar and Crum (1999), Rui (2007), Yang and Maxwell (2011)
Costs	Fixed and variable costs for the organisation related to the adoption of the data platform	Bouchbout and Alimazighi (2008), Kuan and Chau (2001), Premkumar and Ramamurthy (1995), Rui (2007)
Complexity	The ease of use of the data platform to the adopting organisation	Bouchbout and Alimazighi (2008), Chwelos, Benbasat and Dexter (2001), Kuan and Chau (2001), Ramdani, Kawalek and Lorenzo (2009), Rui (2007)
Compatibility	Extent to which the data platform is in line with the technology, values or norms, and existing practices of the organisation	Bouchbout and Alimazighi (2008), Kuan and Chau (2001), Lippert and Govindrajulu (2006), Ramdani, Kawalek and Lorenzo (2009), Rui (2007)
Reliability	Availability and continuous proper functioning of the data platform	Bouchbout and Alimazighi (2008), Lippert and Govindrajulu (2006)
Scalability	Ease to adjust the data platform in terms of system size, scope, and/or function	Bouchbout and Alimazighi (2008)
Security	Guarantee of the confidentiality, integrity and availability of the data platform	Bouchbout and Alimazighi (2008), Fu, Chang, Ku, Chang and Huang (2014), Lippert and Govindrajulu (2006), Yang and Maxwell (2011)

4.4 Organisational context

The organisational context refers to the internal situation at the focal firm that is considering the adoption of the technology (Baker, 2012; Kuan & Chau, 2001). The characteristics of the organisational context can influence the data sharing behaviour of the organisation, e.g. if the organisation believes it is not capable to perform certain tasks. When an organisation perceives itself to be unable to perform the task of sharing data due to a lack of organisational readiness, the organisation could be unwilling to share data to prevent failure or loss of image (Sun et al., 2016). Not only is it important that benefits can be perceived by the organisation, but the organisation should also be able to achieve the benefits with the allotted resources (Kuan & Chau, 2001). The organisational factors reflect the availability of internal resources, or organisational readiness (Iacovou et al., 1995), of the adopting firm. Prior IS adoption research made a distinction in organisational readiness between the availability of technological, financial, and human resources (Rui, 2007). An organisation is believed to increase its willingness to share data when it has the perception that the organisational resources are sufficient to actually adopt the IS, achieve the benefits and cope with the costs (Bouchbout & Alimazighi, 2008; Kuan & Chau, 2001; Mäkipää, 2006).

4.4.1 Technological readiness

The *technological readiness* or availability of technological resources is considered important by many IS adoption researchers (Grover, 1993; Kuan & Chau, 2001; Premkumar & Ramamurthy, 1995; Rui, 2007; Zhu et al., 2003). Organisations that already employ highly sophisticated technology and possess suitable technological infrastructure would likely need to change less technology within the company to be able to participate in a data platform. Moreover, the technological readiness also reflects the data collection practices within the company.

The data collection impacts the quality of the data. As was discussed in section 2.6, the quality of the data refers to the ability of the data to satisfy its usage requirements and can be measured by its accuracy, timeliness, relevance, completeness, trustworthiness and contextual definition (Cheong & Chang, 2007). Organisations that have access to the required technological resources such as hardware, high quality data, and suitable data management practices are more likely to adopt new IS technology.

4.4.2 Financial readiness

The *financial readiness* of the organisation is considered important (Bouchbout & Alimazighi, 2008; Grover, 1993; Kuan & Chau, 2001; Premkumar & Ramamurthy, 1995; Rui, 2007; Zhu et al., 2003). Often IS adoption researchers mention the size of the organisation as important, which refers to larger organisations have more available resources to allocate. The financial readiness reflects the organisation's available financial resources to allocate to the adoption of the IOS. Some organisations might have enough financial resources readily available to allocate to the adoption of IOS innovation, whereas other organisation might have to find financial support to investment the money. Financial resources can be necessary to pay for example for installation costs, changes to existing systems for implementation, and ongoing expenses whilst using the IOS.

4.4.3 Human readiness

The *human readiness* reflects the organisation's ability concerning IT usage and IT management. The more sophisticated a firm is in IT usage and management, the less likely are they to feel intimidated by the technology (Rui, 2007). This factors thus reflects the presence of sufficiently technically-skilled human resources within the focal firm. The availability of employees that are able to use the technology will likely increase the willingness of the adopting firm to adopt the technology. The IS knowledge and IT expertise of the employee needs to be sufficient so that no training of existing employees, or recruiting new employees with the required knowledge and expertise is necessary (Chau & Tam, 1997; Rui, 2007; Zhu et al., 2003).

4.4.4 Conclusion

In literature, the following factors related to the organisation were identified to be relevant to the adoption of the technology: technological readiness, financial readiness, human readiness. In the context of this research, each of these factors are added to the conceptual model.

Table 4.2: Factors within the Organisation context

Organisation		
Factor	Description	References
Technological readiness	Availability of internal technological resources	Grover (1993), Iacovou, Benbasat and Dexter (1995), Kuan and Chau (2001), Premkumar and Ramamurthy (1995), Rui (2007), Zhu, Xu and Dedrick (2003)
Financial readiness	Availability of internal financial resources	Bouchbout and Alimazighi (2008), Grover (1993), Iacovou, Benbasat and Dexter (1995), Kuan and Chau (2001), Premkumar and Ramamurthy (1995), Rui (2007), Zhu, Xu and Dedrick (2003).
Human readiness	Availability of internal human resources	Chau and Tam (1997), Iacovou, Benbasat and Dexter (1995), Rui (2007), Zhu, Xu and Dedrick (2003)

4.5 External task environment context

The external task environment context refers to the environment that the adopting firm is part of (Baker, 2012; Kuan & Chau, 2001). Organisations operate in an environment rather than alone in a vacuum as was discussed in section 2.3. The environment provides both opportunities and imposes constraints to the organisation (Rui, 2007).

4.5.1 Trading partners

IOS adoption studies have identified several characteristics related to trading partners that are considered to be relevant to the decision to adopt the IOS. The inter-organisational relationship is described by researchers as socio-political processes regarding the transaction climate and the power-dependence in relationships (Rui, 2007). In the context of traditional IOS, such as EDI, the trading partner is the party that is receiving the data or information from the focal firm. However, in the context of a digital platform that comprises an ecosystem of actors, they are more different types of actors involved. In section 2.4 were the roles of the parties that are involved in a data-based ecosystem explained. A distinction was made between the roles to result in three different groups of actors: the data providers, the data ecosystem enabling actors, and the application users. The data provider is the unit of analysis in this research, or focal firm in the model. The trading partners will be considered to belong to one of the two remaining groups: the (data ecosystem) enabling actors and the application users.

Trust in the trading partner and the readiness of the trading partner are considered most important (Bouchbout & Alimazighi, 2008; Fu et al., 2014; Hart & Saunders, 1997; Lippert & Govindrajulu, 2006; Madlberger, 2008; Mäkipää, 2006; Rui, 2007; Sun et al., 2016; Yang & Maxwell, 2011; Zhu et al., 2003). Trust refers to the belief of the organisation that the trading partner will refrain from expected or unexpected actions that will harm the organisation (Bouchbout & Alimazighi, 2008). Interconnectedness and shared fate are important for a business ecosystem to operate. The shared fate or trust can be seen as the driver of knowledge sharing and co-operative behaviour. Ecosystems are dynamic, as they can change over time, making this is an important factor of an ecosystem to consider (Dawes, Vidiasova & Parkhimovich, 2016).

A trading partner's *readiness* refers to the same parts of organisational readiness as discussed in section 4.4. The trading partner's readiness will reflect he willingness and ability of the trading partner to succeed in its role in the data-based ecosystem (Bouchbout & Alimazighi, 2008). In the context of inter-organisational collaboration, the *relative power* of the trading partners is proved to be important as well (Madlberger, 2008; Mäkipää, 2006). Studies on EDI adoption also confirmed that the relative power of the trading partner is a critical factor to EDI adoption (Hart & Saunders, 1997). When the trading partner is relatively powerful, meaning that it can influence the industry or impose actions on other organisations, data providing organisations could oppose to cooperate. Firms with a weaker position in the inter-organisational relationship may be unwilling to share their data with the more powerful organisation in order to avoid them increasing their power even more.

More powerful parties may put pressure on less powerful firms to adopt the IOS or lose business due to it not being a part of the network (Rui, 2007). The coercion to adopt an IS is called *external pressure* and could be experienced due to pressure from competitors, partners, consumers, industry, government or any other entity in the macro environment (Iacovou et al., 1995).

4.5.2 Regulation

The *regulations* set by government institutions is another factor that is mentioned by Lippert and Govindrajulu (2006). Regulations can result in either barriers or incentives to technology adoption. When the regulations regarding the collection, distribution, and processing of data would require the adoption of specialised standards this could for example lead to additional effort or costs to adhere to the regulations. Organisations that fail to be compliant to regulations could also face potential legal outcomes. Furthermore, governments can encourage adoption of innovations by developing beneficial business and tax laws (Lippert & Govindrajulu, 2006).

4.5.3 Ecosystem data governance

Ecosystem data governance is added as a new factor as it was not yet mentioned in other literature on IOS adoption. However, in the context of sharing data with an ecosystem by means of a digital platform, the ecosystem data governance is considered to be vital for the success of the ecosystem as multiple parties participate in contributing, processing and using data (S. U. Lee et al., 2017). The ecosystem data governance can be seen a part of the ecosystem around the platform that can alter the decision of potential data platform participants. The concept of ecosystem data governance was further elaborated on in section 2.6.

As this research aims to make a contribution to literature on ecosystem data governance in the context of ecosystem platforms, three sub-factors that are part of ecosystem data governance will be included in the conceptual model as well. This will allow to not only derive the relative importance of ecosystem data governance, but also the relative importance of the sub-factors and therefore provide a better understanding which aspects of ecosystem data governance are considered important by data providers. The sub-factors that have been added are: the governance mode, the governance domain of data ownership & access, and the governance domain of data usage.

4.5.4 Conclusion

In literature, the following factors related to the environment were identified to be relevant to the adoption of the technology: trading partner's readiness, trust in trading partner, relative power of trading partner, external pressure, and regulation. These were adopted to the context of sharing IoT data by distinguishing between (data ecosystem) enabling parties and application users as the trading partners in the ecosystem. Furthermore, ecosystem data governance was added to the conceptual model due to the claimed importance of ecosystem data governance to the success of platform ecosystems when multiple parties participate in contributing, processing and using data. Three aspects of ecosystem data governance have been added to the model: the governance mode, the governance of data ownership & access, and the governance of data usage.

Table 4.3: Factors within the Environment context

Environment		
Factor	Description	References
Application user readiness	Application user's availability of organisational resources to be able to fulfil role in the platform ecosystem successfully	Bouchbout and Alimazighi (2008), Lippert and Govindrajulu (2006), Sun, Cegielski, Jia and Hall (2016)
Enabling party readiness	Enabling party's availability of organisational resources to be able to fulfil role in the platform ecosystem successfully	Same as for 'Application user readiness'
Trust in application user	Belief of the organisation that the application user will refrain from expected or unexpected actions that will harm the organisation	Bouchbout and Alimazighi (2008), Fu, Chang, Ku, Chang and Huang (2014), Hart and Saunders (1997), Lippert and Govindrajulu (2006), Madlberger (2008), Mäkipää (2006), Rui (2007), Sun, Cegielski, Jia and Hall (2016), Yang and Maxwell (2011), Zhu, Xu and Dedrick (2003)
Trust in enabling party	Belief of the organisation that the enabling party will refrain from expected or unexpected actions that will harm the organisation	Same as for 'Trust in application user'
Relative power of application user	Application user's influence on the industry or ability to impose actions on other organisations	Bouchbout and Alimazighi (2008), Hart and Saunders (1997), Madlberger (2008), Mäkipää (2006)
Relative power of enabling party	Enabling party's influence on the industry or ability to impose actions on other organisations	Same as for 'Relative power of application user'
External pressure	Coercion experienced from competitors, partners, consumers, industry, or government to adopt the data platform	Iacovou, Benbasat and Dexter (1995), Lippert and Govindrajulu (2006), Rui (2007), Sun, Cegielski, Jia and Hall (2016)
Regulation	Governmental regulations regarding the collection, distribution, and processing of data	Lippert and Govindrajulu (2006)
Ecosystem data governance	Governance decisions on data ownership & access and data usage, as well as the structure of the governance in the ecosystem	Own contribution. Important role stressed by S. U. Lee, Zhu and Jeffery (2017), Schreieck, Hein, Wiesche and Krcmar (2018), van den Broek and van Veenstra (2018)

4.6 Conceptual model

In this chapter, first the research questions 1A was answered: *What theoretical framework is suitable to analyse the factors relevant to data platform participation according to scientific literature?* The most common used IS adoption frameworks have been discussed and the TOE framework has been chosen as the suitable framework to use in this research.

Thereafter, the research question SQ1b was answered: *What factors are relevant to analyse the willingness of data providers to participate in a data platform according to scientific literature?* From existing scientific literature on IOS adoption and the core concepts, the relevant factors to data platform participation were identified. These factors have been placed within the TOE framework on multiple levels of analysis: technology, organisation, and environment.

The conceptual model for this research consists of the factors that are expected to be relevant to the willingness of data providers to participate in a data platform ecosystem. The dependent variable in the conceptual model is the willingness of the data provider to participate in a data platform ecosystem.

The following conceptual model has been composed as a result of the literature review.

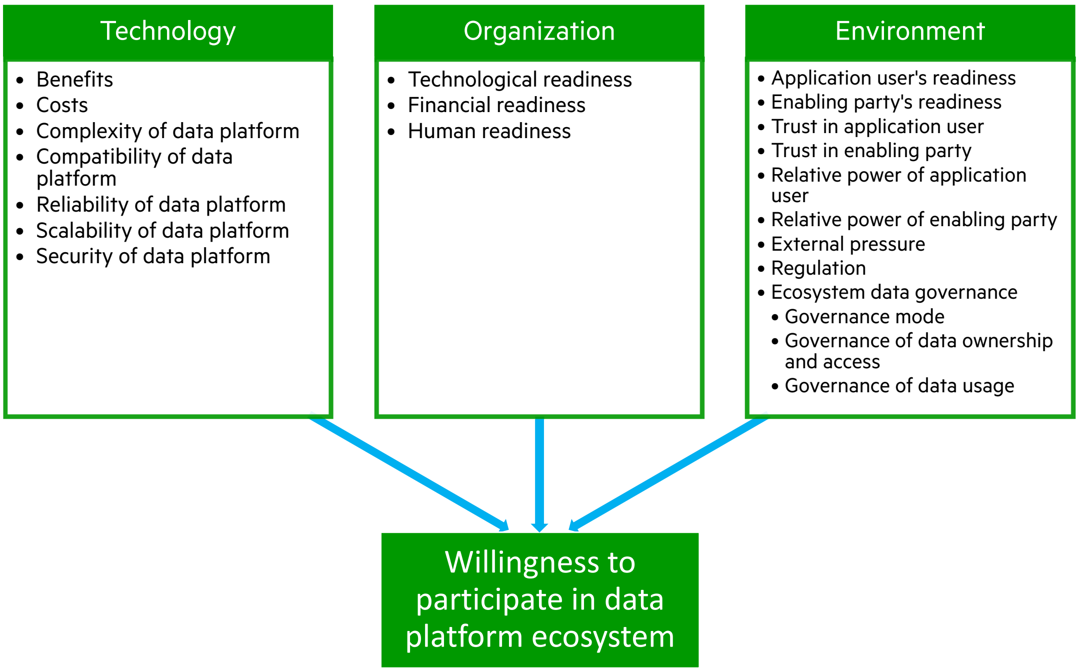


Figure 4.2: The conceptual model

5 | The relative importance of the factors

In this chapter, first research sub-question 1c will be answered: *What is the relative importance of each of the identified relevant factors to data platform participation willingness according to data providers in Dutch horticulture?* The conceptual model, as formed in chapter 4, was tested by means of a survey to determine the weights of the relevant factors in the model. As mentioned before in section 3.1.3, the BWM method was chosen to be applied to the collected data in order to answer this research sub-question.

The respondents of the survey and their characteristics will be presented and analysed on representativeness. This will help to later on be able to discuss the generalisability of the results. After the respondent characteristics, the survey data will be analysed using the BWM method to derive the weights of the categories and the individual factors. The results and reliability of the BWM analysis will be presented and interpreted. Thereafter, differences between the results of respondents based on the classification data will be discussed. A distinction will be made based on current data sharing activity and type of crop. The purpose of this analysis is to gain insight in a quantitative manner on the relative importance of the factors in the conceptual model.

In the second part of this chapter, the drivers and barriers to data platform participation will be discussed that are experienced by horticulturists. This will answer the second research question: *What concerns, related to the relevant factors for data platform participation, do IoT data providers in Dutch horticulture have?* As was discussed in chapter 3, the chosen method to answer this question is semi-structured face-to-face interviews with horticulturists.

5.1 Results of BWM

The input from each individual respondent is processed to derive their corresponding weights. By taking the mean of the weights for each factor as derived from each respondent, a single weight vector is obtained. In this section, the mean single weight vectors of the local and global weights will be presented along with the standard deviations and median values to indicate the central tendency of the weights. As will later on be shown, the distributions are often skewed and outliers exist in the results. Therefore, reporting the median is useful as a measure of central tendency as well. The standard deviation indicates the variation of the weights among the respondents. The input for the BWM calculations can be found in Appendix B. A table with the BWM results from each individual respondent can be found in Appendices D (local) and F (global). As was explained earlier in section 3.1.3, the mean values that are reported for each set of comparisons add up to 1. The values can therefore be interpreted as the share each component has in the decision for the group they belong to. In case of the comparison between categories, the weights represent the share each category has in the willingness of data platform participation. For the individual factors within each category, the local weights will represent the share of the factor for data platform participation willingness within the corresponding category. In table 5.1, the frequencies are presented of the categories and factors chosen as the most or least important within the corresponding comparisons.

Table 5.1: Frequency of categories and factors chosen most and least important in the survey

	Factor	Chosen as most important	Chosen as least important
Main categories	Technology	14	1
	Organisation	7	21
	Environment	9	8
Within Technology	Benefits	22	2
	Costs	0	12
	Complexity	2	0
	Compatibility	0	11
	Reliability	1	1
	Scalability	0	3
	Security	6	1
Within Organisation	Technological readiness	14	9
	Financial readiness	7	9
	Human readiness	9	12
Within Environment	Application user's readiness	3	2
	Enabling party's readiness	2	1
	Trust in application user	10	0
	Trust in enabling party	3	0
	Relative power of application user	2	1
	Relative power of enabling party	3	3
	External pressure	0	13
	Regulation	0	10
	Ecosystem data governance	7	0
Within Ecosystem data governance	Governance mode	2	21
	Governance of data ownership & access	21	5
	Governance of data usage	7	4

5.1.1 Category weights

As the factors are categorised in three groups (Technology, Organisation, and Environment), first the local weights of the categories themselves were derived. These weights will later on be used to calculate the global weights of each of the relevant factors by multiplying the weight of the category with the local weight of the individual factor. The technology category is considered the most important category by 14 respondents. A total of 7 respondents considered the organisation category as the most important, whereas 9 of the respondents considered the environment to be the most important. The decision on which category is the most important is therefore not unanimous, but shows a slight preference towards the technology category. The technology, organisation, and environment categories were chosen as the least important a total of 1, 21, and 8 times respectively. The weights of the categories are shown in table 5.2, whereas a visual representation is provided in figure 5.1. The individual local weights of the categories of all respondents are shown in Appendix D.

Table 5.2: Results of BWM - categories mean weights

	Technology	Organisation	Environment	ξ^L
Mean	0.4012	0.2308	0.3680	0.1356
SD	0.2285	0.2401	0.2443	0.0880
Median	0.3777	0.1000	0.3069	0.1065

The standard deviations indicate that there is considerable volatility in the weights by the individual respondents. However, based on the median values, the order of importance remains the same. All three median values are lower than the mean, indicating a positively skewed distribution for each of the category weights. Out of all the category comparisons by the respondents, only one respondent made a fully consistent comparison (#20). The mean of comparisons is not fully consistent as is indicated by the mean ξ^L value of .1356. However, this value implies good consistency of the comparison mean.

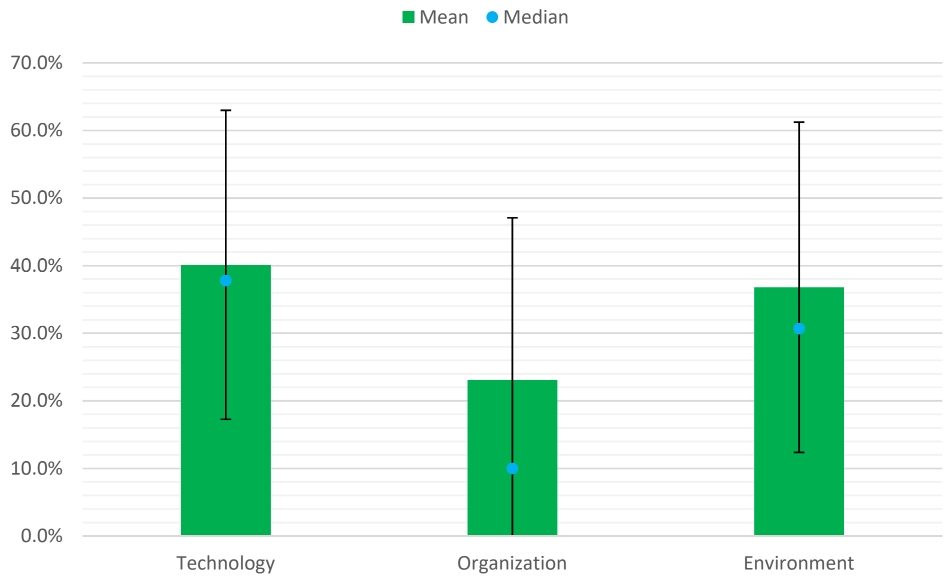


Figure 5.1: Results of BWM - categories mean weights

5.1.2 Technology context: local weights

The individual local weights of the factors in the technology context are shown in table 5.3, whereas figure 5.2 provides a visual interpretation. The individual local weights of the factors in the technology context of all respondents are shown in Appendix D. The highest ranking factor is the benefits, which is chosen 22 times as the most important within this category. Security was the second most chosen factor as most important (6 times). The costs (12) and compatibility (11) were the most often chosen as the least important within this category.

Table 5.3: Results of BWM - technology mean local weights

	Benefits	Costs	Complexity	Compatibility	Reliability	Scalability	Security	ξ^L
Mean	0.2585	0.0863	0.1660	0.0721	0.1231	0.0844	0.2097	0.0900
SD	0.0923	0.0825	0.0757	0.0452	0.0531	0.0318	0.0903	0.0368
Median	0.2611	0.0486	0.1538	0.0680	0.1132	0.0814	0.2285	0.0833

The standard deviations for these factors indicate considerable volatility in the weights by the individual respondents as well. Based on the median values, the order of importance remains the same. The median values of the benefits and security are slightly higher than the mean, indicating a slightly negatively skewed distribution. The median value for the other factors are all slightly lower, indicating a slightly positively skewed distribution. There are no respondents with a fully consistent comparison within this category. The mean of these comparisons were therefore not fully consistent either. However, with a mean ξ^L value of .0900 the comparison mean can be considered very consistent.

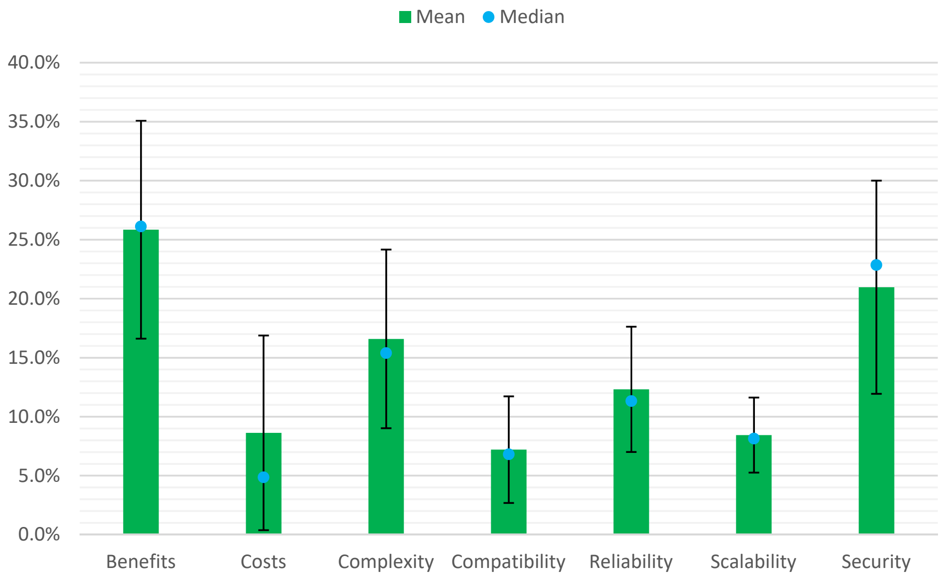


Figure 5.2: Results of BWM - technology mean local weights

5.1.3 Organisation context: local weights

The mean local weights, standard deviations and median weights within the organisation context are presented in table 5.4, whereas figure 5.3 provides a visual interpretation. The individual local weights of the factors in the organisation context of all respondents are shown in Appendix D. The respondents consider their own technological readiness the most important factor within the organisation context based on the mean weights. The technological readiness is chosen 14 times as the most important and 9 times as the least important. Financial readiness is chosen 7 times as the most important and 9 times as the least important. Human readiness is chosen 9 times as the most important and 12 times as the least important. This shows that there is large variety among the respondents on which factors are considered most and least important.

Table 5.4: Results of BWM - organisation mean local weights

	Technological Readiness	Financial readiness	Human readiness	ξ^L
Mean	0.4039	0.2825	0.3136	0.1196
SD	0.2448	0.1995	0.2335	0.0882
Median	0.3333	0.2325	0.2444	0.1213

The standard deviations for these factors indicate considerable volatility in the weights by the individual respondents. Based on the median values, the order of importance remains the same. The median values are lower than the mean for all three factors, indicating a slightly positively skewed distribution. There are four respondents with fully consistent comparisons (#2, 18, 21 and 27). For the mean of this comparison, the ξ^L value is .138. This indicates again good consistency of the comparison mean.

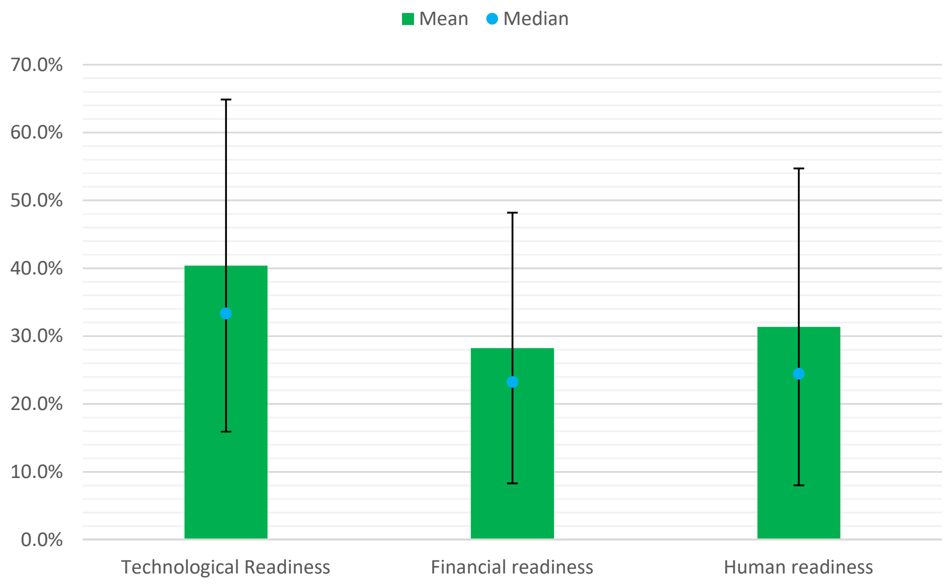


Figure 5.3: Results of BWM - organisation mean local weights

5.1.4 Environment context: local weights

The individual local weights of the factors in the environment context are shown in table 5.5. In figure 5.4 a visual interpretation is presented. The individual local weights of the factors in the environment context of all respondents are shown in Appendix D. Trust in the application user is considered the most important within this context. This factor is also chosen as the most important within this category (10 times). Ecosystem data governance was chosen 7 times as the most important and is also assigned the second highest weight within this category, just slightly above trust in the enabling party. External pressure (13) and regulation (10) have been most often chosen as the least important within this category. This again shows variety among the respondents on which factors are the most and least important.

Table 5.5: Results of BWM - environment mean local weights

	Application user's readiness	Enabling party's readiness	Trust in application user	Trust in enabling party	Relative power of application user
Mean	0.1095	0.1253	0.1733	0.1496	0.0931
SD	0.0769	0.0507	0.0744	0.0650	0.0519
Median	0.0883	0.1177	0.1748	0.1334	0.0802

	Relative power of enabling party	External pressure	Regulation	Ecosystem data governance	ξ^L
Mean	0.0810	0.0381	0.0638	0.1545	0.0826
SD	0.0478	0.0410	0.0470	0.0848	0.0307
Median	0.0737	0.0398	0.0499	0.1493	0.0769

The standard deviations for these factors indicate considerable volatility in the weights by the individual respondents. Based on the median values, the order of importance remains the same. The median value of trust in the application user is slightly higher than the mean, indicating a slightly negatively skewed distribution. The median value for the other factors are all slightly lower, indicating a slightly positively skewed distribution. There are no respondents with a fully consistent comparison within this category. Therefore, the mean of these comparisons are not fully consistent either. However, with a mean ξ^L value of .083 the mean of the comparisons can be considered to be very consistent, or reliable.

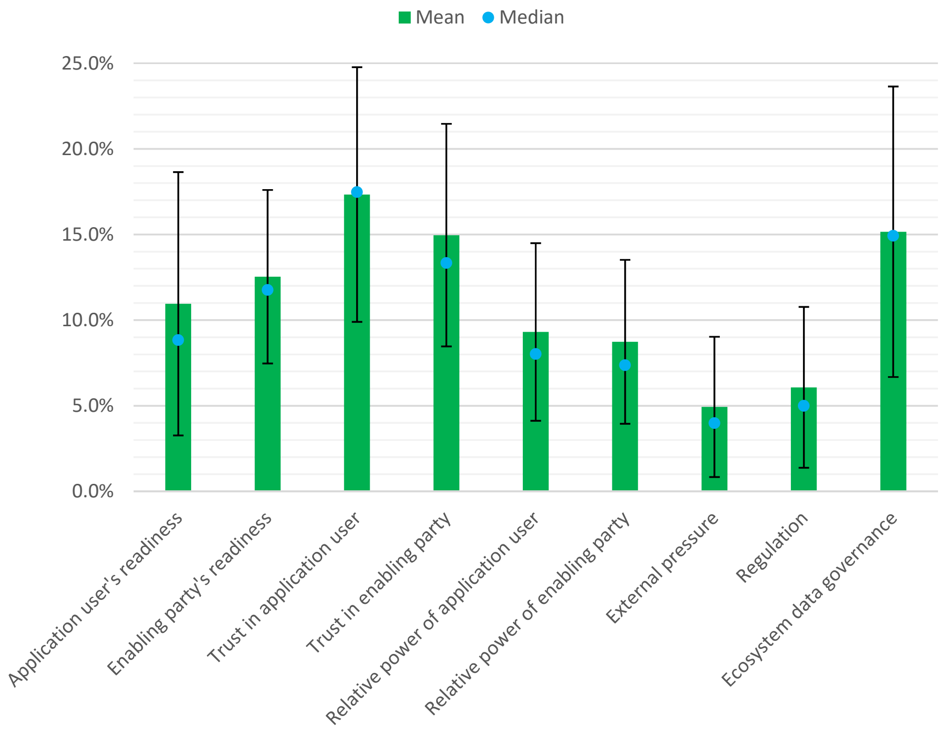


Figure 5.4: Results of BWM - environment mean local weights

5.1.5 Ecosystem data governance: local weights

Ecosystem data governance had already been assigned a local weight of .150 within the environment context. However, as three sub-factors are included in the conceptual model, local weights have also been derived for those sub-factors. These sub-factors are the ecosystem data governance mode, the governance domain of data ownership & access, and the governance domain of data usage. The results of the BWM calculations are shown in table 5.6, whereas figure 5.5 provides a visual interpretation. The individual local weights of the sub-factors of ecosystem data governance of all respondents are shown in Appendix D. The domain of data ownership & access is considered the most important and is chosen as most important 21 times. The governance mode is considered to be the least important sub-factor of ecosystem data governance and is chosen to be the least important 21 times.

Table 5.6: Results of BWM - ecosystem data governance mean local weights

	Governance mode	Governance of data ownership & access	Governance of data usage	ξ^L
Mean	0.1857	0.4457	0.3686	0.1016
SD	0.1508	0.1915	0.1740	0.0982
Median	0.1111	0.4702	0.3864	0.0787

The standard deviations for these factors again indicate considerable volatility in the weights by the individual respondents. Based on the median values, the order of importance remains the same. The median values of 'governance of data ownership & access' and 'governance of data usage' are slightly higher than the mean, indicating a slightly negatively skewed distribution. The median value for the 'governance mode' is lower than the mean, indicating a slightly positively skewed distribution. Within this group, the comparisons of six respondents are fully consistent (#8, 11, 13, 14, 20 and 24). The mean ξ^L value of .132, implies good consistency of the mean of the comparisons.

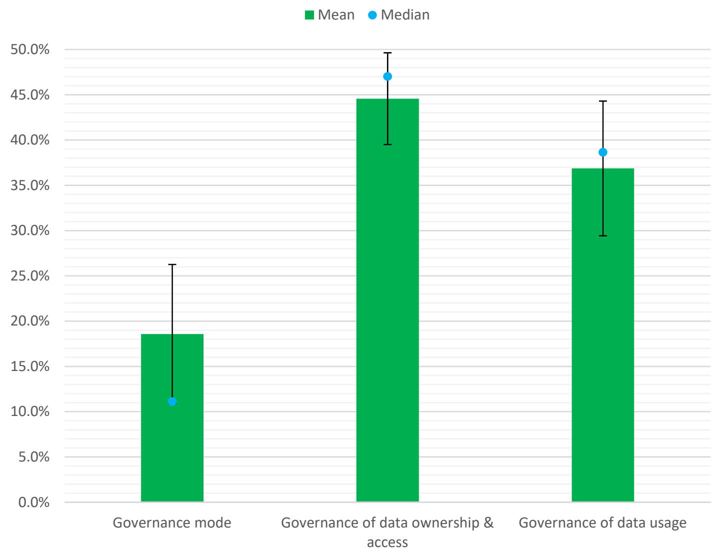


Figure 5.5: Results of BWM - ecosystem data governance mean local weights

5.1.6 Global weights

When the local weights of the individual factors are multiplied with the local weights of the categories, the global weights of the factors are derived. This is done for all respondents individually to derive the global weights corresponding to their input of the BWM survey. The global weights make it possible to directly put all the factors beside each other to see how important they are relatively to each other, from the decision-maker's perspective. Similarly as done with the local weights, the mean is calculated of the global weights of the individual respondents to derive a single global weight vector. The global weights are shown in table 5.7, whereas figure 5.6 provides a visual interpretation. The individual global weights of the factors in the organisation context of all respondents are shown in Appendix D. The benefits are considered the most important (.1055) by a small margin over human readiness (.0890). Ecosystem data governance ranks 7th with a global weight of .0569. The least important factors are compatibility (.0296), regulation (.0247), and external pressure (.0200).

Table 5.7: Results of BWM - global weights of categories and factors

Main categories	Category weight	Factors	Mean global weights	SD	Median
Technology	0.4012	Benefits	0.1055	0.0763	0.0823
		Costs	0.0306	0.0355	0.0167
		Complexity	0.0736	0.0601	0.0670
		Compatibility	0.0296	0.0270	0.0192
		Reliability	0.0493	0.0321	0.0520
		Scalability	0.0321	0.0203	0.0239
		Security	0.0805	0.0558	0.0588
Organisation	0.2308	Technological Readiness	0.0860	0.1134	0.0502
		Financial readiness	0.0558	0.0634	0.0394
		Human readiness	0.0890	0.1391	0.0213
Environment	0.3680	Application user's readiness	0.0338	0.0265	0.0213
		Enabling party's readiness	0.0418	0.0279	0.0352
		Trust in application user	0.0658	0.0531	0.0539
		Trust in enabling party	0.0533	0.0386	0.0419
		Relative power of application user	0.0375	0.0442	0.0244
		Relative power of enabling party	0.0343	0.0368	0.0220
		External pressure	0.0200	0.0308	0.0135
		Regulation	0.0247	0.0341	0.0129
		Ecosystem data governance	0.0569	0.0511	0.0385

As can be observed in table 5.7 and figure 5.6, the standard deviations of the factors are large and indicate a large variation in global weights amongst the respondents. This is partly due to the variation of the categories resonating in the global weights as well as the variation in the local weights. For most factors, the medians are fairly close to the mean. With the exception of the factor reliability, all factors show a positively skewed distribution as the median is lower than the mean. Especially the median values of technological readiness and human readiness are much lower than the mean, as the median is lower than the mean with 42% and 76% respectively. Both these factors also show the largest standard deviation and have a coefficient of variation of 132% and 156% respectively. Based on the median values, the ranking of importance of the factors changes compared to the ranking based on the mean.

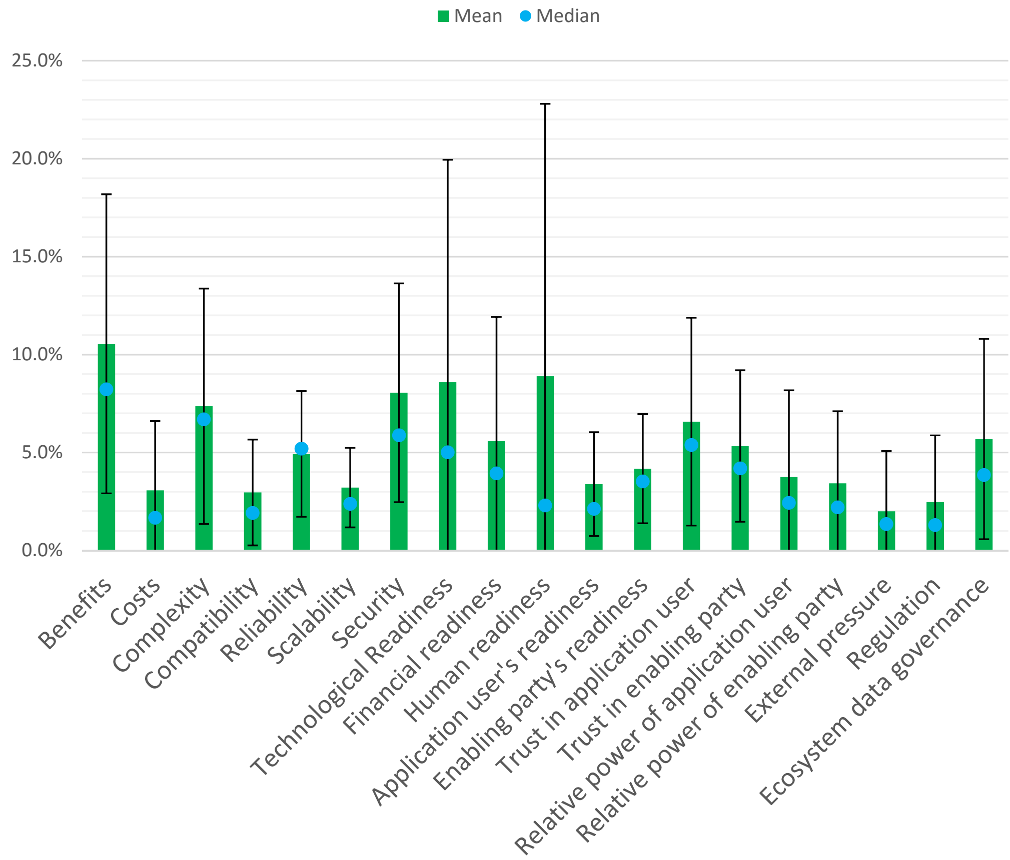


Figure 5.6: Results of BWM - mean global weights

5.1.7 Consistency

The aggregated consistency indicators have all shown good consistency as was discussed per comparison. The individual consistency indicators per comparison and per respondent are shown in Appendix E. The closer the consistency indicator is to 0, the more consistent the comparison is, whereas a value of 0 indicates a fully consistent comparison. However, as was discussed previously in section 3.1.3, BWM does not include a threshold value for the consistency indicator, but other researchers often have considered a value below 0.25 to represent good consistency. As the results of the BWM weights being aggregated, higher values on the individual level will not degrade the results as long as the aggregate consistency can be considered good. In the consistency table in Appendix E, comparison 1 refers to the comparison between the categories, comparison 2 to the comparison within the technology category, comparison 3 to the comparison within the organisation category, comparison 4 to the comparison within the environment category, and comparison 5 to the comparison between the sub-factors of ecosystem data governance.

5.2 Classification comparison

The data is analysed with regard to two different confounding variables extracted from the classification data provided by the respondents. The respondents were asked to indicate their current data sharing activity and type of crop that they grow. The data is analysed with regard to those two classifications to see if there are any differences within the survey sample. As described in section 3.1.4, two-tailed Mann-Whitney U tests were performed to analyse the differences between groups of respondents.

5.2.1 Data sharing activity

First, the BWM results are analysed with regard to the the current data sharing activity of the respondents. The respondents indicated whether they currently are sharing IoT data on LetsGrow, on another data platform, by means other than a data platform, or are not sharing IoT data. If the respondent indicated that he or she is not sharing IoT data, the respondent was additionally asked whether they are currently willing to do so or not. Based on this information, the respondents have been classified as 'sharing data' or 'not sharing data'. In total 19 respondents are classified as sharing, whereas the other 11 are classified as not sharing.

Table 5.8: Mann-Whitney U test results categories - sharing vs non-sharing

Category	Exact Sig. (2-tailed)
Technology	0.2450
Organisation	0.5458
Environment	0.1554

In table 5.8 are the Mann-Whitney U test results shown for the categories. None of the p-values are below 0.05, indicating no significant difference between the groups. In table 5.9 are the Mann-Whitney U test results shown for the local factors. Again, none of the p-values are below 0.05, indicating no significant difference between the two groups.

Table 5.9: Mann-Whitney U test results local factors - sharing vs non-sharing

Local factor	Exact Sig. (2-tailed)
Benefits	0.2001
Costs	0.8656
Complexity	0.3721
Compatibility	0.3279
Reliability	0.5816
Scalability	0.2497
Security	0.5816
Technological Readiness	1.0000
Financial readiness	0.2628
Human readiness	0.6356
Application user's readiness	0.8324
Enabling party's readiness	0.7348
Trust in application user	0.2001
Trust in enabling party	0.3070
Relative power of application user	0.1226
Relative power of enabling party	0.8990
External pressure	0.2001
Regulation	0.6412
Ecosystem data governance	0.5528

Table 5.10 reports the Mann-Whitney U test results for the local factors within ecosystem data governance. Once more, none of the p-values are below 0.05, indicating no significant difference between the groups. At last, the global weights between the two groups don't show a significant difference either as can be seen in table 5.11 with no p-values below 0.05.

Table 5.10: Mann-Whitney U test results ecosystem data governance local factors - sharing vs non-sharing

Local factor	Exact Sig. (2-tailed)
Governance mode	1.0000
Governance of data ownership & access	0.8464
Governance of data usage	0.7631

Table 5.11: Mann-Whitney U test results global factors - sharing vs non-sharing

Global factor	Exact Sig. (2-tailed)
Benefits	0.1123
Costs	0.8656
Complexity	0.3721
Compatibility	0.2001
Reliability	0.4197
Scalability	0.7995
Security	0.5247
Technological Readiness	0.6719
Financial readiness	0.9662
Human readiness	0.9485
Application user's readiness	0.2871
Enabling party's readiness	0.1123
Trust in application user	0.1123
Trust in enabling party	0.0774
Relative power of application user	0.1226
Relative power of enabling party	0.2158
External pressure	0.6719
Regulation	0.3279
Ecosystem data governance	0.1123

The complete Mann-Whitney U test results are reported in Appendix G. The results have shown no significant differences in weights between the sharing or non-sharing groups of horticulturists.

5.2.2 Type of crop

Respondents were also asked in the survey which type of crops they grow at their firm. In the group of respondents, the horticulturists that grow vegetables make up for 46.7% of the respondents. The group that grows flowers and plants make up for 50% of the respondents. Only one respondent is involved in tree nursery (3.3%) and none of the respondents grew fruit. The respondents were split up in two groups: those that grow vegetables (14 respondents) and those that grow flowers or plants (15 respondents). As there is only one respondent involved in tree nursery, this group is too small to compare to the other groups as differences could be resulting from personal preferences of the respondent. Moreover, a sample size of 1 is too low to perform a Mann-Whitney U test.

Table 5.12: Mann-Whitney U test results categories - vegetables vs flowers & plants

Local category	Exact Sig. (2-tailed)
Technology	0.0699
Organisation	0.1820
Environment	0.0072

In table 5.12 are the Mann-Whitney U test results shown for the categories. The p-values of Technology and Organisation are above 0.05, but the p-value of Environment is below 0.05. This indicates that there is a significant difference in distributions of the Environment weight between the vegetable and flowers & plants horticulturists. In table 5.13 are the Mann-Whitney U test presented for the local factors. The financial readiness is the only local weight that shows a p-values below 0.05, indicating a significant difference between the two groups on this weight. All other local weights have p-values above 0.05, indicating no significant difference.

Table 5.13: Mann-Whitney U test results local factors - vegetables vs flowers & plants

Local factor	Exact Sig. (2-tailed)
Benefits	0.1583
Costs	0.5045
Complexity	0.1861
Compatibility	0.2340
Reliability	0.8467
Scalability	0.1718
Security	0.1337
Technological Readiness	0.5555
Financial readiness	0.0077
Human readiness	0.2133
Application user's readiness	0.8467
Enabling party's readiness	0.7148
Trust in application user	0.9468
Trust in enabling party	0.7800
Relative power of application user	0.1121
Relative power of enabling party	0.5045
External pressure	0.0932
Regulation	0.5613
Ecosystem data governance	0.5325

Table 5.15 reports the Mann-Whitney U test results for the local factors within ecosystem data governance. None of these factors have p-values that are below 0.05, indicating no significant difference between the groups. At last, among the global weights, as shown in table 5.14, a significant difference is present in the weights of the benefits, application user's readiness, enabling party's readiness, trust in application user, trust in enabling party, relative power of application user, relative power of enabling party, and regulation. For all of these factors, the p-value are below 0.05.

Table 5.14: Mann-Whitney U test results global factors - vegetables vs flowers & plants

Global factor	Exact Sig. (2-tailed)
Benefits	0.0259
Costs	0.7472
Complexity	0.1583
Compatibility	0.0769
Reliability	0.2898
Scalability	0.5325
Security	0.8467
Technological Readiness	0.3766
Financial readiness	0.4773
Human readiness	0.2135
Application user's readiness	0.0203
Enabling party's readiness	0.0091
Trust in application user	0.0328
Trust in enabling party	0.0105
Relative power of application user	0.0059
Relative power of enabling party	0.0091
External pressure	0.4253
Regulation	0.0051
Ecosystem data governance	0.2172

Table 5.15: Mann-Whitney U test results ecosystem data governance local factors - vegetables vs flowers & plants

Local factor	Exact Sig. (2-tailed)
Governance mode	0.4984
Governance of data ownership & access	0.2656
Governance of data usage	0.3708

The complete Mann-Whitney U test results are reported in Appendix H. The results have shown a significant difference on several weights between the groups of horticulturists that grow vegetables and those that grow flowers or plants.

5.3 Interview results: concerns regarding the relevant factors

The interviewees were asked to elaborate on their choices on what they consider most and least important by completing the survey. This gave insight on what concerns the horticulturists might have related to the relevant factors. The results from these interviews will be presented per category of the conceptual model.

5.3.1 Technology

The benefits are considered most important by interviewees A, B, C, E and F. These interviewees all mention that the benefits are the main reason why they would even consider sharing data with other parties. The benefits could therefore be large enough to be decisive to data platform participation, even when barriers would be experienced regarding other factors. Participation should lead to benefits such as knowledge that would help increasing the efficiency of the cultivation method, or comparing practices with competitors. Interviewee B added that they have been participating in a data platform in the past but stopped once they believed the benefits were no longer there. As they gained all the knowledge that they wanted to gain with their participation, the costs relative to the benefits became too large. Interviewee E noted that it might seem that many horticulturists are in this business due to their passion, but it in the end, the industry is very competitive and it all comes down to making money. Concerning the benefits, interviewee E noted that for horticulturists the costs for energy and labour are still improvement areas which could benefit from sharing data. However, due to more horticulturists and cooperatives gaining in size, the data that is being gathered within the boundaries of the firm or cooperative might be enough to draw valuable conclusion from data, making data-sharing across the boundaries of the firm or cooperative unnecessary.

The costs are considered the least important by interviewees A, B, E and F. Interviewee B mentions that the costs are not relevant as it should just work as required and this comes at a price. When they would invest in a system, they expect it to always work accordingly to avoid the cost of down-time. However, in this research, this is referred to as the reliability of the technology. Interviewees A, E and F noted that the costs are not important as it not about what the system will cost, but what benefits it will bring. Spending money is important to make money according to interviewee A.

The complexity of the data platform is mentioned as very important by interviewees B, C and F. The platform should be easy to use for the employees and should not require too much time or attention of the employees. Interviewee F has past experiences with adopting new technology that is difficult to use, consequently requiring him to hire a technically-skilled employee. However, this has led to the employee doing work below his level most of the day as initiating the system only requires a few minutes. Low complexity of the technology can therefore be decisive for adoption.

The compatibility of the data platform has not been mentioned as being very important by the interviewees. According to interviewees C and D, it is less important as this is just considered a one-time issue if the platform is not compatible with the current technology or way of working within the firm. Once the data platform is integrated, this factor loses its relevance. Interviewee E considers the compatibility reasonably important but not decisive. Adoption should not completely change the current way of working, but sharing data should be possible with the firm's current processes in place.

As did interviewee B before, interviewees C, D and E mentioned that the reliability is another important, albeit not the most important, factor. According to interviewee D, the reliability is closely related to the ease of use of the technology. A highly reliable platform would be seen as a more user-friendly platform, and thus increase the willingness to adopt. Interviewee E considers this factor important but not decisive.

Scalability is considered important by interviewee D when considering the future. The interviewee acknowledges that the amount data that is being collected keeps growing and thus making this factor more important with the future in mind. This also applies to being able to use the platform for different types of data in the future, such as financial data. Interviewee C mentioned that scalability is not decisive but nice to have. Interviewee E considers the scalability of the platform not really important.

Security is mentioned by interviewees B and E as equally important as the benefits. As the amount of data that is being collected keeps growing, interviewee B indicated that is almost impossible to keep track of all the data or information that they have. Due to the fact that most data is related to the cultivation method, it is considered valuable data. Security is therefore very important, as the interviewee mentioned a lack of trust in others that could gain access to the data. Interviewee F noted that security is very important, perhaps even the most important, but he believes that any platform nowadays would be secure, thus making it not decisive in his decision.

5.3.2 Organisation

Interviewee B considers the organisation category to be the least important as he believes that his firm experiences no problems regarding the three factors. According to the interviewee, the technology within the company is considered to be relatively easy to implement and change. However, interviewee C noted that the ability of the organisation to extract, store and handle the data is very important. Being able to guarantee high quality data is considered difficult and should be focused on more.

The financial resources are considered the least important by interviewees A, B, and F as the available financial resources are just a small hurdle in case the business-case would be positive. Financial resources will be made available if its worth the investment. Interviewee A noted that once he is convinced it will be profitable or add value, this should never be a problem.

Regarding the human resources, interviewee B believes the employees will not encounter any problems in case they would need to adapt to new practices to share data. This can be considered just a new tool in their work, which they will learn how to use. Interviewee D also mentions that this is not a factor he would worry about as the new practices can be thought to the employees. Interviewees A and E are of opinion that when it is really important to participate and there are no required employees available, a new technically-skilled employee will be hired. Interviewee C thinks otherwise and considers the human resources the most important. The employees should be able to use and understand how to use the platform, otherwise it would be useless to him.

5.3.3 Environment

The readiness of the application user is most important according to interviewee A. When the party that want to use the data is not able to do so, due to a lack of readiness, than the benefits will be lost. According to the interviewee, the application user should be able and knowledgeable enough to deliver.

According to interviewee D, the party responsible for the platform (one of the enabling parties) should preferably be a party that is a known party within the sub-sector. These are often the parties that the interviewee said to trust the most as they know them well. Furthermore, these parties are believed to be able to react quicker when changes or actions are required. Therefore, the readiness and trust of the enabling party is considered to be important. Interviewee E also confirmed the horticulture sub-sector to be very internally focused by saying that often horticulturists consider anything that is from the 'Westland' (the area which hosts the most greenhouses in the Netherlands) to be 'good', and anything from elsewhere is 'bad'.

The trust in both parties are believed to be most important by interviewee D. As the data could potentially contain a lot of value, it is considered to be important to think wisely who the data is being shared with and whether those parties can be trusted with the data. The interviewee noted that they are currently sharing data on a platform and this is purely based on trust in the other parties. They only share their data with parties they fully trust. Interviewee C believes that trust in both types of parties is less important. Agreeing to participate in a data platform would likely require the organisations to sign certain agreements regarding the data, which are much more important. The interviewee is referring to the ecosystem data governance. Moreover, the interviewee does not want to be worrying about trust once his firm agrees to participate, but wants to focus on realising the benefits of participation.

The importance of the power of the enabling party is very depend of the context according to interviewee B. Power could be used in two ways: positive and negative. The interviewee considers this more important in the decision when he might expect the party to be using their power against him in the future. However, the interviewee added that trust in the party would make the power irrelevant. When the party is trusted, the enabling party is believed not use their power in a negative sense regarding his organisation.

The ecosystem data governance is mentioned by interviewee F as the most important factor by far. According to him, the ecosystem data governance embodies the other factors in this category, or could at least make the other factors irrelevant. The governance of data reflects the agreements regarding the data on the platform and there also stipulates how data should be correctly handled. However, ecosystem data governance is considered the least important by interviewee B. The main reason for this is the way he believes society deals with any data related agreements, such as when one would download a smartphone app. He believes that most people, including himself, do not really immerse themselves in the data governance aspects when considering participation. However, the interviewee does believe that it probably should be much more important than he would rate it now in his decision-making.

Interviewee A considers the external pressure the least important, but considers this to be related to the relative power of the other actors. The interviewee believes when the horticulturist refuses to participate, the other party, such as an enabling party, has no leg to stand on to make the horticulturist share the data. The interviewee is convinced he will always have the final say in whether he will share his IoT data.

5.3.4 Ecosystem data governance

Interviewees A, B, C, E and F mentioned that the governance mode is not important, as long as the governance domains are well organised. Interviewee D also mentions that it very important that the governance domains are organised well, but considers the party responsible for the governance even more important. According to the interviewee, this is related to the trust in the party responsible for the governance. Once this party is trusted, they would also trust the party to organise the governance domains well. Interviewee A mentioned that governance mode should not be something that horticulturists should be worrying about. It is important that there is a responsible party that takes control of the data governance, but it does not matter which party this is. The interviewee said that he wants to focus on what is important to him: actually providing data and extracting value.

The governance domain of ownership & access is considered the most important of the ecosystem data governance by interviewees B, C, E and F. They mentioned that ownership and access to data will be important especially if they want to be able to keep control of their own data. Access to data is also considered very important in case parties which data has been shared with would leave the platform. In such a scenario, interviewee B stressed that he would like to be able to make the other party unable to use the data any more. Interviewee D noted that it is very important to him to keep the ownership of his own data and to be able to decide on access to data at any time.

Interviewee E mentioned that data governance is necessary to avoid large parties, such as seed suppliers, to gain all the benefits of the data that is being shared. Those parties have a lot of power and could use the data to improve their product upon which their product would become more expensive, even to the horticulturists that provided the data to improve the product. There is a concern that the benefits will not be distributed fairly, indicating the importance of the governance domain of data usage.

5.4 Synthesis of findings

In this section, the BWM results and interviews will be synthesised. This is also known as meta-inferences as an integrative view is presented of the findings from both the qualitative and quantitative results in a research with a mixed methods research design (Venkatesh et al., 2013). The weights of the most and least important factors, as well as the ecosystem data governance and the sub-factors, will be elaborated on and juxtaposed to the interview results. The global weights are shown in table 5.16 as the percentage share they represent in the willingness to participate, ranked from highest to lowest share.

Table 5.16: Factors ranked on global weight

Rank	Factor	Share
1	Benefits	10.55%
2	Human readiness	8.90%
3	Technological readiness	8.60%
4	Security	8.05%
5	Complexity	7.36%
6	Trust in application user	6.58%
7	Ecosystem data governance	5.69%
8	Financial readiness	5.58%
9	Trust in enabling party	5.33%
10	Reliability	4.93%
11	Enabling party's readiness	4.18%
12	Relative power of application user	3.75%
13	Relative power of enabling party	3.43%
14	Application user's readiness	3.38%
15	Scalability	3.21%
16	Costs	3.06%
17	Compatibility	2.96%
18	Regulation	2.47%
19	External pressure	2.00%
	Willingness to participate	100%

A first observation that can be made is the low spread of the global weights. The weights lie fairly close to each other, indicating that the horticulturists do not consider one or several factors as extremely more important or definitely decisive for their decision on data platform participation. However, some are more important than others and the distribution of the factors' contribution to the participation willingness is shown by the BWM results. Moreover, the low spread likely indicates that the horticulturists are considering a more complete picture rather than basing their decision on just a few most important factors. When the factors are ranked on importance based on the median values, as is shown in table 5.17, ecosystem data governance is still in the upper half of the set of factors. Ecosystem data governance ranks 9th based on the median values.

Table 5.17: Factors ranked on median value

Rank	Factor	Median
1	Benefits	0.0823
2	Complexity	0.0670
3	Security	0.0588
4	Trust in application user	0.0539
5	Reliability	0.0520
6	Technological readiness	0.0502
7	Trust in enabling party	0.0419
8	Financial readiness	0.0394
9	Ecosystem data governance	0.0385
10	Enabling party's readiness	0.0353
11	Relative power of application user	0.0244
12	Scalability	0.0239
13	Human readiness	0.0230
14	Relative power of enabling party	0.0220
15	Application user's readiness	0.0213
16	Compatibility	0.0192
17	Costs	0.0168
18	External pressure	0.0135
19	Regulation	0.0129

5.4.1 Most important factors

The benefits (.1055) that the adopting firm perceives to sharing IoT data on a platform will influence the decision to participate the most. This factor is identified as the most important factor based on the global mean weights. Within the technology context, this factor is also assigned the highest local weight. When considering the median values, benefits also ranked first. Similarly, five out of six interviewees explicitly acknowledged that the benefits are the most important within the technology context, and perhaps in total. The benefits are the motivation to even consider adoption in the first place, and an absence or lack of benefits would likely prohibit adoption. A lack of benefits could even lead to discontinuation of data platform participation (interviewee B). Therefore, to ensure participation of the data provider, the benefits that the data provider perceives to receive should be sufficiently large, and the data provider should be made aware of the those benefits. The type of benefits that were mentioned most often by the interviewees were reducing costs of energy and labour, and increasing production efficiency.

The human readiness (.0890) & technological readiness (.0860) are weighted the second and third most important based on the mean global weight respectively. However, based on the median values, both rank lower. These factors have also shown a high standard deviation as respondents have weighted these factors with variation. The higher weight of human readiness could indicate that the horticulturists consider the human resources more difficult to improve than the technological resources. The technological readiness reflects the availability of technological resources, such as IT infrastructure, and the availability of high quality data that can be shared. To increase data quality or replace IT infrastructure, the firm will likely have to deal with organisational change. Employees would need to get used to the new IT infrastructure and way of working. As interviewee C stressed, the organisation's ability to extract, store, and handle data is very important. The human readiness is essential to participation as a lack of technically-skilled employees will lead to needing to hire new employees. This is considered unwanted by interviewee C. In line with the variation in the global weight for these factors is mentioned that the human readiness are not considered to be a problem (interviewees A, B, D, and E). This is also repeated for the technological readiness (interviewee B).

The security of the data platform (.0805) is considered the fourth most important. This factor is related to the information asymmetry and economical or competitive sensitivity of the IoT data. The high economical sensitivity of IoT data in combination with the fact that often it is unsure what the value of the IoT data is to others, makes it especially unwanted for unauthorised actors to gain access to the data. Due to the quickly growing amount of data, it can be difficult to keep track of the data and the value it might have. Sharing IoT data on a platform without knowing what the value might be, could have large negative consequences if sensitive data falls in the wrong hands. Most data that is collected with IoT during operations of the horticulturist, includes data on the cultivation method. The horticulturists consider their cultivation method to be their competitive advantage and are unwilling to share this with just anyone. This factor is even often considered to be equally important as the benefits (interviewees B, E, and F), which have been identified as the most important. If the benefits are large enough, the horticulturist might be willing to participate, but if the platform is not secure enough this could introduce risks that offset the benefits completely.

The complexity (.0736) is weighted the fifth highest based on the mean global weights and refers to the ease of use of the platform for the adopting firm. The user-friendliness of the platform will contribute positively to the participation decision of the adopting firm. The easier the platform is to use, the more likely the horticulturist will consider participation (interviewees B, C and F). Easier to use platforms require less time and effort of the horticulturist to participate. The complexity is even ranked higher (2nd) based on the median values.

The trust in the application user (0.0658) is weighted the sixth highest. This factor is related to the party that eventually puts the data to use. The economical or competitive sensitivity of the IoT data makes trust more important to prevent misuse of data (interviewee D). Based on the median values, the trust in the application user is ranked high as well (4th). Although trust can be considered important, it should also be noted that the importance can be offset by contracts or ecosystem data governance to prevent misuse of data (interviewee C). The ecosystem data governance could be organised in such a way that at least barriers or concerns related to the trust in the application user might be diminished or eliminated.

5.4.2 Ecosystem data governance

The ecosystem data governance (.0569) is considered the seventh most important factor in this research based on the mean global weight. The relatively high weight and ranking indicate that this factor is considered important, albeit not one of the most important. The relative high weight resulting from the BWM method does confirm that ecosystem data governance plays a role in the decision about data platform participation for Dutch horticulturists. This claim has also been confirmed by the interviewees (C and F), indicating that this is not a factor that should be left out when analysing data platform participation willingness. Furthermore, the factor had been chosen by 8 respondents as the most important within the environment category. Based on the median values, the ecosystem data governance ranks in the top half of the factors on the 9th place.

When the sub-factors of ecosystem data governance are zoomed in on, some interesting observations can be made. Considering the local weights of the sub-factors, the governance domain of data ownership & access (.4457) is assigned a much higher weight than the governance mode (.1857), and a slightly higher weight than the governance domain of data usage (.3686). This order stays the same when considering the median values for the weights. This indicates that the horticulturists are more focused on the definition of ownership of data & access to data rather than how the governance is organised. This relates to the prior discussed findings which indicated that the IoT data of horticulturists are highly economical sensitive and could contain a lot of information about their cultivation method or strategy, which gives the horticulturists their competitive advantage. The importance of ownership & access definition of the data has additionally been confirmed by the interviewees (B, C, D, E and F). It is unwanted for unauthorised parties to be able to gain access to the data or for other parties to reap all the benefits from using the data (interviewee E). The relative high importance of the governance domain of data usage stresses relates to the issues of data misuse. Wrong use of data could result in the provided data being used against the data providing party to gain an advantage. This would stand in stark contrast to the benefits of participation, which are considered to be the most important of all factors in the tested model.

5.4.3 Least important factors

The lowest weight has been assigned to the external pressure (.0200) on the data provider. Based on the median values, this factor ranked second-last. This reaffirms the claim of interviewee A that he believes horticulturists will always have the final say in whether they will share their IoT data. Dutch horticulturists clearly consider the decision on data platform participation to be their own and believe this cannot be coerced. This might be related to the large amount of cooperatives and interest groups in the sub-sector protecting the interests of horticulturists. It might therefore be unlikely that for example refusal to participate, results in the exclusion of business with parties that requested the participation, such as retailers.

Regulation is likewise weighted very low (.0247) based on the mean global weight and is ranked last based on the median value. As none of the interviewees mentioned this factor, it is likely that no concerns currently exist regarding regulations. Regulation is not believed to influence the decision of horticulturists to participate.

The compatibility (.0296) is considered the third least important in total, and least important within the technology context. Based on the median values, this factor is ranked the fourth least important. A lack of compatible systems would indicate a needed investment in technology to integrate the data platform (interviewees C and D). This could be related to the importance of a positive benefit-cost ratio. Large benefits might result in the adopting firm to consider a hurdle such as lack of compatibility to be less important. Solving the compatibility issues could therefore be worthwhile considering the benefits that will result. In addition, this factor is considered a one-time problem when it forms a barrier to participation (interviewees C and D). Once the data platform is integrated within the organisation, this factor loses its relevance. Other interviewees did note that compatibility is preferred but the BWM results show that an incompatible data platform will likely not form a large barrier to data platform participation, making it not decisive (interviewee E).

The costs are weighted the fourth lowest (.0306) based on the mean global weights and the third least important when considering the median values. The costs were also considered the absolute least important by four interviewees (A, B, E and F). As the benefits are considerably more important than the costs (.1055 versus .0306), this reaffirms the importance of a positive benefit-cost ratio to the horticulturists. The high importance of benefits, combined with low importance of costs, can be interpreted as the need for a positive business case in which the benefits have to outweigh the costs (interviewees A, E and F). The horticulturists are more than willing to invest in something if it results in benefits for them that are larger than the required investment.

6 Discussion

This research is conducted to gain insight on the relative importance of ecosystem data governance to the data platform participation willingness of IoT data providers. As prior literature only mentions the importance of ecosystem data governance for a data platform to be successful, this research aimed to explore the importance of it to the data provider's willingness to participate. In this research, ecosystem data governance is assigned a relative global weight of .0569 by using the BWM method, ranking it 7th (out of 19) on the ordinal scale of importance. As the benefits of participation has the highest weight assigned (.1055), this means the ecosystem data governance is almost half as important as the benefits of participation. However, in this chapter will be explored what this weight for ecosystem data governance means for the objective of this research, and how this weight can be explained. The results that were previously presented will be discussed to help clarify the results' meaning and what can be learned from them. Knowledge on why certain factors are considered more important than others contributes to placing the results in perspective. The results of the BWM and interviews will therefore be juxtaposed to prior discussed existing literature. By doing so, this chapter will contribute to answering the last research question (3): *What do we learn by analysing the results of the previous research questions with the aim to provide recommendations to improve the data platform participation of data providers in Dutch horticulture?*

Furthermore, the contributions of this research will be discussed and the limitations will be addressed. Based on the analysis of the results, recommendations for future research will be made, as well as recommendations to KPN on how to solve their practical problem. The chapter will conclude with a reflection on the research and how it is relevant to the Management of Technology MSc program at the Delft University of Technology.

6.1 The relative importance of ecosystem data governance

As was presented in the previous chapter, ecosystem data governance is assigned a mean global weight of .0569, indicating ecosystem data governance to be half as important as the most important factor. The benefits are considered the most important and this is in line with many other IS researchers who have often identified the benefits as one of the most important factors for IOS adoption as was discussed in section 4.3. This factor simply represents the question 'what is in it for me?'. The benefits that result from the adoption could potentially be able to offset barriers related to other factors. However, the global weights have shown a low spread, possibly indicating that the IoT data providers in Dutch horticulture do not base their participation decision on just one or several factors. Value extraction from IoT and a positive benefit-cost ratio have also been considered the most important drivers for the adoption of IoT in agriculture (Pierpaoli et al., 2013).

The human and technological readiness are identified as the second and third most important factors based on the mean global weights. These factors represent the data provider's own available resources and capabilities to participate in a data platform. When concerns exist such as a lack of human and technological resources, participation can be impeded. The more able a firm is regarding IT usage and management, the less likely they are to feel intimidated by the technology (Rui, 2007). A lack of available technically-skilled human resources could be resolved by training existing employees of recruiting new employees who are sufficiently technically-skilled. A lack of technological resources can on its turn be resolved by investing in new technology or out-sourcing certain tasks to enable the data platform participation.

The security and complexity of the data platform are also assigned a higher weight than ecosystem data governance based on the mean global weights. Both are characteristics of the technology and can be interpreted as a prerequisite factor to participation. Whereas there are often serious concerns regarding data misuse, data abuse, privacy issues, and revenue sharing between parties (S. U. Lee et al., 2017), a highly secure data platform is required. On the other hand, a data platform with low complexity will also increase the data platform participation willingness as it will cost the data provider less effort and time to participate. Both of these factors have also been mentioned often in literature as being important to IOS adoption as was shown in section 4.3.

The trust in the application user is another factor that is given a higher mean global weight than ecosystem data governance. As was previously discussed in section 4.5, many IS researchers have identified trust as an important factor for IOS adoption. Trust between platform users and other involved parties is also considered a crucial factor to the success of a platform ecosystem (S. U. Lee et al., 2017; Schreieck et al., 2016; Tiwana et al., 2010). This is due to concerns about data ownership, access to data, and the use of data (S. U. Lee et al., 2017). Data could be used by other parties in such a way that it could hurt the data providing company in a commercial way. A lack of trust can therefore severely hamper the data platform participation of data providers. Application users and enabling parties should refrain from expected or unexpected actions that can harm the data providing organisation (Bouchbout & Alimazighi, 2008).

The important role of ecosystem data governance is in line with existing research claiming control and platform governance to play a vital role in the success or effectiveness of platform ecosystems (Ghazawneh & Henfridsson, 2010; Schreieck et al., 2018; Schreieck et al., 2016; Tiwana et al., 2010; Van den Broek & Van Veenstra, 2015). The data governance in a platform ecosystem is often mentioned as an important factor to the success of a data platform ecosystem (S. U. Lee et al., 2017; Van den Broek & Van Veenstra, 2015; van den Broek & van Veenstra, 2018). However, most researchers have only claimed the important role in regard to the success or effectiveness of a platform ecosystem. The findings in this research show that the ecosystem data governance is also important to platform participation. As no other researchers have studied this before, no direct connections can be made with findings in other literature. Nevertheless, when considering literature on data platform success, the participation of all sides is required to attain a successful and sustainable platform. The required parties would first need to be willing to participate before a data platform can become successful. In this research the data platform participation willingness is analysed from the perspective of the data provider. The results from this research therefore indicate the relative importance of ecosystem data governance to the data provider for the participation decision, rather than the absolute role of ecosystem data governance in the platform ecosystem.

The relatively high importance of ecosystem data governance might be due to the fact that this factor can be responsible to offset any barriers to participation which are related to the trust in other stakeholders, the security of the platform and the benefits resulting from participation. These are all factors that are considered very important by the data providers. Although this indicates some level of dependency between those factors, this is merely due to concerns regarding the factors and not the factors itself. All factors are considered to be completely independent in the BWM, whereas it is possible that there is some level of dependency in reality. It is still up to the decision-maker to determine whether he or she considers ecosystem data governance more important than e.g. trust in the application user. It might be possible that the trust in the application user is still considered to be much more important even though the ecosystem data governance mechanisms would completely eliminate all risks related to a lack of trust. Therefore, it is still possible to compare the factors independently from each other, as per required by BWM. Concerns related to the trust and readiness of the application user and enabling party are especially exposed to the ecosystem data governance. If there is no trust in the application user, the data provider might fear that their data will be used incorrectly or forwarded to unauthorised parties. This is often considered one of the main concerns around data platforms as was mentioned before. A lack of trust in the application user could become less relevant when the mechanisms and rules related to the governance domains of data ownership & access and data usage exclude or reduce the risk that the data provider perceives (S. U. Lee et al., 2017). Besides determining how ownership of data is defined to protect the data provider's data against unauthorised use, the data governance can also include monitoring and conformance practices to include countermeasures when those governance rules are broken. Ecosystem data governance can therefore be considered to likely play a crucial role in the participation willingness of data providers.

The ability and available resources of the application users and enabling parties contribute to the success of the data platform as those parties need to create value and facilitate the exchange of data. However, a lack of readiness of the application user or enabling party does not necessarily have to mean that the benefits perceived by the data provider are impacted. For example, if the data provider receives a fixed amount of money to provide data to the platform, the value that the application user extracts from the data will not influence the fixed amount received by the data provider. It is however possible that a lack of readiness of the application user or enabling party results in improper use or modification of the data. This is again something that could be avoided by proper ecosystem data governance on the platform by design. Rules that are set within the governance domain of data ownership & access could require application users to fulfil certain ability requirements before being able to gain access to data or the platform. The platform entry barriers can therefore prevent unable application users from participating in the platform. In addition, mechanisms within the governance domain of data usage can be put in place to ensure correct use of data on the platform.

6.1.1 Ecosystem data governance sub-factors

When zoomed in on the ecosystem data governance, the governance domains of data ownership & access and data usage were considered the most important. Concerns exist among the horticulturists that ownership and control over their own data will not be possible. It was mentioned that the IoT data from the horticulturist's operations are commercially sensitive. This is also argued as an important reason for the data providers to request tight control over their data (Van den Broek & Van Veenstra, 2015). If the IoT data falls into the hands of competitors, the competitor could get insights that may harm the data provider. Appropriate data governance is able to deal with these issues and overcome the these barriers to data platform participation (S. U. Lee et al., 2017; Van den Broek & Van Veenstra, 2015).

Besides data ownership and access, governance mechanisms for the data usage on the data platform are important to the data provider as well. Moreover, unclear data ownership, and unknown or invisible data usage are often considered critical issues as well in the context of a data platform (S. U. Lee et al., 2017). To prevent data misuse, appropriate governance mechanisms are needed. The findings in this research confirm that data misuse is a serious concern and data providers want to protect their competitive advantage. By putting governance mechanisms in place that can accurately monitor data usage and deal with data misuse and unwanted data modification, the participation willingness of data providers can be increased.

Even though the governance mode is considered the least important of the three sub-factors, this is often argued to be important to platform ecosystem success (Provan & Kenis, 2008; Van den Broek & Van Veenstra, 2015). The findings in this research show that the horticulturists consider the governance domains and mechanisms much more important than how the governance is organised. As long as the governance is appropriate, the mode is just a side-issue.

6.1.2 Platform provider's perspective

The weight that ecosystem data governance has been assigned, has different meanings when the weights are interpreted from a different perspective. A distinction can be made between factors that a platform provider (part of the enabling party role), such as KPN, can directly influence or change and those that cannot be directly influenced or changed. When the weights of the factors are considered from the perspective of a platform provider, such as KPN, there are few factors left that can be addressed by the enabling party to increase the participation willingness. The benefits (.1055), human readiness (.0890) and technological readiness (.0860), security (.0805), complexity (.0736), trust in application user (.0658) all have higher weights assigned than ecosystem data governance (.0569). However, the benefits are not created by the enabling party, but result from the exchange with the application user. The human, financial and technological readiness are likewise factors that are not related to the enabling party but the data provider itself. If these factors pose a problem to participation, it is the data provider's own responsibility to improve this and eliminate any barriers. It is possible that the enabling party could assist the data provider in this, but the enabling party will not have direct influence on these factors on its own. The security and complexity of the platform are the two highest weighted technological factors in the technology context and the highest weighted factors that a platform provider (enabling party) could directly influence. By increasing the security and reducing the complexity of the platform, participation willingness of data providers can be improved. The ecosystem data governance is the highest weighted factor in the environment context that an enabling party could influence directly when the enabling party is responsible for the ecosystem data governance as a lead organisation or NAO. Based on the mean global weights, ecosystem data governance is the third most important factor that can be directly influenced by a platform provider.

6.2 Differences within survey sample

When the BWM results were compared of those horticulturists which were sharing data and those who did not share data, no significant differences in weights could be found. However, when the respondents in the survey sample were compared based on the type of crop that they grow, significant differences between the groups became apparent regarding the local weight of the environment category, and the global weights of the benefits, application user's readiness, enabling party's readiness, trust in application user, trust in enabling party, relative power of application user, relative power of enabling party, and regulation. This is an interesting fact as this could mean that the groups based on the type of crop consider other factors as the most important. The largest difference is found in the way that both groups weigh the categories of contexts. The vegetable horticulturists weigh the environment (.4779) the highest and the organisation the lowest (.1870). This is completely different for horticulturists that grow flowers and plants. This group weighs the technology context (.4678) the highest and the environment (.2503) the lowest. There is no clear explanation at this moment for the differences between the two groups. However, this is an interesting finding that should be further explored.

6.3 Limitations

The limitations of this research will guide further research and help understand the true value of the results of the research. Limitations of this research will be discussed regarding multiple important aspects: the reliability, the completeness and generality of the model, the used definitions and wording, the sample size, and the spatial and temporal conditions. Besides pointing out the limitations regarding these aspects of the research, recommendations will be made on how these can be overcome when this research will be (partly) repeated by other researchers.

6.3.1 Reliability

The consistency value of the BWM gives a good indication of the reliability of the survey responses. However, not many comparisons were fully consistent and it remains unsure to why there was any form of inconsistency in those other comparisons. This could for example have been due to distraction while the respondents were filling the survey, due to respondents not fully understanding how to use the method, or due to the wording in the survey. However, an attempt was made by pre-testing the survey to exclude the last two reasons. Despite not many comparisons being fully consistent, the BWM results have shown reasonable to good consistencies, supporting the reliability of the results.

6.3.2 Conceptual model: completeness & generality

By relying on the literature reviews of three other authors, the completeness of the model relies on the thoroughness of the literature reviews that were used. The adding of context specific factors and adjusting other factors to the context has been done to the best of our ability. However, this cannot fully guarantee the completeness of the conceptual model such that it contains all of the most relevant factors. Nevertheless, we do believe that this model gives a very good representation of the factors relevant to data platform participation. As model completeness cannot be guaranteed, it is neither possible to claim any absolute importance of the factors to the participation willingness, but merely the relative importance of the factors to each other. The BWM method used in this research also only provides a distribution of the importance between the included factors.

The conceptual model that is tested in this research is created with the context of a data platform ecosystem in mind rather than the specific context of the Dutch horticulture sub-sector. It is always advisable to consider the specific type of IOS when identifying the relevant factors for IOS adoption (Baker, 2012; Dedrick & West, 2004; Rui, 2007), as has been done in this research. This model is therefore more generic, making it more suitable to study the data platform participation willingness of data providers in other industries as well. The relevant factors in the model were extracted from literature, by first consulting literature reviews on the most common factors for IOS adoption. Thereafter, several factors were adjusted and ecosystem data governance was added to adopt the conceptual model to the context of a data platform ecosystem. However, it is still possible that additional factors could become apparent when applying the model in another industry. Although the model is thought to be more generic and transferable to other industries, this is not empirically confirmed.

6.3.3 Used definitions and wording

The definitions of the factors and the wording of the questions in the survey of this research can likely have had an effect on the results as the parallel-form reliability was not tested. Although an attempt was made to provide clear, unambiguous and non steering definitions and questions in the survey, it cannot be said with certainty that the definitions and wordings had no effect on the results. It is therefore advised to test for the parallel-form reliability in future research to address this limitation.

6.3.4 Sample size

The number of respondents is considered low considering the sample frame as discussed in section 3.2. Horticulturists that were personally contacted and refused to participate reasoned that they either did not have the time for participation, did not think the research was to their interest, or thought that the topic of data sharing was too sensitive. It is interesting that the large amount of effort to use trusted communication channels to approach potential respondents has not led to a large amount of horticulturists willing to participate in the research. As was mentioned before in section 2.1, the topic of data sharing, is considered very sensitive in the sub-sector. This might be a reason why most of the horticulturists refused to participate. The horticulturists experience a more competitive environment and they consider their data to represent their cultivation method or strategy. However, it remains unsure why the horticulturists that received the survey through LTO refused to fill in the survey as it was not possible to receive the horticulturists' contact information from LTO. There was one participant that claimed the survey to be too difficult to complete and therefore stopped halfway.

Considering the standard deviations of the weights as presented in chapter 5, considerable variation in the weights is present. A larger sample size will likely contribute to a lower standard deviation to ensure more accurate results. Nevertheless, ecosystem data governance has shown to be considered reasonably important based both on the mean global weight, the median values, and the interviews.

6.3.5 Spatial and temporal conditions

In this research, all participants were operating in the same macro business environment in the Netherlands as was described in section 3.2.3. As this business environment can change in time and can differ from country to country, it is possible that the results will change when the same research is conducted at a later time with the same population, or even the same sample. The conditions included the macro-environment political, economical, social and technological conditions. When for example the political situation within the Netherlands would change and lead to new legislation regarding data sharing practices, it could be that regulation would be considered more important than it was in this research. The same could be said for a change in the macro-economic situation of the Dutch horticulture sector. As was shown in section 2.1, the economic situation of horticulture firms has been improving over the past few years. However, when the economic situation would deteriorate, factors such as the costs and financial readiness could be weighted much higher as these could be perceived as a larger barrier to participation. This results in the test-retest reliability to likely be low on the long term.

The conceptual model was created from literature and adjusted to the specific context of a data platform ecosystem. The model can be considered to be generally applicable to analyse the data platform participation willingness of data providers. However, the included factors could change over time as well. Especially technological innovations regarding data platforms could introduce new interesting factors to consider for inclusion. As was mentioned before, it is always important to adapt the factors within the model to the IOS that is the focus of the research. Therefore, it is advised to confirm in the future whether the relevant factors stay the same when the macro-environment changes or new innovations are introduced related to data platforms.

6.4 Contributions & further research

In this research, the TOE framework is used to categorise the relevant factors to data platform participation. This framework has proved to be a suitable framework to study data platform participation in this research. It has previously been used by many other IS researchers to analyse IOS success or adoption. As the specific IOS that is considered in this research is a data platform, it has been shown that the TOE framework can also be used to study the adoption of a data platform. The framework allows to consider a wide range of factors: technology, organisation, and external task environment. This made it possible to analyse factors on multiple levels of analysis. The findings have also shown that the external task environment factors are indeed important for the participation decision as multiple parties with different goals are involved in a data platform ecosystem.

In this research, the participation in a data platform ecosystem has been conceptualised as the adoption of a specific IOS. Consequently, by drawing upon existing IOS adoption literature to identify the relevant factors, the conceptual model was constructed. These factors were adjusted to the specific context, also leading to ecosystem data governance being added. As a result, a novel set of factors have been identified to study data platforms. In this research, a more complete set of factors is used to achieve a more complete picture of the important factors. Many other IS researchers have often studied a smaller set factors as was shown in chapter 4. The conceptual model is more generally applicable in the context of studying data platform participation. As the conceptual model not sector specific, this model can be used by researchers to analyse the data platform participation willingness and barriers in other sectors or industries.

In this research, a contribution has also been made to digital platform literature in the context of data sharing on a data platform. As was discussed in section 1.4.1, platform sustainability is important to ensure the success of a platform. This includes the participation of all required sides on the platform, of which the data providers were the focal party in this research. Whereas it has been proved in this research that ecosystem data governance is important to the data provider's participation, at least in the Dutch horticulture. This makes it plausible that ecosystem data governance will be important to data platform participation in other industries as well. The model was tested in the Dutch horticulture sub-sector as per request of KPN to focus on Dutch agriculture. As a result no conclusion can be drawn about other sectors or industries, leaving to wonder whether other industries will consider the same set of factors to be the most important. It is therefore recommended to apply this model to other industries in order to gain more knowledge on the contribution and role of ecosystem data governance for data platform ecosystems. Furthermore, there is so far no scientific proof that the ecosystem data governance is also important for the participation of other types of actors in an ecosystem data platform. Therefore, it is worth researching this as the success of a multi-sided digital platform requires participation from all sides. By doing so, one should remember the importance of the factors being adjusted to the context. This model was developed by taking the perspective of the data provider. It might be possible that when a different perspective is taken, the factors will differ as well.

Ecosystem data governance and platform governance have often been argued by researchers to be of great importance to the success of data platform ecosystems, as was discussed in section 1.4.1. This research has shown that ecosystem data governance will also play an important role for the participation in data platform ecosystems. As platform sustainability is important, future research should focus on how ecosystem data governance should be organised to promote participation. Well-organised data governance will increase the participation willingness of data providers. Furthermore, attention should be paid to the execution of ecosystem data governance, including which governance mode is preferred to support participation and contribute to the success of data platform ecosystems.

Furthermore, it is advised to address the other before mentioned limitations of this research in future research as well. These include validating the completeness of the model, checking the parallel-form reliability of the results, increasing the sample size, and extending the research to other industries. Whilst doing so, researchers should keep the spatial and temporal effects in mind. The model was tested in Dutch horticulture among 30 respondents. To strengthen the research's results with more evidence, it is advised to further test the model with a larger group of horticulturists. As was noted before, the survey sample also showed a relatively high share of respondents that currently share data or are willing to do so, possibly introducing a bias in the response. It is therefore also advised to test the model with more horticulturists who are not sharing IoT data, nor are willing to, in order to explore the existence of a bias. Moreover, the BWM results showed a significant difference between horticulturists growing vegetables and those growing flowers & plants. As no clear explanation for this is available at this time, it is advised to explore the underlying reasons for this difference. It might be related to the small sample size, but other reasons may be plausible as well.

The BWM application has shown reliable results in this research and has contributed to compare the importance of the factors in relation to each other. However, BWM assumes no correlation between the factors or criteria that are studied. The interviewees however did point out that they considered some factors to be slightly related to each other. It is therefore advised to test whether this has an impact on the results and whether certain factors in the model should be combined or defined different.

Although an overview is created of how contributory each factor is to data platform participation willingness of Dutch horticulturists, there is no knowledge yet on what the minimum requirements of the Dutch horticulturists are regarding the factors. To know what exactly is considered a secure data platform, a data platform with low complexity, or proper ecosystem data governance will help significantly to realise more willingness to participate. Notably the requirements for ecosystem data governance will be of great interest as this will be able to eliminate barriers related to other factors.

6.5 Recommendations to KPN

As this research has provided insight into which factors are considered the most important for participation, this knowledge can be used by KPN to improve the participation willingness of data providers. By improving the status-quo regarding the most important factors and focus development effort towards eliminating barriers related to these factors, the participation willingness of data providers can be improved. This enables KPN to focus their development effort more effectively towards the most critical aspects of data platform participation. The horticulturists will subsequently be able to benefit from this as well. The more IoT data that will be shared by horticulturists, the more potential value can be extracted by developing new use-cases for the data on the platform.

Recommendations to KPN to improve the participation willingness of data providers in Dutch horticulture can be made in two ways. Firstly by looking at the overall global weights, and secondly by looking at the weights of factors that can be directly influenced by KPN. If the global weights of all the factors are considered, the five highest weighted factors are: benefits, human readiness, technological readiness, security, complexity. Out of those five only two can be directly influenced or changed by KPN as an enabling party. Nevertheless, KPN could also indirectly improve the benefits, human readiness, and technological readiness. The benefits are referring to what the data providers receives in return for providing data to the platform ecosystem. These are related to what application users offer in return for the data that is being used. KPN can for example improve the benefits that data providers perceive by assisting the application users as a service provider or application developer in order to create value with the data. Additionally, from application users should be required that they ensure enough benefits to flow towards the data providers as a result of the value creation. A second option would be to attract more service providing and application developing parties to the platform to increase the likelihood of new value being created with the data. The third option would be to increase the awareness of benefits for the data providers in case the data providers were not yet aware of the possible benefits resulting from participation. The human readiness within the data providing organisation could be improved by KPN by providing training for existing employees to be able to work with the data platform. The technological readiness within the data providing organisation could be improved by assisting the data provider to upgrade technological infrastructure or IT practices to ensure the technological readiness.

Improving the factors of benefits, human readiness, and technological readiness each require extensive effort and time of KPN. Individual data providers or other parties within the platform ecosystem would need assistance or guidance to improve the situation. As an alternative, KPN could focus their time and effort on the factors that KPN could directly influence, resulting in a more centralised and focused effort. Both the security and complexity of the data platform have been found to be important to Dutch horticulturists. Meeting the requirements of horticulturists on both these factors could improve the willingness of the horticulturists to participate in the data platform. This requires development effort from the platform provider, which in this case would be KPN. Directing the development efforts more efficiently towards the directly influenceable factors could save KPN time and resources. The ecosystem data governance could additionally have a much larger impact than expected, based on the global weights of factors. As was discussed before, the ecosystem data governance could contribute to eliminating barriers or concerns related to other factors. By setting data governance mechanisms in place to ensure revenue sharing, safeguarding of data, entry barriers to participation, and participant data conformance, barriers or concerns related to the benefits of participation, safety of data, and the trust in and readiness of other participants could be diminished or eliminated.

6.6 Reflection and relevance to MOT

This research has reflected the course materials of the Management of Technology (MOT) MSc program very well. The research mainly focused on how businesses can increase the extraction of value with modern technology within the organisation. Internet-of-Things devices and resulting data are becoming common corporate resources in many manufacturing and production industries, including agriculture. To stimulate value creation with these corporate resources, sharing the data is believed to be promising. Within this research, different levels of analysis were considered: the technology, the internal organisation, and the external business environment. A link was created between the academic knowledge on Information Systems adoption and the empirical domain. This allowed me to contribute new knowledge on digital platform participation and the role of ecosystem data governance, as well as make a contribution towards realising more data platform participation in Dutch horticulture. To be able to conduct this research, knowledge has been used from multiple MOT courses, such as 'Technology Battles', 'Technology, Strategy and Entrepreneurship', 'Research Methods', 'Intra- and Inter-organisational Decision-making', 'Emerging and Breakthrough Technologies', and 'Financial Management'. Knowledge gained from each of the courses have been most useful to design the research, build on literature, put concepts in perspective, and ultimately interpret the results to make helpful recommendations.

7 Conclusions

This research was conducted to explore the relative importance of ecosystem data governance for data platform participation of IoT data providers. For the success of a multi-sided platform, participation of all sides is required. As KPN aims to be an IoT data platform provider, they want to know which factors are most important to IoT data providers regarding their willingness to participate in a data platform. The agricultural sector is considered to be strategically important for KPN, leading to the request to conduct the research in this sector. However, due to the limited time available to complete this research, the Dutch horticulture sub-sector was chosen as the research population. The main objective of the research was:

Formulate recommendations to KPN to improve the willingness of data providers to participate in an IoT data platform ecosystem by analysing the relative importance of ecosystem data governance to the willingness of Dutch horticulturists to participate in an IoT data platform ecosystem as a data provider.

In order to be able to achieve the objective three research questions were formulated. The first research question additionally had three sub-questions. The answers to the research (sub)questions will now be presented.

The first research questions was:

RQ1: What is the relative importance of ecosystem data governance to the willingness of IoT data providers to participate in an ecosystem data platform?

This research question was answered by combining the knowledge from answering three sub-questions. The answers to the first two sub-question resulted in the conceptual model.

SQ1a: What theoretical framework is suitable to analyse the factors relevant to ecosystem data platform participation according to scientific literature?

This question was answered in Chapter 4 by conducting a literature review on the most used IS adoption frameworks in IS research literature. After considering the characteristics of several common used frameworks, the TOE framework (Baker, 2012) was chosen as the most suitable for this research. This framework distinguishes between three different contexts to which factors can belong: Technology, Organisation, and External task environment.

The second sub-question was formulated to identify the relevant factors to data platform participation.

SQ1b: What factors are relevant to analyse the willingness of data providers to participate in an ecosystem data platform according to scientific literature?

This question was answered in Chapter 4 as well by conducting a literature review on IOS adoption factors within the IS literature stream. The factors were adjusted to the specific context of a data platform ecosystem by using knowledge that was gained on the subject during a prior literature review on the core concepts of data platform ecosystems. This led to the following factors in the Technology context: perceived benefits, perceived costs, complexity, compatibility, reliability, scalability, and security. The organisation context contains the following factors: technological readiness, financial readiness, and human readiness. The factors within the environment context are: application user's readiness, enabling party's readiness, trust in application user, trust in enabling party, relative power of application user, relative power of enabling party, external pressure, regulation, and ecosystem data governance. Ecosystem data governance was added as it is considered highly relevant to data platform ecosystems and important for the success of data platform ecosystems by IS researchers. As this research aimed to determine the contributory role of ecosystem data governance relative to the other factors, three sub-factors were added to gain a deeper understanding of this factor. The sub-factors are: governance mode, governance domain of data ownership & access, and governance domain of data usage.

The third sub-question was formulated to gather quantitative insight about the relative importance of each of the identified relevant factors according to Dutch horticulturists.

SQ1c: What is the relative importance of each of the identified relevant factors to the ecosystem data platform participation willingness according to IoT data providers in Dutch horticulture?

This question was answered in Chapter 5 by means of an online survey among a sample of 30 horticulturists. The Best-Worst Method was used in this survey to be able to derive weights for each of the identified relevant factors. This resulted in a ranking of the factors based on the mean weight. Benefits is considered the most important and is just over five times more important than external pressure, the least important factor of the set. The top five of most important factors are completed by human readiness, technological readiness, security, and complexity. Ecosystem data governance ranks 7th and is considered about half as important as the benefits. Compared to the least important factor, external pressure, ecosystem data governance is considered almost three times as important. The five lowest weighted factors are: scalability, costs, compatibility, regulation, and external pressure. When zoomed in on the sub-factors of ecosystem data governance, the governance domain of data ownership & access is considered most important. This sub-factors is slightly more important than the governance domain of data usage, and almost two and one half times more important than the governance mode.

The second research question was formulated to gain qualitative insight about the concerns that horticulturists could have related to the identified relevant factors.

RQ2: What concerns, related to the relevant factors for ecosystem data platform participation, do IoT data providers in Dutch horticulture have?

This question was answered in Chapter 5 by reporting the concerns that were mentioned by six horticulturists during face-to-face semi-structured interviews. The main identified concerns are a lack of benefits, lack of user-friendliness of the data platform, low integration with current technology or practices, low reliability of the data platform, a non-secure data platform, lack of internally sufficient technological resources, lack of qualified employees, lack of application user readiness, lack of trust in application user or enabling party, fear for misuse of power of the application user or enabling party, and a not properly organised ecosystem data governance to retain ownership and control of their own data.

The third research question was formulated to combine the knowledge from the previously answered research (sub-)questions in order to achieve the research objective.

RQ3: What do we learn by analysing the results of the previous research questions with the aim to provide recommendations to improve the data platform participation of data providers in Dutch horticulture?

This question was answered in Chapter 6 and has led to the main conclusion of this research. KPN has been recommended to focus on the factors that they can directly influence to focus their development time and resources more efficiently. KPN is therefore recommended to focus on providing a data platform with a high level of security and a low level of complexity. These factors are both considered relatively important for data platform participation by Dutch horticulturists. Furthermore, the ecosystem data governance should be another focal factor as this factors is considered reasonably important and moreover, proper ecosystem data governance can likely eliminate barriers or diminish concerns related to several other factors such as the benefits of participation, safety of data, and the trust in and readiness of other participants. The ecosystem data governance domains can ensure revenue sharing, prevent and monitor data misuse, and form entry barriers to the data platform ecosystem to ensure the participation of capable parties.

The final conclusion of this research is that ecosystem data governance is considered important by IoT data providers in Dutch horticulture. Although ecosystem data governance is considered around half as important as the most important factor, it is still almost three times as important as the least important factor. It is concluded that ecosystem data governance should not be left out when analysing data platform participation. The concerns mentioned during the interviews can be addressed by appropriate ecosystem data governance, consequently benefiting the data provider's willingness to participate in a data platform. As the participation of all sides is required for the success of a data platform, the ecosystem data governance will thus have a reasonable impact on the data platform sustainability. Based on the BWM results and concerns in the interviews, it is also concluded that the governance domains of data ownership & access and data usage should be focal points to ensure a positive contribution of ecosystem data governance. Retaining data ownership and preventing data misuse are important to Dutch horticulturists to be willing to participate in an IoT data platform.

References

Ackoff, R. L. (1989). From data to wisdom. *Journal of Applied Systems Analysis*, *16*(1), 3–9.

Adner, R. (2016). Ecosystem as Structure: An Actionable Construct for Strategy. *Journal of Management*, *43*(1), 39–58. doi:10.1177/0149206316678451

AIOTI. (2015). Smart Farming and Food Safety Internet of Things Applications – Challenges for Large Scale Implementations. *Aioti*, 49. Retrieved from https://aioti.eu/wp-content/uploads/2017/03/AIOTIWG06Report2015-Farming-and-Food-Safety.pdf

Allee, V. (2000). Reconfiguring the Value Network. *Journal of Business Strategy*, *21*(4), 36–39. doi:10.1108/eb040103

Allemang, D. & Teegarden, B. (2016). A Global Data Ecosystem for Agriculture and Food. *godan: Global Open Data for Agriculture & Nutrition*. doi:10.1079/CABICOMM-79-12

Amiot, E. (2015). The Internet of Things Disrupting Traditional Business Models. *Oliver Wyman*. Retrieved from http://www.oliverwyman.com/content/dam/oliver-wyman/global/en/2015/jun/Internet-of-Things_Report.pdf

Ashton, K. (2011). That 'internet of things' thing. *RFiD Journal*, *22*(7), 97–114.

Atzori, L., Iera, A. & Morabito, G. (2017). Understanding the Internet of Things: definition, potentials, and societal role of a fast evolving paradigm. *Ad Hoc Networks*, *56*, 122–140. doi:10.1016/j.adhoc.2016.12.004

Baker, J. (2012). The Technology–Organization–Environment Framework. In *Springer* (pp. 231–245). doi:10.1007/978-1-4419-6108-2_12

Bertino, E. (2016). Data Security and Privacy in the IoT. *2016*, 1–3. Retrieved from https://openproceedings.org/2016/conf/edbt/paper-a.pdf

Bhattacharya, M., Chu, C. H. & Mullen, T. (2008). A comparative analysis of RFID adoption in retail and manufacturing sectors. *2008 IEEE International Conference on RFID (Frequency Identification), IEEE RFID 2008*, 241–249. doi:10.1109/RFID.2008.4519360

BO Akkerbouw. (2017). Akkerbouwsector komt met Gedragscode Datagebruik. Retrieved from https://www.bo-akkerbouw.nl/2017/01/05/akkerbouwsector-komt-gedragscode-datagebruik-akkerbouw/

Bondt, N., Robbert, R., Lan, G., Linda, P. & Cor, V. (2016). Nut van ICT-gebruik voor tuinbouwondernemers. *Wageningen Economic Research*.

Bouchbout, K. & Alimazighi, Z. (2008). A framework for identifying the critical factors affecting the decision to adopt and use inter-organizational information systems. *Proceedings of the World Academy of Science, Engineering and Technology*, *43*, 338–345. Retrieved from https://pdfs.semanticscholar.org/4646/126b7a50d4cf9c88b927759dc39c601f3623.pdf

Bucherer, E. & Uckelmann, D. (2011). Business Models for the Internet of Things. In *Architecting the internet of things* (Vol. 35, *0632993*, pp. 253–277). Berlin, Heidelberg: Springer Berlin Heidelberg. doi:10.1007/978-3-642-19157-2_10

CBS. (2017). StatLine - Landbouw; economische omvang naar omvangsklasse, bedrijfstype. Retrieved from https://opendata.cbs.nl/statline/#/CBS/nl/dataset/80785ned/table?ts=1526025639135%20http://statline.cbs.nl/Statweb/publication/?DM=SLNL&PA=80785NED&D1=a&D2=0&D3=0-1,7,17,21,30,38-39,42-44&D4=a&HDR=G3&STB=G1,T,G2&VW=T%20https://opendata.cbs.nl/statline/#/CBS/n

CBS. (2018). CBS StatLine - Landbouw; gewassen, dieren en grondgebruik naar hoofdbedrijfstype, regio. Retrieved from http://statline.cbs.nl/StatWeb/publication/?DM=SLNL&PA=80783NED&D1=0&D2=a&D3=0&D4=0,5,(l-2),(l-1),l&VW=T%20http://statline.cbs.nl/StatWeb/publication/?DM=SLNL&PA=80783NED&D1=0,33-36,39-42,45-47,50-52&D2=2&D3=0&D4=0,5,8-10&HDR=G2,G3&STB=T,G1&VW=T

Chau, P. Y. K. & Tam, K. Y. (1997). Factors affecting the adoption of open systems: An exploratory study. *MIS Quarterly: Management Information Systems*, *21*(1), 1–20. doi:10.2307/249740

Chen, D. & Zhao, H. (2012). Data Security and Privacy Protection Issues in Cloud Computing. *2012 International Conference on Computer Science and Electronics Engineering*, *1*(March 2012), 647–651. doi:10.1109/ICCSEE.2012.193

Chen, F., Deng, P., Wan, J., Zhang, D., Vasilakos, A. V. & Rong, X. (2015). Data mining for the internet of things: Literature review and challenges. doi:10.1155/2015/431047

Chen, M., Mao, S. & Liu, Y. (2014). Big data: A survey. In *Mobile networks and applications* (Vol. 19, *2*, pp. 171–209). Springer US. doi:10.1007/s11036-013-0489-0

Cheong, L. L. K. & Chang, V. (2007). The need for data governance: a case study. *Paper presented at the 18th Australasian Conference on Information System, Toowoomba, Australia*, *18*(2005), 999–1008.

Chwelos, P., Benbasat, I. & Dexter, A. S. (2001). Research Report: Empirical Test of an EDI Adoption Model. *Information Systems Research*, *12*(3), 304–321. doi:10.1287/isre.12.3.304.9708

Coetzee, M. & Eloff, J. H. P. (2005). An access control framework for web services. *Information Management & Computer Security*, *13*(1), 29–38. doi:10.1108/09685220510582656

Darking, M., Whitley, E. A. & Dini, P. (2008). Governing diversity in the digital ecosystem. *Communications of the ACM*, *51*(10), 137. doi:10.1145/1400181.1400211

Dawes, S. S., Vidiasova, L. & Parkhimovich, O. (2016). Planning and designing open government data programs: An ecosystem approach. *Government Information Quarterly*, *33*(1), 15–27. doi:10.1016/j.giq.2016.01.003

De Reuver, M. & Bouwman, H. (2012). Governance mechanisms for mobile service innovation in value networks. *Journal of Business Research*, *65*(3), 347–354. doi:10.1016/j.jbusres.2011.04.016

de Reuver, M., Sørensen, C. & Basole, R. C. (2017). The digital platform: a research agenda. *Journal of Information Technology*, 1–12. doi:10.1057/s41265-016-0033-3

de Ruyter, J. (2016). Digitalisering: driver in de tuinbouw. Retrieved from https://insights.abnamro.nl/2016/05/digitalisering-driver-in-de-tuinbouw/

Dedrick, J. & West, J. (2004). An exploratory study into open source platform adoption. In *37th annual hawaii international conference on system sciences, 2004. proceedings of the* (10 pp.). IEEE. doi:10.1109/HICSS.2004.1265633

Demil, B. & Lecocq, X. (2006). Neither market nor hierarchy nor network: The emergence of bazaar governance. *Organization Studies*, *27*(10), 1447–1466. doi:10.1177/0170840606067250

Du, T. C., Lai, V. S., Cheung, W. & Cui, X. (2012). Willingness to share information in a supply chain: A partnership-data-process perspective. *Information & Management*, *49*(2), 89–98. doi:10.1016/j.im.2011.10.003

Fu, H.-P., Chang, T.-H., Ku, C.-Y., Chang, T.-S. & Huang, C.-H. (2014). The critical success factors affecting the adoption of inter-organization systems by SMEs. *Journal of Business & Industrial Marketing*, *29*(5), 400–416. doi:10.1108/JBIM-04-2012-0070

Gartner. (2016). Gartner Says 6.4 Billion Connected "Things" Will Be in Use in 2016, Up 30 Percent From 2015. Retrieved from https://www.gartner.com/newsroom/id/3165317

Ghazawneh, A. & Henfridsson, O. (2010). Governing Third-Party Development through Platform Boundary Resources. *31st International Conference on Information Systems*, 48.

Ghazawneh, A. & Henfridsson, O. (2013). Balancing platform control and external contribution in third-party development: The boundary resources model. *Information Systems Journal*, *23*(2), 173–192. doi:10.1111/j.1365-2575.2012.00406.x

Green, H. (2016). The Internet of Things in the Cognitive Era: Realizing the future and full potential of connected devices. Retrieved from http://www-01.ibm.com/common/ssi/cgi-bin/ssialias?subtype=WH&infotype=SA&htmlfid=WWW12366USEN&attachment=WWW12366USEN.PDF

Grover, V. (1993). An Empirically Derived Model for the Adoption of Customer-based Interorganizational Systems. *Decision Sciences*, *24*(3), 603–640. doi:10.1111/j.1540-5915.1993.tb01295.x

Gubbi, J., Buyya, R., Marusic, S. & Palaniswami, M. (2013). Internet of Things (IoT): A vision, architectural elements, and future directions. *Future Generation Computer Systems*. Including Special sections: Cyber-enabled Distributed Computing for Ubiquitous Cloud and Network Services & Cloud Computing and Scientific Applications — Big Data, Scalable Analytics, and Beyond, *29*(7), 1645–1660. doi:10.1016/j.future.2013.01.010

Gupta, H. & Barua, M. K. (2016). Identifying enablers of technological innovation for Indian MSMEs using best-worst multi criteria decision making method. *Technological Forecasting and Social Change*, *107*, 69–79. doi:10.1016/j.techfore.2016.03.028

Hart, P. & Saunders, C. (1997). Power and Trust: Critical Factors in the Adoption and Use of Electronic Data Interchange. *Organization Science*, *8*(1), 23–42. doi:10.1287/orsc.8.1.23

Iacovou, C. L., Benbasat, I. & Dexter, A. S. (1995). Electronic Data Interchange and Small Organizations: Adoption and Impact of Technology. *MIS Quarterly*, *19*(4), 465. doi:10.2307/249629

Immonen, A., Palviainen, M. & Ovaska, E. (2014). Requirements of an Open Data Based Business Ecosystem. *Access, IEEE*, *2*, 88–103. doi:10.1109/ACCESS.2014.2302872

IOF2020. (2011). How to feed 9 billion people in 2050. *The New Scientist*, *209*(2795), 6–6. doi:10.1016/S0262-4079(11)60059-6

Jacobides, M. G., Cennamo, C. & Gawer, A. (2018). Towards a theory of ecosystems. *Strategic Management Journal*, *39*(8), 2255–2276. doi:10.1002/smj.2904

Jernigan, S., Ransbotham, S. A. M. & Kiron, D. (2016). Data Sharing and Analytics Drive Success With IoT. *MIT Sloan Management Review*, *58*(1), 1–17. Retrieved from https://sloanreview.mit.edu/projects/data-sharing-and-analytics-drive-success-with-internet-of-things/

Johnson, R. B. & Onwuegbuzie, A. J. (2004). Mixed Methods Research: A Research Paradigm Whose Time Has Come. *Educational Researcher*, *33*(7), 14–26. doi:10.3102/0013189X033007014

Johnson, R. B., Onwuegbuzie, A. J. & Turner, L. A. (2007). Toward a Definition of Mixed Methods Research. *Journal of Mixed Methods Research*, *1*(2), 112–133. doi:10.1177/1558689806298224

Khan, N., Yaqoob, I., Hashem, I. A. T., Inayat, Z., Mahmoud Ali, W. K., Alam, M., … Gani, A. (2014). Big Data: Survey, Technologies, Opportunities, and Challenges. *The Scientific World Journal*, *2014*, 1–18. doi:10.1155/2014/712826

Khatri, V. & Brown, C. V. (2010). Designing data governance. *Communications of the ACM*, *53*(1), 148. doi:10.1145/1629175.1629210

KPN. (2016). Nederland heeft eerste landelijk dekkende LoRa-netwerk voor Internet-of-Things. Retrieved from https://overons.kpn/nl/nieuws/2016/nederland-heeft-eerste-landelijk-dekkende-lora-netwerk-voor-internet-of-things

KPN. (2017). Our mission. Retrieved from https://overons.kpn/en/the-company/our-mission

KPN. (2018). KPN at a glance. Retrieved from https://overons.kpn/en/the-company/kpn-at-a-glance

Kravets, J. & Zimmermann, K. (2012). Inter-organizational information alignment: A conceptual model of structure and governance for cooperations. In *18th americas conference on information systems 2012, amcis 2012* (Vol. 6, pp. 1127–1136).

Kuan, K. & Chau, P. (2001). A perception-based model for EDI adoption in small businesses using a Technology Organization Environment framework. *Elsevier*, *38*(8), 507–521.

Lavalle, S., Lesser, E., Shockley, R., Hopkins, M. S. & Kruschwitz, N. (2011). Big Data, Analytics and the Path From Insights to Value. *MIT Sloan Management Review*, *52*(2), 21–32. doi:10.0000/PMID57750728

Lee, I. & Lee, K. (2015). The Internet of Things (IoT): Applications, investments, and challenges for enterprises. *Business Horizons*, *58*(4), 431–440. doi:10.1016/j.bushor.2015.03.008

Lee, J. (2016a). *Addressing ROI in Internet of Things Solutions* (tech. rep. No. September). Microsoft. Microsoft. Retrieved from http://download.microsoft.com/download/2/a/9/2a95ea76-140b-4844-8904-4d27a1d756e9/addressing_roi_in_internet_of_things_solutions_white_paper.pdf

Lee, J. (2016b). Creating new value from an existing IoT solution. Retrieved from https://blogs.microsoft.com/iot/2016/09/20/creating-new-value-from-an-existing-iot-solution/

Lee, S. U., Zhu, L. & Jeffery, R. (2017). Data Governance for Platform Ecosystems : Critical Factors and the State of Practice. *Twenty First Pacific Asia Conference on Information Systems, Langkawi 2017*, 1–12. Retrieved from http://arxiv.org/abs/1705.03509

Leminen, S., Rajahonka, M., Westerlund, M. & Siuruainen, R. (2015). Ecosystem business models for the Internet of things. *Internet of Things Finland*, *35*(January), 10–13. doi:10.1007/978-3-642-19157-2. arXiv: 9809069v1 [gr-qc]

Leminen, S., Westerlund, M., Rajahonka, M. & Siuruainen, R. (2012). Towards IOT ecosystems and business models. In *Lecture notes in computer science (including subseries lecture notes in artificial intelligence and lecture notes in bioinformatics)* (Vol. 7469 LNCS, pp. 15–26). doi:10.1007/978-3-642-32686-8_2

Li, S., Xu, L. D. & Zhao, S. (2015). The internet of things: a survey. *Information Systems Frontiers*, *17*(2), 243–259. doi:10.1007/s10796-014-9492-7

Lippert, S. K. & Govindrajulu, C. (2006). Technological , Organizational , and Environmental Antecedents to Web Services Adoption. *Communications of the IIMA*, *6*(1), 146–158. doi:10.1017/CBO9781107415324.004

Madaan, N., Ahad, M. A. & Sastry, S. M. (2017). Data integration in IoT ecosystem: Information linkage as a privacy threat. *Computer Law & Security Review*, *34*(1), 125–133. doi:10.1016/j.clsr.2017.06.007

Madakam, S., Ramaswamy, R. & Tripathi, S. (2015). Internet of Things (IoT): A Literature Review. *Journal of Computer and Communications*, *03*(05), 164–173. doi:10.4236/jcc.2015.35021

Madlberger, M. (2008). Interorganizational collaboration in supply chain management: What drives firms to share information with their trading partners? In *Proceedings of the annual hawaii international conference on system sciences* (pp. 11–11). IEEE. doi:10.1109/HICSS.2008.219

Mäkipää, M. (2006). Inter-organizational information systems in cooperative inter-organizational relationships: Study of the factors influencing to success. In *Project e-society: Building bricks* (Vol. 226, pp. 68–81). Boston, MA: Springer US. doi:10.1007/978-0-387-39229-5_7

Manyika, J., Chui, M., Bisson, P., Woetzel, J., Dobbs, R., Bughin, J. & Aharon, D. (2015). The Internet of Things: Mapping the value beyond the hype. *McKinsey Global Institute*, (June), 144. doi:10.1007/978-3-319-05029-4_7

Markus, M. L. & Bui, Q. " (2012). Going Concerns: The Governance of Interorganizational Coordination Hubs. *Journal of Management Information Systems*, *28*(4), 163–198. doi:10.2753/MIS0742-1222280407

Mattern, F., Floerkemeier, C. & Friedemann, M. (2010). From the Internet of Computers to the Internet of Things. *From Active Data Management to Event-Based Systems and More*, *3*(6462), 242–259. doi:10.4236/jcc.2015.35021

Mazhelis, O., Luoma, E. & Warma, H. (2012). Defining an Internet-of-Things ecosystem. In *Lecture notes in computer science (including subseries lecture notes in artificial intelligence and lecture notes in bioinformatics)* (Vol. 7469 LNCS, pp. 1–14). Springer. doi:10.1007/978-3-642-32686-8_1

Mcafee, A. & Brynjolfsson, E. (2012). Spotlight on Big Data Big Data: The Management Revolution, 2012. Acedido em 15-03-2017. (October). Retrieved from http://tarjomefa.com/wp-content/uploads/2017/04/6539-English-TarjomeFa-1.pdf

Mineraud, J., Mazhelis, O., Su, X. & Tarkoma, S. (2016). A gap analysis of Internet-of-Things platforms. *Computer Communications*, *89-90*, 5–16. doi:10.1016/j.comcom.2016.03.015

Minerva, R., Biru, A. & Rotondi, D. (2015). Towards a definition of the Internet of Things (IoT). *IEEE Internet Things*, *1*, 1–86. doi:10.5923/j.ijit.20150401.01

Moore, J. F. (1993). Predators and prey: a new ecology of competition. *Harvard business review*, *71*(3), 75–86. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/10126156

Muegge, S. (2011). Business Ecosystems as Institutions of Participation : A Systems Perspective on Community-Developed Platforms. *Technology Innovation Management Review*, *1*(November), 4–13. doi:10.2307/2786545

Noronha, A., Moriarty, R., O'Connell, K. & Villa, N. (2014). *Attaining IoT Value : How To Move from Connecting Things to Capturing Insights Gain an Edge by Taking Analytics to the Edge*. Retrieved from https://www.cisco.com/c/dam/en_us/solutions/trends/iot/docs/iot-data-analytics-white-paper.PDF

Oliveira, T. & Martins, M. F. (2011). Literature review of information technology adoption models at firm level. *The Electronic Journal Information Systems Evaluation (EJISE)*, (14(1),), 110–121.

Osterwalder, A. (2004). The Business Model Ontology - A Proposition in a Design Science Approach. *Business*, *Doctor*, 1–169. doi:10.1111/j.1467-9310.2010.00605.x

Peltoniemi, M. (2004). Cluster, Value Network and Business Ecosystem: Knowledge and Innovation Approach. *Conference Paper*, (September 2004), 9–10. doi:10.1016/j.respol.2014.04.014

Pierpaoli, E., Carli, G., Pignatti, E. & Canavari, M. (2013). Drivers of Precision Agriculture Technologies Adoption: A Literature Review. *Procedia Technology*. 6th International Conference on Information and Communication Technologies in Agriculture, Food and Environment (HAICTA 2013), *8*, 61–69. doi:10.1016/j.protcy.2013.11.010

Porter, M. E. & Millar, V. E. (1985). How information gives you competitive advantage. *Harvard Buiness Review*, *63*(4), 149. doi:10.1038/bdj.2007.481

Powell, W. W. (1990). Neither Market Nor Hierarchy: Network Forms of Organization. In *Research in organizational behavior* (pp. 295–336). Research in Organizational Behavior.

Praditya, D., Janssen, M. & Sulastri, R. (2017). Determinants of Business-to-Government Information Sharing Arrangements. *Electronic Journal of e-Government*, *15*(1), 44–56.

Premkumar, G. & Ramamurthy, K. (1995). The Role of Interorganizational and Organizational Factors on the Decision Mode for Adoption of Interorganizational Systems. *Decision Sciences*, *26*(3), 303–336. doi:10.1111/j.1540-5915.1995.tb01431.x

Provan, K. G. & Kenis, P. (2008). Modes of network governance: Structure, management, and effectiveness. *Journal of public administration research and theory*, *18*(2), 229–252. doi:10.1093

Ramamurthy, K., Premkumar, G. & Crum, M. R. (1999). Organizational and Interorganizational Determinants of EDI Diffusion and Organizational Performance: A Causal Model. *Journal of Organizational Computing and Electronic Commerce*, *9*(4), 253–285. doi:10.1207/S153277440904_2

Ramdani, B., Kawalek, P. & Lorenzo, O. (2009). Predicting SMEs' adoption of enterprise systems. *Journal of Enterprise Information Management*, *22*(1/2), 10–24. doi:10.1108/17410390910922796

Reinsel, D., Gantz, J. & Rydning, J. (2017). Data Age 2025: The Evolution of Data to Life-Critical. *IDC White Paper; Sponsored by Seagate*, (April), 1–25. Retrieved from https://www.seagate.com/www-content/our-story/trends/files/Seagate-WP-DataAge2025-March-2017.pdf

Rezaei, J. (2015). Best-worst multi-criteria decision-making method. *Omega (United Kingdom)*, *53*(Supplement C), 49–57. doi:10.1016/j.omega.2014.11.009

Rezaei, J. (2016). Best-worst multi-criteria decision-making method: Some properties and a linear model. *Omega (United Kingdom)*, *64*(Supplement C), 126–130. doi:10.1016/j.omega.2015.12.001

Rezaei, J., Hemmes, A. & Tavasszy, L. (2017). Multi-criteria decision-making for complex bundling configurations in surface transportation of air freight. *Journal of Air Transport Management*, *61*, 95–105. doi:10.1016/j.jairtraman.2016.02.006

Rezaei, J., Nispeling, T., Sarkis, J. & Tavasszy, L. (2016). A supplier selection life cycle approach integrating traditional and environmental criteria using the best worst method. *Journal of Cleaner Production*, *135*, 577–588. doi:10.1016/j.jclepro.2016.06.125

Rezaei, J., Wang, J. & Tavasszy, L. (2015). Linking supplier development to supplier segmentation using Best Worst Method. *Expert Systems with Applications*, *42*(23), 9152–9164. doi:10.1016/j.eswa.2015.07.073

Rui, G. (2007). *Information systems innovation adoption among organizations-A match-based framework and empirical studies* (Doctoral dissertation).

Schreieck, M., Hakes, C., Wiesche, M. & Krcmar, H. (2017). Governing platforms in the internet of things. In *Lecture notes in business information processing* (Vol. 304, pp. 32–46). doi:10.1007/978-3-319-69191-6_3

Schreieck, M., Hein, A., Wiesche, M. & Krcmar, H. (2018). The challenge of governing digital platform ecosystems. In *Digital marketplaces unleashed* (pp. 527–538). Berlin, Heidelberg: Springer Berlin Heidelberg. doi:10.1007/978-3-662-49275-8_47

Schreieck, M., Wiesche, M. & Krcmar, H. (2016). Design and Governance of Platform Ecosystems-Key Concepts and Issues for Future Research. In *Ecis* (ResearchPaper76).

Sekaran, U. & Bougie, R. (2016). *Research Methods For Business: A Skill Building Approach*. John Wiley & Sons. doi:10.1016/0304-405X(77)90015-0

Sicari, S., Rizzardi, A., Cappiello, C., Miorandi, D. & Coen-Porisini, A. (2018). Toward Data Governance in the Internet of Things. (Vol. 715, pp. 59–74). Springer. doi:10.1007/978-3-319-58190-3

Stirling, C., Kruh, W., Proudfoot, I., Claydon, L. & Stott, C. (2013). The agricultural and food value chain : Entering a new era of cooperation. *KPMG: Global Life sciences*, 1–40.

Sun, S., Cegielski, C. G., Jia, L. & Hall, D. J. (2016). Understanding the Factors Affecting the Organizational Adoption of Big Data. *Journal of Computer Information Systems*, *58*(3), 193–203. doi:10.1080/08874417.2016.1222891

Tallon, P. P. (2013). Corporate governance of big data: Perspectives on value, risk, and cost. *Computer*, *46*(6), 32–38. doi:10.1109/MC.2013.155

Tilson, D., Lyytinen, K. & Sørensen, C. (2010). Digital infrastructures: The missing IS research agenda. *Information Systems Research*, *21*(4), 748–759. doi:10.1287/isre.1100.0318

Tiwana, A., Konsynski, B. & Bush, A. A. (2010). Research Commentary: Platform Evolution: Coevolution of Platform Architecture, Governance, and Environmental Dynamics. *Source: Information Systems Research Information Systems Research*, *21*(4), 675–687. doi:10.1287/isre.ll00.0323

Tornatzky, L. G. & Klein, K. J. (1982). Innovation characteristics and innovation adoption-implementation: A meta-analysis of findings. *IEEE Transactions on Engineering Management*, *EM-29*(1), 28–45. doi:10.1109/TEM.1982.6447463

Turner, V., Gantz, J. F., Reinsel, D. & Minton, S. (2014). The Digital Universe of Opportunities: Rich Data and Increasing Value of the Internet of Things. *IDC White Paper*, *2*(April), 1–5. doi:10.7790/ajtde.v2n3.47

UNECE. (2013). Classification of big data types. *United Nations Economic Commission for Europe*, (June 2013), 3112–3114. Retrieved from https://statswiki.unece.org/display/bigdata/Classification+of+Types+of+Big+Data

Van den Broek, T. & Van Veenstra, A. F. (2015). Modes of governance in inter-organisational data collaborations : Complete Research. *Twenty-Third European Conference on Information Systems (ECIS), Münster, Germany, 2015*. doi:10.18151/7217509

van den Broek, T. & van Veenstra, A. F. (2018). Governance of big data collaborations: How to balance regulatory compliance and disruptive innovation. *Technological Forecasting and Social Change*, *129*(September 2017), 330–338. doi:10.1016/j.techfore.2017.09.040

Venkatesh, V., Brown, S. A. & Bala, H. (2013). Bridging the qualitative-quantitative divide: Guidelines for conducting mixed methods research in information systems. *MIS quarterly*, *37*(1), 21–54.

Vermesan, O., Bahr, R., Gluhak, A., Boesenberg, F., Hoeer, A. & Osella, M. (2016). IoT Business Models Framework. *UNIFY-IoT*, 1–57. Retrieved from http://www.unify-iot.eu/wp-content/uploads/2016/10/D02_01_WP02_H2020_UNIFY-IoT_Final.pdf

Verschuren, P., Doorewaard, H. & Mellion, M. J. (2010). *Designing a research project*. Eleven International publishing house The Hague.

Voorn, E. (2017). Glastuinbouw als succesvoorbeeld van innovatie en samenwerking. Retrieved from https://www.deondernemer.nl/nieuwsbericht/170694/glastuinbouw-als-succesvoorbeeld-van-innovatie-en-samenwerking

Wageningen University. (2017). Solvabiliteit glastuinbouw opnieuw gestegen. Retrieved from https://www.agrimatie.nl/ThemaResultaat.aspx?subpubID=2232&themaID=2265&indicatorID=2009&sectorID=2240

Wareham, J. D., Fox, P. & Cano Giner, J. L. (2013). Technology Ecosystem Governance. *Ssrn*, (January). doi:10.2139/ssrn.2201688

Watson, R. T. & Webster, J. (2002). Analyzing the Past To Prepare for the Future : Writing a Review. *MIS Quarterly*, *26*(2), xiii–xxiii. doi:10.1.1.104.6570

Weill, P. & Ross, J. W. (2004). IT Governance on One Page. *SSRN Electronic Journal*. doi:10.2139/ssrn.664612

Weiser, M. (1991). The Computer for the 21st Century. In *Scientific america – communications, computers and networks* (Vol. 265, *3*, pp. 66–75).

Westerlund, M., Leminen, S. & Rajahonka, M. (2014). Designing Business Models for the Internet of Things. *Technology Innovation Management Review*, *4*(7), 5–14. doi:10.1007/978-3-642-19157-2

Wolfert, S. (2017). 'AGRARISCHE DATA DELEN IS SLEUTEL TOT SUCCES'. Retrieved from https://www.boerderij.nl/Home/Blogs/2017/3/Agrarische-data-delen-is-sleutel-voor-succes-104204E/

Wolfert, S., Ge, L., Verdouw, C. & Bogaardt, M.-J. (2017). Big Data in Smart Farming–A review. *Agricultural Systems*, *153*, 69–80.

WUR. (2017). DATA-FAIR: agri-food data delen voor nieuwe business op voorwaarden van ondernemer. Retrieved from https://www.wur.nl/nl/nieuws/DATA-FAIR-agri-food-data-delen-voor-nieuwe-business-op-voorwaarden-van-ondernemer.htm

Yang, T. M. & Maxwell, T. A. (2011). Information-sharing in public organizations: A literature review of interpersonal, intra-organizational and inter-organizational success factors. *Government Information Quarterly*, *28*(2), 164–175. doi:10.1016/j.giq.2010.06.008

Yoo, Y., Boland, R. J., Lyytinen, K. & Majchrzak, A. (2012). Organizing for Innovation in the Digitized World. *Organization Science*, *23*(5), 1398–1408. doi:10.1287/orsc.1120.0771

Zhu, K., Kraemer, K. L. & Xu, S. (2006). The Process of Innovation Assimilation by Firms in Different Countries: A Technology Diffusion Perspective on E-Business. *Management Science*, *52*(10), 1557–1576. Retrieved from http://pubsonline.informs.org/doi/abs/10.1287/mnsc.1050.0487

Zhu, K., Xu, S. & Dedrick, J. (2003). Assessing drivers of e-business value: results of a cross-country study. *Icis*, 1–13. Retrieved from https://aisel.aisnet.org/cgi/viewcontent.cgi?article=1121&context=icis2003

Zuiderwijk, A. & Loukis, E. (2014). Elements for the development of an open data marketplace. *Conference for E-Democracy and Open Governement*, 309.

APPENDICES

A | Information on KPN

This research is commissioned by KPN's CTO department. KPN (Koninklijke PTT Nederland) is a leading supplier of ICT-services in the Netherlands and focusses mainly on providing connectivity and cloud services for both the consumer and business market (KPN, 2018). KPN started out as a public telecommunications company in 1881 but extended its offering with many other ICT services over the years. The company has a strong focus on innovation to stay ahead of the curve, keep growing and succeed in their mission to help the Netherlands become more sustainable, more secure and more enjoyable (KPN, 2017).

KPN is focussing on the development, adoption and implementation of IoT technologies to strengthen their position in the Dutch IoT solutions market. An example of the efforts made is the realization of full network coverage across the Netherlands with LoRa in 2016, a new low power connectivity protocol specifically designed for IoT solutions (KPN, 2016). KPN's LoRa network made the Netherlands the first country in the world to reach country-wide LoRa coverage. To keep moving forward with their IoT activities, KPN is eager to extent their knowledge about the development, adoption and implementation of IoT.

The CTO division is specifically focussed on developing a vision for 2025 around certain relevant technologies, including IoT, and translating that vision into a technology roadmap to operationalize the needed investments.

B BWM steps

Linear BWM can be completed in five steps (Rezaei, 2016):

1. Determine the set of relevant decision criteria or factors. $\{c_1, c_2, \ldots, c_n\}$
2. Identify the best (e.g. most important) and the worst (e.g. least important) factors.
3. Conduct a pairwise comparison to determine the preference of the best factor over all the other factors by using a number between 1 and 9 (1= equally important, 9= absolutely more important). This results in the Best-to-Others vector:
$$A_B = (a_{B1}, a_{B2}, \ldots, a_{Bn}) \tag{7}$$
With a_{Bj} indicating the preference of the best factor B over factor j.
4. Likewise conduct a pairwise comparison to determine the preference of all other factors over the worst factor by using a number between 1 and 9 (1= equally important, 9= absolutely more important). This results in the Other-to-Worst vector:
$$A_W = (a_{1W}, a_{2W}, \ldots, a_{nW}) \tag{8}$$
With a_{jW} indicating the preference of the factor j over the worst factor W.
5. Calculate the optimal weights of the relevant factors $(w_1^*, w_2^*, \ldots, w_n^*)$ This is done by minimizing the maximum absolute differences, with the non-negativity condition for the weights and the sum of all weights being equal to 1 in mind. For each pair of Best-to-others and Others-to-worst, the optimal weight has to comply to $w_B/w_J = a_{Bj}$ and $\frac{w_j}{w_W} = a_{jW}$. This results in the following min-max model:
$$\begin{aligned} &minmax_j = \{|\frac{w_B}{w_j} - a_{Bj}]|, |\frac{w_j}{w_W} - a_{jW}|\} \\ &s.t. \\ &\sum_j w_j = 1 \\ &w_j \geq 0, forallj \end{aligned} \tag{9}$$
The min-max model is then transferred to the following problem:
$$\begin{aligned} &min\xi^L \\ &s.t. \\ &|w_B - a_{Bj}w_J| \leq \xi^L, forallj \\ &|w_j - a_{jW}w_W| \leq \xi^L, forallj \\ &\sum_j w_j = 1 \\ &w_j \geq 0, forallj \end{aligned} \tag{10}$$
By solving this problem, the optimal weights and ξ^L are obtained, whereas ξ^L indicates the reliability of the weights based on the consistency of the comparisons. The closer this value is to zero, the higher the consistency and thus the reliability.

C BWM input data

Table C.1: BWM input data

ID	Best 1	Worst 1	B1 to A1	B1 to A2	B1 to A3	A1 to W1	A2 to W1	A3 to W1
1	Factoren buiten uw bedrijf	Factoren binnen uw bedrijf	5	7	1	3	1	7
2	Factoren van de technologie	Factoren binnen uw bedrijf	1	6	5	6	1	6
3	Factoren van de technologie	Factoren binnen uw bedrijf	1	5	7	5	1	3
4	Factoren van de technologie	Factoren buiten uw bedrijf	1	4	7	7	4	1
5	Factoren van de technologie	Factoren binnen uw bedrijf	1	7	3	7	1	3
6	Factoren van de technologie	Factoren buiten uw bedrijf	1	3	7	3	4	1
7	Factoren binnen uw bedrijf	Factoren van de technologie	8	1	6	1	8	7
8	Factoren buiten uw bedrijf	Factoren binnen uw bedrijf	2	7	1	5	1	7
9	Factoren van de technologie	Factoren binnen uw bedrijf	1	5	2	5	1	4
10	Factoren buiten uw bedrijf	Factoren binnen uw bedrijf	8	9	1	7	1	9
11	Factoren van de technologie	Factoren binnen uw bedrijf	1	5	1	1	3	1
12	Factoren van de technologie	Factoren binnen uw bedrijf	1	5	2	5	1	4
13	Factoren buiten uw bedrijf	Factoren binnen uw bedrijf	3	7	1	3	1	7
14	Factoren van de technologie	Factoren binnen uw bedrijf	1	3	3	3	1	5
15	Factoren buiten uw bedrijf	Factoren binnen uw bedrijf	2	5	1	3	1	5
16	Factoren binnen uw bedrijf	Factoren buiten uw bedrijf	5	1	7	7	7	1
17	Factoren binnen uw bedrijf	Factoren buiten uw bedrijf	5	1	3	1	3	1
18	Factoren binnen uw bedrijf	Factoren buiten uw bedrijf	3	1	5	3	5	1
19	Factoren buiten uw bedrijf	Factoren binnen uw bedrijf	7	9	1	4	1	9
20	Factoren binnen uw bedrijf	Factoren buiten uw bedrijf	1	1	3	3	3	1
21	Factoren van de technologie	Factoren binnen uw bedrijf	1	7	1	7	1	3
22	Factoren buiten uw bedrijf	Factoren binnen uw bedrijf	2	5	1	4	1	5
23	Factoren buiten uw bedrijf	Factoren binnen uw bedrijf	7	9	1	3	1	9
24	Factoren van de technologie	Factoren binnen uw bedrijf	1	5	2	5	1	4
25	Factoren buiten uw bedrijf	Factoren binnen uw bedrijf	5	8	1	3	1	8
26	Factoren binnen uw bedrijf	Factoren buiten uw bedrijf	7	1	1	1	1	1
27	Factoren van de technologie	Factoren binnen uw bedrijf	1	7	3	7	1	6
28	Factoren van de technologie	Factoren binnen uw bedrijf	1	6	3	6	1	3
29	Factoren van de technologie	Factoren binnen uw bedrijf	1	6	3	6	1	4
30	Factoren binnen uw bedrijf	Factoren buiten uw bedrijf	4	1	7	5	7	1

Table C.1: BWM input data (*Continued*)

ID	Best 2	Worst 2	B2 to A1	B2 to A2	B2 to A3	B2 to A4	B2 to A5	B2 to A6
1	Veiligheid van dataplatform	Aansluiting van dataplatform	3	4	4	4	4	3
2	Mogelijke voordelen van data delen	Uitbreidings mogelijkheid van dataplatform	1	6	5	5	5	7
3	Gebruiksgemak van dataplatform	Mogelijke kosten van data delen	7	9	1	3	6	4
4	Mogelijke voordelen van data delen	Aansluiting van dataplatform	1	1	1	4	4	4
5	Mogelijke voordelen van data delen	Aansluiting van dataplatform	1	2	3	9	3	3
6	Mogelijke voordelen van data delen	Mogelijke kosten van data delen	1	5	5	3	3	6
7	Veiligheid van dataplatform	Aansluiting van dataplatform	2	1	2	1	3	3
8	Mogelijke voordelen van data delen	Uitbreidings mogelijkheid van dataplatform	1	3	2	5	4	6
9	Mogelijke voordelen van data delen	Aansluiting van dataplatform	1	5	1	5	2	3
10	Mogelijke voordelen van data delen	Aansluiting van dataplatform	1	5	5	1	5	5
11	Stabiliteit van dataplatform	Mogelijke voordelen van data delen	9	9	1	5	1	1
12	Mogelijke voordelen van data delen	Aansluiting van dataplatform	1	3	2	6	3	4
13	Veiligheid van dataplatform	Stabiliteit van dataplatform	3	3	6	5	7	4
14	Mogelijke voordelen van data delen	Aansluiting van dataplatform	1	5	1	7	1	3
15	Veiligheid van dataplatform	Mogelijke kosten van data delen	1	5	2	3	2	4
16	Mogelijke voordelen van data delen	Mogelijke kosten van data delen	1	9	3	5	5	5
17	Veiligheid van dataplatform	Aansluiting van dataplatform	1	7	1	5	1	3
18	Mogelijke voordelen van data delen	Veiligheid van dataplatform	1	1	3	5	3	7
19	Mogelijke voordelen van data delen	Aansluiting van dataplatform	1	1	7	7	7	5
20	Mogelijke voordelen van data delen	Uitbreidings mogelijkheid van dataplatform	1	7	1	3	1	3
21	Mogelijke voordelen van data delen	Mogelijke kosten van data delen	1	1	1	1	3	3
22	Mogelijke voordelen van data delen	Aansluiting van dataplatform	1	5	1	5	2	5
23	Veiligheid van dataplatform	Mogelijke kosten van data delen	2	9	5	6	3	4
24	Mogelijke voordelen van data delen	Mogelijke kosten van data delen	1	7	1	4	2	4
25	Mogelijke voordelen van data delen	Mogelijke kosten van data delen	1	9	3	6	3	7
26	Gebruiksgemak van dataplatform	Mogelijke voordelen van data delen	7	1	1	1	1	1
27	Mogelijke voordelen van data delen	Mogelijke kosten van data delen	1	9	3	6	4	7
28	Mogelijke voordelen van data delen	Mogelijke kosten van data delen	1	9	3	5	3	4
29	Mogelijke voordelen van data delen	Mogelijke kosten van data delen	1	9	2	6	4	6
30	Mogelijke voordelen van data delen	Mogelijke kosten van data delen	1	9	3	5	5	6

Table C.1: BWM input data (*Continued*)

ID	B2 to A7	A1 to W2	A2 to W2	A3 to W2	A4 to W2	A5 to W2	A6 to W2	A7 to W2	Best 3	Worst 3
1	1	7	7	5	1	3	4	4	Beschikbare financiële middelen	Beschikbaar personeel
2	7	7	6	7	5	5	1	7	Beschikbare technologische middelen	Beschikbaar personeel
3	7	9	1	9	2	9	7	8	Beschikbare technologische middelen	Beschikbaar personeel
4	4	4	5	7	1	4	7	6	Beschikbaar personeel	Beschikbare technologische middelen
5	1	9	8	7	1	3	8	8	Beschikbare technologische middelen	Beschikbaar personeel
6	1	5	1	2	6	3	3	9	Beschikbare technologische middelen	Beschikbaar personeel
7	1	9	7	8	1	8	7	1	Beschikbare technologische middelen	Beschikbaar personeel
8	2	6	6	6	4	5	1	6	Beschikbare technologische middelen	Beschikbaar personeel
9	1	5	3	6	1	5	3	8	Beschikbare technologische middelen	Beschikbaar personeel
10	1	1	9	9	1	9	9	9	Beschikbare technologische middelen	Beschikbaar personeel
11	1	1	5	9	9	9	1	9	Beschikbare financiële middelen	Beschikbare technologische middelen
12	1	6	5	6	1	5	4	7	Beschikbaar personeel	Beschikbare financiële middelen
13	1	6	7	6	4	1	2	7	Beschikbaar personeel	Beschikbare technologische middelen
14	1	7	3	5	1	7	5	7	Beschikbaar personeel	Beschikbare technologische middelen
15	1	4	1	4	3	5	2	5	Beschikbare financiële middelen	Beschikbaar personeel
16	3	9	1	7	5	7	3	7	Beschikbaar personeel	Beschikbare financiële middelen
17	1	1	1	3	1	7	7	5	Beschikbare technologische middelen	Beschikbare financiële middelen
18	5	5	7	2	7	5	2	1	Beschikbaar personeel	Beschikbare technologische middelen
19	3	7	5	3	1	3	3	3	Beschikbare financiële middelen	Beschikbare technologische middelen
20	1	3	1	3	1	3	1	7	Beschikbare technologische middelen	Beschikbare financiële middelen
21	5	1	1	9	1	7	3	9	Beschikbare technologische middelen	Beschikbaar personeel
22	2	5	2	7	1	6	2	8	Beschikbare technologische middelen	Beschikbare financiële middelen
23	1	9	1	5	4	7	6	9	Beschikbare financiële middelen	Beschikbare technologische middelen
24	1	7	1	7	3	6	4	7	Beschikbaar personeel	Beschikbare financiële middelen
25	1	9	1	7	4	6	5	9	Beschikbare financiële middelen	Beschikbare technologische middelen
26	1	1	1	7	5	3	5	7	Beschikbare financiële middelen	Beschikbare technologische middelen
27	2	9	1	7	4	5	3	9	Beschikbare technologische middelen	Beschikbare financiële middelen
28	1	9	1	7	5	7	5	7	Beschikbaar personeel	Beschikbare financiële middelen
29	2	9	1	7	4	6	5	7	Beschikbare technologische middelen	Beschikbaar personeel
30	3	9	1	7	4	7	4	7	Beschikbaar personeel	Beschikbare financiële middelen

Table C.1: BWM input data (*Continued*)

ID	B3 to A1	B3 to A2	B3 to A3	A1 to W3	A2 to W3	A3 to W3	Best 4	Worst 4
1	5	1	7	7	7	1	Data bestuur	Vaardigheid van data ontvanger
2	1	7	7	7	1	1	Vaardigheid van data ontvanger	Macht van bemiddelende partij
3	1	8	7	7	3	1	Vaardigheid van bemiddelende partij	Regelgeving
4	3	4	1	1	5	3	Vaardigheid van data ontvanger	Macht van data ontvanger
5	1	2	8	8	8	1	Macht van data ontvanger	Externe druk
6	1	2	2	2	5	1	Vertrouwen in data ontvanger	Regelgeving
7	1	3	4	4	4	1	Macht van bemiddelende partij	Externe druk
8	1	4	5	5	3	1	Vertrouwen in data ontvanger	Externe druk
9	1	3	4	4	2	1	Vaardigheid van bemiddelende partij	Regelgeving
10	1	5	5	5	5	1	Macht van bemiddelende partij	Externe druk
11	1	1	5	1	1	1	Vertrouwen in data ontvanger	Vaardigheid van data ontvanger
12	3	5	1	4	1	5	Vertrouwen in data ontvanger	Regelgeving
13	7	3	1	1	3	7	Macht van bemiddelende partij	Externe druk
14	1	5	1	1	1	1	Data bestuur	Externe druk
15	2	1	3	2	3	1	Data bestuur	Regelgeving
16	7	7	1	3	1	7	Vertrouwen in bemiddelende partij	Externe druk
17	1	7	3	7	1	3	Vertrouwen in data ontvanger	Regelgeving
18	1	1	1	1	1	1	Vertrouwen in data ontvanger	Externe druk
19	7	1	3	1	7	7	Vertrouwen in data ontvanger	Regelgeving
20	1	3	1	3	1	3	Data bestuur	Vaardigheid van bemiddelende partij
21	1	3	5	5	5	1	Vaardigheid van data ontvanger	Regelgeving
22	1	4	3	4	1	3	Data bestuur	Externe druk
23	5	1	3	1	5	5	Macht van data ontvangende partij	Macht van bemiddelende partij
24	2	5	1	3	1	5	Vertrouwen in data ontvangende partij	Externe druk
25	5	1	3	1	5	3	Data bestuur	Regelgeving
26	7	1	1	1	7	7	Vertrouwen in bemiddelende partij	Macht van bemiddelende partij
27	1	5	3	5	1	3	Vertrouwen in data ontvangende partij	Regelgeving
28	3	7	1	3	1	7	Data bestuur	Externe druk
29	1	3	5	5	3	1	Vertrouwen in data ontvangende partij	Externe druk
30	4	7	1	3	1	7	Vertrouwen in bemiddelende partij	Externe druk

Table C.1: BWM input data (*Continued*)

ID	B4 to A1	B4 to A2	B4 to A3	B4 to A4	B4 to A5	B4 to A6	B4 to A7	B4 to A8	B4 to A9	A1 to W4	A2 to W4	A3 to W4	A4 to W4	A5 to W4	A6 to W4	A7 to W4	A8 to W4	A9 to W4
1	4	4	4	3	4	2	1	1	1	1	3	3	6	5	7	9	9	4
2	1	6	7	7	7	8	6	6	6	8	2	7	7	7	1	6	6	6
3	3	1	2	2	5	7	6	4	2	7	4	8	9	5	9	3	1	4
4	1	3	6	6	2	3	7	7	4	2	6	4	4	1	6	4	2	2
5	7	3	1	3	1	3	9	7	2	7	7	9	7	9	9	1	4	4
6	2	5	1	2	3	6	6	6	2	8	4	6	4	7	4	2	1	8
7	2	2	4	4	4	1	3	3	3	6	6	7	7	6	3	1	5	6
8	5	3	1	2	4	5	7	6	2	4	5	7	6	6	4	1	2	6
9	3	1	1	3	3	3	6	6	3	5	6	7	5	6	5	2	1	7
10	1	1	1	1	1	1	1	1	1	9	9	9	9	9	1	1	9	9
11	9	1	1	1	9	1	9	1	1	1	1	9	1	1	1	1	1	4
12	6	3	1	3	5	5	6	7	2	5	7	7	5	5	4	2	1	7
13	6	2	3	1	4	1	7	6	5	5	7	7	7	9	7	1	3	3
14	5	3	1	1	3	7	7	1	1	5	5	7	7	7	7	1	5	7
15	3	2	1	1	2	2	2	7	1	2	2	8	7	5	5	7	1	7
16	3	1	3	1	5	5	9	9	9	7	7	7	9	7	5	1	3	1
17	3	1	1	1	1	3	2	5	3	7	5	5	7	3	1	1	1	1
18	2	2	1	4	4	4	7	6	3	5	3	7	7	5	4	1	5	3
19	3	3	1	4	3	2	7	9	9	9	9	9	9	9	9	9	1	9
20	5	5	5	5	5	5	5	5	1	3	1	3	3	3	3	3	5	5
21	1	3	3	1	1	3	7	5	9	5	3	3	3	1	1	1	1	1
22	4	3	2	3	5	5	7	7	1	3	3	5	5	4	4	1	1	7
23	5	7	2	3	1	9	8	7	2	5	3	9	7	9	1	3	4	8
24	4	3	1	2	4	5	8	7	6	4	5	8	7	5	5	1	2	6
25	6	3	1	2	6	5	7	9	1	3	5	8	6	3	3	2	1	9
26	1	1	7	1	7	7	9	9	9	1	1	1	7	1	1	1	1	1
27	5	3	1	2	4	6	8	8	1	5	5	8	7	4	3	2	1	7
28	5	4	3	3	6	6	8	8	1	5	6	8	8	5	5	1	2	8
29	6	3	1	3	7	6	8	7	1	3	5	8	6	3	3	1	2	8
30	3	1	3	1	5	5	9	9	3	7	7	7	9	4	4	1	1	6

Table C.1: BWM input data (*Continued*)

ID	Best 5	Worst 5	B5 to A1	B5 to A2	B5 to A3	A1 to W5	A2 to W5	A3 to W5
1	Beleid data eigenaarschap en toegang	Beleid data gebruik	2	1	3	2	3	1
2	Beleid data gebruik	Bestuur verantwoordelijke	7	6	1	1	6	7
3	Beleid data gebruik	Beleid data eigenaarschap en toegang	5	5	1	5	1	5
4	Beleid data eigenaarschap en toegang	Beleid data gebruik	2	1	3	2	3	1
5	Bestuur verantwoordelijke	Beleid data gebruik	1	2	4	4	5	1
6	Beleid data eigenaarschap en toegang	Bestuur verantwoordelijke	7	1	1	1	7	7
7	Beleid data eigenaarschap en toegang	Beleid data gebruik	2	1	3	6	3	1
8	Beleid data gebruik	Bestuur verantwoordelijke	4	1	1	1	4	4
9	Beleid data eigenaarschap en toegang	Bestuur verantwoordelijke	5	1	3	1	5	3
10	Beleid data eigenaarschap en toegang	Bestuur verantwoordelijke	9	1	1	1	9	1
11	Beleid data eigenaarschap en toegang	Bestuur verantwoordelijke	9	1	1	1	9	9
12	Beleid data eigenaarschap en toegang	Bestuur verantwoordelijke	4	1	2	1	4	3
13	Beleid data eigenaarschap en toegang	Bestuur verantwoordelijke	1	1	1	1	1	1
14	Beleid data eigenaarschap en toegang	Bestuur verantwoordelijke	7	1	7	1	7	1
15	Bestuur verantwoordelijke	Beleid data eigenaarschap en toegang	1	3	3	3	1	2
16	Beleid data eigenaarschap en toegang	Bestuur verantwoordelijke	5	1	1	1	5	3
17	Beleid data gebruik	Beleid data eigenaarschap en toegang	1	5	1	1	1	5
18	Beleid data gebruik	Beleid data eigenaarschap en toegang	1	3	1	4	1	3
19	Beleid data eigenaarschap en toegang	Bestuur verantwoordelijke	5	1	5	1	5	5
20	Beleid data eigenaarschap en toegang	Bestuur verantwoordelijke	3	1	1	1	3	3
21	Beleid data gebruik	Bestuur verantwoordelijke	3	3	1	1	7	3
22	Beleid data eigenaarschap en toegang	Bestuur verantwoordelijke	4	1	1	1	4	3
23	Beleid data eigenaarschap en toegang	Bestuur verantwoordelijke	5	1	2	1	5	7
24	Beleid data eigenaarschap en toegang	Bestuur verantwoordelijke	4	1	1	1	4	4
25	Beleid data eigenaarschap en toegang	Bestuur verantwoordelijke	7	1	3	1	7	4
26	Beleid data gebruik	Beleid data eigenaarschap en toegang	3	5	1	3	1	5
27	Beleid data eigenaarschap en toegang	Bestuur verantwoordelijke	7	1	3	1	7	6
28	Beleid data eigenaarschap en toegang	Bestuur verantwoordelijke	7	1	1	1	7	6
29	Beleid data eigenaarschap en toegang	Bestuur verantwoordelijke	7	1	3	1	7	4
30	Beleid data eigenaarschap en toegang	Bestuur verantwoordelijke	5	1	1	1	5	4

D BWM results - local weights

Table D.1: BWM results - local weights categories

#	Technology	Organisation	Environment	ξ^L
1	0.1688	0.0909	0.7403	0.1039
2	0.7253	0.0769	0.1978	0.2637
3	0.7531	0.1111	0.1358	0.1975
4	0.7083	0.2083	0.0833	0.1250
5	0.6727	0.0909	0.2364	0.0364
6	0.6000	0.2800	0.1200	0.2400
7	0.0625	0.7656	0.1719	0.2656
8	0.3269	0.0769	0.5962	0.0577
9	0.5750	0.1000	0.3250	0.0750
10	0.1353	0.0588	0.8059	0.2765
11	0.4286	0.1429	0.4286	0.2857
12	0.5750	0.1000	0.3250	0.0750
13	0.2364	0.0909	0.6727	0.0364
14	0.6000	0.1111	0.2889	0.2667
15	0.3056	0.1111	0.5833	0.0278
16	0.2000	0.7333	0.0667	0.2667
17	0.1429	0.6571	0.2000	0.0571
18	0.2444	0.6444	0.1111	0.0889
19	0.1349	0.0714	0.7937	0.1508
20	0.4286	0.4286	0.1429	0.0000
21	0.5152	0.0909	0.3939	0.1212
22	0.3250	0.1000	0.5750	0.0750
23	0.1282	0.0769	0.7949	0.1026
24	0.5750	0.1000	0.3250	0.0750
25	0.1667	0.0833	0.7500	0.0833
26	0.1111	0.5556	0.3333	0.2222
27	0.6571	0.0714	0.2714	0.1571
28	0.6600	0.1000	0.2400	0.0600
29	0.6545	0.0909	0.2545	0.1091
30	0.2179	0.7051	0.0769	0.1667
Mean	0.4012	0.2308	0.3680	0.1356
SD	0.2285	0.2401	0.2443	0.0880
Median	0.3777	0.1000	0.3069	0.1065

Table D.2: Technology: local weights

#	Benefits	Costs	Complexity	Compatibility	Reliability	Scalability	Security	ξ^L
1	0.3333	0.0909	0.0909	0.0303	0.0909	0.1212	0.2424	0.1212
2	0.4239	0.0989	0.1187	0.1187	0.1187	0.0363	0.0848	0.1696
3	0.3026	0.0207	0.3026	0.1397	0.0698	0.1047	0.0599	0.1164
4	0.2105	0.2368	0.2895	0.0263	0.0789	0.0789	0.0789	0.1053
5	0.2581	0.1613	0.1075	0.0215	0.1075	0.1075	0.2366	0.0645
6	0.2590	0.0341	0.0695	0.1159	0.1159	0.0579	0.3476	0.0886
7	0.3215	0.2411	0.1206	0.0236	0.0804	0.0804	0.1324	0.1087
8	0.2931	0.1256	0.1884	0.0754	0.0942	0.0349	0.1884	0.0837
9	0.2085	0.0510	0.2409	0.0324	0.1274	0.0849	0.2548	0.0463
10	0.2227	0.0830	0.0830	0.0306	0.0830	0.0830	0.4148	0.1921
11	0.0185	0.0360	0.2688	0.0649	0.2225	0.1205	0.2688	0.1020
12	0.2500	0.1026	0.1538	0.0321	0.1026	0.0769	0.2821	0.0577
13	0.2767	0.1365	0.0683	0.0819	0.0287	0.1024	0.3054	0.1042
14	0.2155	0.0517	0.1724	0.0259	0.2241	0.0862	0.2241	0.0431
15	0.2154	0.0410	0.1538	0.1026	0.1538	0.0769	0.2564	0.0513
16	0.3683	0.0290	0.1586	0.0952	0.0952	0.0952	0.1586	0.1076
17	0.1192	0.0462	0.1760	0.0284	0.2895	0.1079	0.2328	0.0908
18	0.2633	0.3200	0.1283	0.0770	0.1283	0.0550	0.0284	0.1215
19	0.3442	0.2770	0.0588	0.0420	0.0588	0.0823	0.1371	0.0672
20	0.1938	0.0362	0.1938	0.0845	0.1938	0.0447	0.2534	0.0596
21	0.1781	0.0244	0.3318	0.1781	0.1106	0.1106	0.0664	0.1537
22	0.2334	0.0633	0.2937	0.0301	0.1581	0.0633	0.1581	0.0828
23	0.3083	0.0268	0.0751	0.0626	0.1251	0.0938	0.3083	0.0670
24	0.2329	0.0274	0.2329	0.0685	0.1370	0.0685	0.2329	0.0411
25	0.3033	0.0255	0.1256	0.0628	0.1256	0.0538	0.3033	0.0737
26	0.0286	0.0857	0.1429	0.2000	0.1429	0.2000	0.2000	0.0571
27	0.3605	0.0316	0.1455	0.0727	0.1091	0.0623	0.2182	0.0759
28	0.3064	0.0269	0.1236	0.0742	0.1236	0.0927	0.2526	0.0645
29	0.3304	0.0284	0.2025	0.0675	0.1012	0.0675	0.2025	0.0746
30	0.3742	0.0294	0.1612	0.0967	0.0967	0.0806	0.1612	0.1093
Mean	0.2585	0.0863	0.1660	0.0721	0.1231	0.0844	0.2097	0.0900
SD	0.0923	0.0825	0.0757	0.0452	0.0531	0.0318	0.0903	0.0368
Median	0.2611	0.0486	0.1538	0.0680	0.1132	0.0814	0.2285	0.0833

Table D.3: Organisation: local weights

#	Technological Readiness	Financial readiness	Human readiness	ξ^L
1	0.2000	0.7333	0.0667	0.2667
2	0.7778	0.1111	0.1111	0.0000
3	0.7909	0.1182	0.0909	0.1546
4	0.1111	0.2407	0.6482	0.3148
5	0.5882	0.3529	0.0588	0.1177
6	0.5000	0.3750	0.1250	0.2500
7	0.6222	0.2667	0.1111	0.1778
8	0.6852	0.2037	0.1111	0.1296
9	0.6286	0.2286	0.1429	0.0571
10	0.7143	0.1948	0.0909	0.2597
11	0.3333	0.5238	0.1429	0.1905
12	0.2600	0.1000	0.6400	0.1400
13	0.0909	0.2364	0.6727	0.0364
14	0.3333	0.1429	0.5238	0.1905
15	0.2917	0.5417	0.1667	0.0417
16	0.1313	0.0909	0.7778	0.1414
17	0.6727	0.0909	0.2364	0.0364
18	0.3333	0.3333	0.3333	0.0000
19	0.0667	0.6533	0.2800	0.1867
20	0.4286	0.1429	0.4286	0.0000
21	0.6364	0.2727	0.0909	0.1818
22	0.6250	0.1250	0.2500	0.1250
23	0.0909	0.6364	0.2727	0.1818
24	0.3056	0.1111	0.5833	0.0278
25	0.1111	0.6444	0.2444	0.0889
26	0.0667	0.4667	0.4667	0.0000
27	0.6444	0.1111	0.2444	0.0889
28	0.2364	0.0909	0.6727	0.0364
29	0.6444	0.2444	0.1111	0.0889
30	0.1970	0.0909	0.7121	0.0757
Mean	0.4039	0.2825	0.3136	0.1196
SD	0.2448	0.1995	0.2335	0.0882
Median	0.3333	0.2325	0.2444	0.1213

Table D.4: External task environment: local weights

#	Application user's readiness	Enabling party's readiness	Trust in application user	Trust in enabling party	Relative power of application user	Relative power of enabling party	External pressure	Regulation	Ecosystem data governance	ξ^L
1	0.0237	0.0569	0.0569	0.0758	0.0569	0.1137	0.2275	0.2275	0.1611	0.0664
2	0.3888	0.0883	0.0757	0.0757	0.0757	0.0310	0.0883	0.0883	0.0883	0.1411
3	0.1104	0.2044	0.1657	0.1657	0.0663	0.0473	0.0552	0.0194	0.1657	0.1269
4	0.2723	0.1466	0.0733	0.0733	0.0524	0.1466	0.0628	0.0628	0.1099	0.1675
5	0.0431	0.1005	0.2266	0.1005	0.2266	0.1005	0.0169	0.0431	0.1423	0.0749
6	0.1563	0.0625	0.2344	0.1562	0.1042	0.0521	0.0521	0.0260	0.1562	0.0781
7	0.1594	0.1594	0.0797	0.0797	0.0797	0.2016	0.0281	0.1063	0.1063	0.1172
8	0.0665	0.1109	0.2583	0.1664	0.0832	0.0665	0.0263	0.0555	0.1664	0.0744
9	0.0952	0.2143	0.2381	0.0952	0.0952	0.0952	0.0476	0.0238	0.0952	0.0714
10	0.1293	0.1293	0.1293	0.1293	0.1293	0.0748	0.0204	0.1293	0.1293	0.0544
11	0.0326	0.1196	0.2065	0.1196	0.0326	0.1196	0.0326	0.1196	0.2174	0.0870
12	0.0605	0.1211	0.2813	0.1211	0.0726	0.0726	0.0605	0.0285	0.1816	0.0819
13	0.0538	0.1615	0.1076	0.2293	0.0807	0.2293	0.0194	0.0538	0.0646	0.0936
14	0.0526	0.0876	0.1877	0.1877	0.0876	0.0375	0.0161	0.1555	0.1877	0.0751
15	0.0683	0.0732	0.1902	0.1707	0.1024	0.1024	0.1024	0.0195	0.1707	0.0341
16	0.1201	0.2349	0.1201	0.2788	0.0721	0.0721	0.0219	0.0400	0.0400	0.0814
17	0.0769	0.1660	0.1660	0.2065	0.1255	0.0769	0.0850	0.0202	0.0769	0.0648
18	0.1647	0.1529	0.2471	0.0824	0.0824	0.0824	0.0235	0.0549	0.1098	0.0824
19	0.1211	0.1211	0.2556	0.0908	0.1211	0.1816	0.0519	0.0164	0.0404	0.1076
20	0.0898	0.0419	0.0898	0.0898	0.0898	0.0898	0.0898	0.0898	0.3293	0.1198
21	0.2083	0.0947	0.0947	0.2462	0.1326	0.0947	0.0406	0.0568	0.0316	0.0757
22	0.0868	0.1158	0.1736	0.1158	0.0695	0.0695	0.0324	0.0496	0.2871	0.0602
23	0.0704	0.0503	0.1759	0.1173	0.2906	0.0255	0.0440	0.0503	0.1759	0.0612
24	0.0934	0.1246	0.2865	0.1868	0.0934	0.0747	0.0249	0.0534	0.0623	0.0872
25	0.0505	0.1010	0.2446	0.1516	0.0505	0.0606	0.0433	0.0266	0.2712	0.0319
26	0.1837	0.1837	0.0612	0.3061	0.0612	0.0612	0.0476	0.0476	0.0476	0.1224
27	0.0626	0.1043	0.2537	0.1564	0.0782	0.0521	0.0391	0.0243	0.2294	0.0591
28	0.0826	0.1032	0.1376	0.1376	0.0688	0.0688	0.0287	0.0516	0.3211	0.0917
29	0.0549	0.1098	0.2745	0.1098	0.0471	0.0549	0.0275	0.0471	0.2745	0.0549
30	0.1078	0.2204	0.1078	0.2673	0.0647	0.0647	0.0234	0.0359	0.1078	0.0563
Mean	0.1095	0.1253	0.1733	0.1496	0.0931	0.0873	0.0493	0.0608	0.1516	0.0834
SD	0.0769	0.0507	0.0744	0.0650	0.0519	0.0478	0.0410	0.0470	0.0848	0.0307
Median	0.0883	0.1177	0.1748	0.1334	0.0802	0.0737	0.0398	0.0499	0.1493	0.0769

Table D.5: Ecosystem data governance: local weights

#	Governance mode	Governance of data ownership & access	Governance of data usage	ξ^L
1	0.2917	0.5417	0.1667	0.0417
2	0.0714	0.1696	0.7589	0.2589
3	0.1948	0.0909	0.7143	0.2597
4	0.2917	0.5417	0.1667	0.0417
5	0.5500	0.3500	0.1000	0.1500
6	0.0667	0.4667	0.4667	0.0000
7	0.3750	0.5250	0.1000	0.2250
8	0.1111	0.4444	0.4444	0.0000
9	0.1111	0.6444	0.2444	0.0889
10	0.0909	0.5758	0.3333	0.2424
11	0.0526	0.4737	0.4737	0.0000
12	0.1250	0.5625	0.3125	0.0625
13	0.3333	0.3333	0.3333	0.0000
14	0.1111	0.7778	0.1111	0.0000
15	0.6000	0.1667	0.2333	0.1000
16	0.1111	0.4815	0.4074	0.0741
17	0.3333	0.1429	0.5238	0.1905
18	0.4583	0.1250	0.4167	0.0417
19	0.0909	0.7143	0.1948	0.2597
20	0.1429	0.4286	0.4286	0.0000
21	0.0909	0.3091	0.6000	0.3273
22	0.1250	0.4583	0.4167	0.0417
23	0.0769	0.5577	0.3654	0.1731
24	0.1111	0.4444	0.4444	0.0000
25	0.0833	0.6667	0.2500	0.0833
26	0.2444	0.1111	0.6444	0.0889
27	0.0714	0.6571	0.2714	0.1571
28	0.0714	0.4762	0.4524	0.0238
29	0.0833	0.6667	0.2500	0.0833
30	0.1000	0.4667	0.4333	0.0333
Mean	0.1857	0.4457	0.3686	0.1016
SD	0.1508	0.1915	0.1740	0.0982
Median	0.1111	0.4702	0.3864	0.0787

E BWM results - consistency indicators

Table E.1: BWM consistency per respondent and comparison

	ξ^L				
#	Comparison 1	Comparison 2	Comparison 3	Comparison 4	Comparison 5
1	0.1039	0.1212	0.2667	0.0544	0.0417
2	0.2637	0.1696	0.0000	0.0544	0.2589
3	0.1975	0.1164	0.1545	0.1269	0.2597
4	0.1250	0.1053	0.3148	0.1269	0.0417
5	0.0364	0.0645	0.1176	0.1269	0.1500
6	0.2400	0.0886	0.2500	0.1269	0.0000
7	0.2656	0.1087	0.1778	0.1172	0.2250
8	0.0577	0.0837	0.1296	0.1172	0.0000
9	0.0750	0.0463	0.0571	0.0714	0.0889
10	0.2765	0.1921	0.2597	0.0544	0.2424
11	0.2857	0.1020	0.1905	0.0544	0.0000
12	0.0750	0.0577	0.1400	0.0544	0.0625
13	0.0364	0.1042	0.0364	0.0936	0.0000
14	0.2667	0.0431	0.1905	0.0751	0.0000
15	0.0278	0.0513	0.0417	0.0341	0.1000
16	0.2667	0.1076	0.1414	0.0814	0.0741
17	0.0571	0.0908	0.0364	0.0814	0.1905
18	0.0889	0.1215	0.0000	0.0814	0.0417
19	0.1508	0.0672	0.1867	0.0814	0.2597
20	0.0000	0.0596	0.0000	0.1198	0.0000
21	0.1212	0.1537	0.1818	0.1198	0.3273
22	0.0750	0.0828	0.1250	0.0602	0.0417
23	0.1026	0.0670	0.1818	0.0612	0.1731
24	0.0750	0.0411	0.0278	0.0872	0.0000
25	0.0833	0.0737	0.0889	0.0319	0.0833
26	0.2222	0.0571	0.0000	0.1224	0.0889
27	0.1571	0.0759	0.0889	0.0591	0.1571
28	0.0600	0.0645	0.0364	0.0917	0.0238
29	0.1091	0.0746	0.0889	0.0549	0.0833
30	0.1667	0.1093	0.0758	0.0563	0.0333
Mean	0.1356	0.0900	0.1196	0.0834	0.1016
SD	0.0880	0.0368	0.0882	0.0307	0.0982
Median	0.1065	0.0833	0.1213	0.0769	0.0787

F BWM results - global weights

Table F.1: BWM global weights

#	Benefits	Costs	Complexity	Compatibility	Reliability	Scalability	Security	Technological readiness	Financial readiness	Human readiness
1	0.0563	0.0153	0.0153	0.0051	0.0153	0.0205	0.0409	0.0182	0.0667	0.0061
2	0.3074	0.0717	0.0861	0.0861	0.0861	0.0264	0.0615	0.0598	0.0085	0.0085
3	0.2279	0.0156	0.2279	0.1052	0.0526	0.0789	0.0451	0.0879	0.0131	0.0101
4	0.1491	0.1678	0.2050	0.0186	0.0559	0.0559	0.0559	0.0231	0.0502	0.1350
5	0.1736	0.1085	0.0723	0.0145	0.0723	0.0723	0.1591	0.0535	0.0321	0.0053
6	0.1554	0.0204	0.0417	0.0695	0.0695	0.0348	0.2086	0.1400	0.1050	0.0350
7	0.0201	0.0151	0.0075	0.0015	0.0050	0.0050	0.0083	0.4764	0.2042	0.0851
8	0.0958	0.0411	0.0616	0.0246	0.0308	0.0114	0.0616	0.0527	0.0157	0.0085
9	0.1199	0.0293	0.1385	0.0186	0.0733	0.0488	0.1465	0.0629	0.0229	0.0143
10	0.0301	0.0112	0.0112	0.0041	0.0112	0.0112	0.0561	0.0420	0.0115	0.0053
11	0.0079	0.0154	0.1152	0.0278	0.0953	0.0516	0.1152	0.0476	0.0748	0.0204
12	0.1438	0.0590	0.0885	0.0184	0.0590	0.0442	0.1622	0.0260	0.0100	0.0640
13	0.0654	0.0323	0.0161	0.0194	0.0068	0.0242	0.0722	0.0083	0.0215	0.0612
14	0.1293	0.0310	0.1034	0.0155	0.1345	0.0517	0.1345	0.0370	0.0159	0.0582
15	0.0658	0.0125	0.0470	0.0313	0.0470	0.0235	0.0783	0.0324	0.0602	0.0185
16	0.0737	0.0058	0.0317	0.0190	0.0190	0.0190	0.0317	0.0963	0.0667	0.5704
17	0.0170	0.0066	0.0251	0.0041	0.0414	0.0154	0.0333	0.4421	0.0597	0.1553
18	0.0644	0.0782	0.0314	0.0188	0.0314	0.0134	0.0069	0.2148	0.2148	0.2148
19	0.0464	0.0374	0.0079	0.0057	0.0079	0.0111	0.0185	0.0048	0.0467	0.0200
20	0.0830	0.0155	0.0830	0.0362	0.0830	0.0192	0.1086	0.1837	0.0612	0.1837
21	0.0918	0.0126	0.1709	0.0918	0.0570	0.0570	0.0342	0.0579	0.0248	0.0083
22	0.0759	0.0206	0.0954	0.0098	0.0514	0.0206	0.0514	0.0625	0.0125	0.0250
23	0.0395	0.0034	0.0096	0.0080	0.0160	0.0120	0.0395	0.0070	0.0490	0.0210
24	0.1339	0.0158	0.1339	0.0394	0.0788	0.0394	0.1339	0.0306	0.0111	0.0583
25	0.0505	0.0043	0.0209	0.0105	0.0209	0.0090	0.0505	0.0093	0.0537	0.0204
26	0.0032	0.0095	0.0159	0.0222	0.0159	0.0222	0.0222	0.0370	0.2593	0.2593
27	0.2369	0.0208	0.0956	0.0478	0.0717	0.0410	0.1434	0.0460	0.0079	0.0175
28	0.2022	0.0177	0.0816	0.0490	0.0816	0.0612	0.1667	0.0236	0.0091	0.0673
29	0.2162	0.0186	0.1325	0.0442	0.0663	0.0442	0.1325	0.0586	0.0222	0.0101
30	0.0816	0.0064	0.0351	0.0211	0.0211	0.0176	0.0351	0.1389	0.0641	0.5021
Mean	0.1055	0.0306	0.0736	0.0296	0.0493	0.0321	0.0805	0.0860	0.0558	0.0890
SD	0.0763	0.0355	0.0601	0.0270	0.0321	0.0203	0.0558	0.1134	0.0634	0.1391
Median	0.0823	0.0167	0.0670	0.0192	0.0520	0.0239	0.0588	0.0502	0.0394	0.0230

Table F.1: BWM global weights (*Continued*)

#	Application user's readiness	Enabling party's readiness	Trust in application user	Trust in enabling party	Relative power of application user	Relative power of enabling party	External pressure	Regulation	Ecosystem data governance
1	0.0175	0.0421	0.0421	0.0561	0.0421	0.0842	0.1684	0.1684	0.1193
2	0.0769	0.0175	0.0150	0.0150	0.0150	0.0061	0.0175	0.0175	0.0175
3	0.0150	0.0278	0.0225	0.0225	0.0090	0.0064	0.0075	0.0026	0.0225
4	0.0227	0.0122	0.0061	0.0061	0.0044	0.0122	0.0052	0.0052	0.0092
5	0.0102	0.0238	0.0536	0.0238	0.0536	0.0238	0.0040	0.0102	0.0336
6	0.0188	0.0075	0.0281	0.0187	0.0125	0.0063	0.0063	0.0031	0.0187
7	0.0274	0.0274	0.0137	0.0137	0.0137	0.0346	0.0048	0.0183	0.0183
8	0.0397	0.0661	0.1540	0.0992	0.0496	0.0397	0.0157	0.0331	0.0992
9	0.0310	0.0696	0.0774	0.0310	0.0310	0.0310	0.0155	0.0077	0.0310
10	0.1042	0.1042	0.1042	0.1042	0.1042	0.0603	0.0164	0.1042	0.1042
11	0.0140	0.0512	0.0885	0.0512	0.0140	0.0512	0.0140	0.0512	0.0932
12	0.0197	0.0394	0.0914	0.0394	0.0236	0.0236	0.0197	0.0093	0.0590
13	0.0362	0.1086	0.0724	0.1542	0.0543	0.1542	0.0130	0.0362	0.0434
14	0.0152	0.0253	0.0542	0.0542	0.0253	0.0108	0.0046	0.0449	0.0542
15	0.0398	0.0427	0.1110	0.0996	0.0598	0.0598	0.0598	0.0114	0.0996
16	0.0080	0.0157	0.0080	0.0186	0.0048	0.0048	0.0015	0.0027	0.0027
17	0.0154	0.0332	0.0332	0.0413	0.0251	0.0154	0.0170	0.0040	0.0154
18	0.0183	0.0170	0.0275	0.0092	0.0092	0.0092	0.0026	0.0061	0.0122
19	0.0961	0.0961	0.2029	0.0721	0.0961	0.1441	0.0412	0.0131	0.0320
20	0.0128	0.0060	0.0128	0.0128	0.0128	0.0128	0.0128	0.0128	0.0470
21	0.0821	0.0373	0.0373	0.0970	0.0522	0.0373	0.0160	0.0224	0.0124
22	0.0499	0.0666	0.0998	0.0666	0.0399	0.0399	0.0186	0.0285	0.1651
23	0.0559	0.0399	0.1398	0.0932	0.2310	0.0203	0.0350	0.0399	0.1398
24	0.0304	0.0405	0.0931	0.0607	0.0304	0.0243	0.0081	0.0173	0.0202
25	0.0379	0.0758	0.1835	0.1137	0.0379	0.0455	0.0325	0.0199	0.2034
26	0.0612	0.0612	0.0204	0.1020	0.0204	0.0204	0.0159	0.0159	0.0159
27	0.0170	0.0283	0.0689	0.0424	0.0212	0.0141	0.0106	0.0066	0.0623
28	0.0198	0.0248	0.0330	0.0330	0.0165	0.0165	0.0069	0.0124	0.0771
29	0.0140	0.0280	0.0699	0.0280	0.0120	0.0140	0.0070	0.0120	0.0699
30	0.0083	0.0170	0.0083	0.0206	0.0050	0.0050	0.0018	0.0028	0.0083
Mean	0.0338	0.0418	0.0658	0.0533	0.0375	0.0343	0.0200	0.0247	0.0569
SD	0.0265	0.0279	0.0531	0.0386	0.0442	0.0368	0.0308	0.0341	0.0511
Median	0.0213	0.0352	0.0539	0.0419	0.0244	0.0220	0.0135	0.0129	0.0385

Table F.1: BWM global weights (*Continued*)

#	Governance mode	Governance of data ownership & access	Governance of data usage
1	0.0348	0.0646	0.0199
2	0.0012	0.0030	0.0133
3	0.0044	0.0020	0.0161
4	0.0027	0.0050	0.0015
5	0.0185	0.0118	0.0034
6	0.0013	0.0087	0.0087
7	0.0068	0.0096	0.0018
8	0.0110	0.0441	0.0441
9	0.0034	0.0199	0.0076
10	0.0095	0.0600	0.0347
11	0.0049	0.0441	0.0441
12	0.0074	0.0332	0.0184
13	0.0145	0.0145	0.0145
14	0.0060	0.0422	0.0060
15	0.0598	0.0166	0.0232
16	0.0003	0.0013	0.0011
17	0.0051	0.0022	0.0081
18	0.0056	0.0015	0.0051
19	0.0029	0.0229	0.0062
20	0.0067	0.0202	0.0202
21	0.0011	0.0038	0.0075
22	0.0206	0.0757	0.0688
23	0.0108	0.0780	0.0511
24	0.0022	0.0090	0.0090
25	0.0170	0.1356	0.0509
26	0.0039	0.0018	0.0102
27	0.0044	0.0409	0.0169
28	0.0055	0.0367	0.0349
29	0.0058	0.0466	0.0175
30	0.0008	0.0039	0.0036
Mean	0.0093	0.0286	0.01890
SD	0.0120	0.0308	0.01760
Median	0.0055	0.0183	0.01390

G Mann-Whitney U test - sharing versus non-sharing

Table G.1: Mann-Whitney U test - global factors sharing versus non-sharing

	Mean		Mann-Whitney	
Global factor	Sharing	Non-sharing	U	Exact Sig. (2-tailed)
Benefits	0.0902	0.1369	142	0.1123
Costs	0.0272	0.0395	109	0.8656
Complexity	0.0679	0.0883	126	0.3721
Compatibility	0.0281	0.0333	135	0.2001
Reliability	0.0473	0.0558	124	0.4197
Scalability	0.0324	0.0330	111	0.7995
Security	0.0787	0.0884	120	0.5247
Technological Readiness	0.0963	0.0611	115	0.6719
Financial readiness	0.0646	0.0383	106	0.9662
Human readiness	0.0602	0.1022	106.5	0.9485
Application user's readiness	0.0381	0.0282	79	0.2871
Enabling party's readiness	0.0479	0.0325	67	0.1123
Trust in application user	0.0755	0.0529	67	0.1123
Trust in enabling party	0.0621	0.0399	63	0.0774
Relative power of application user	0.0460	0.0248	68	0.1226
Relative power of enabling party	0.0390	0.0281	75	0.2158
External pressure	0.0151	0.0310	94	0.6719
Regulation	0.0239	0.0283	81	0.3279
Ecosystem data governance	0.0593	0.0572	97	0.1123

Table G.2: Mann-Whitney U test - local categories sharing versus non-sharing

	Mean		Mann-Whitney U	
Local category	Sharing	Non-sharing	U	Exact Sig. (2-tailed)
Technology	0.3718	0.4753	132	0.2450
Organisation	0.2212	0.2017	119	0.5458
Environment	0.4070	0.3230	71	0.1554

Table G.3: Mann-Whitney U test - local factors sharing versus non-sharing

	Mean		Mann-Whitney U	
Local factor	Sharing	Non-sharing	U	Exact Sig. (2-tailed)
Benefits	0.2367	0.2884	135	0.2001
Costs	0.0945	0.0765	100	0.8656
Complexity	0.1609	0.1761	126	0.3721
Compatibility	0.0715	0.0707	128	0.3279
Reliability	0.1273	0.1178	91	0.5816
Scalability	0.0904	0.0733	77	0.2497
Security	0.2188	0.1973	91	0.5816
Technological Readiness	0.4098	0.4135	104	1.0000
Financial readiness	0.3029	0.2628	78	0.2628
Human readiness	0.2873	0.3237	116	0.6356
Application user's readiness	0.1009	0.1262	110	0.8324
Enabling party's readiness	0.1242	0.1180	96	0.7348
Trust in application user	0.1883	0.1515	74	0.2001
Trust in enabling party	0.1552	0.1273	80	0.3070
Relative power of application user	0.1044	0.0744	68	0.1226
Relative power of enabling party	0.0902	0.0841	108	0.8990
External pressure	0.0386	0.0723	135	0.2001
Regulation	0.0569	0.0706	116	0.6412
Ecosystem data governance	0.1412	0.1757	119	0.5528

Table G.4: Mann-Whitney U test - local EDG factors sharing versus non-sharing

	Mean		Mann-Whitney U	
Local factor	Sharing	Non-sharing	U	Exact Sig. (2-tailed)
Governance mode	0.1887	0.1886	104.5	1.0000
Governance of data ownership & access	0.4391	0.4561	109.5	0.8464
Governance of data usage	0.3722	0.3553	97	0.7631

H Mann-Whitney U test - vegetables versus flowers & plants

Table H.1: Mann-Whitney U test - global factors vegetables versus flowers & plants

	Mean		Mann-Whitney U	
Global factor	Vegetables	Flowers & plants	U	Exact Sig. (2-tailed)
Benefits	0.0721	0.1373	156	0.0259
Costs	0.0251	0.0352	113	0.7472
Complexity	0.0591	0.0880	138	0.1583
Compatibility	0.0228	0.0363	146	0.0769
Reliability	0.0455	0.0540	130	0.2898
Scalability	0.0308	0.0346	120	0.5325
Security	0.0798	0.0824	110	0.8467
Technological Readiness	0.0747	0.0988	126	0.3766
Financial readiness	0.0667	0.0484	88	0.4773
Human readiness	0.0456	0.1348	134	0.2135
Application user's readiness	0.0457	0.0224	52	0.0203
Enabling party's readiness	0.0568	0.0261	46	0.0091
Trust in application user	0.0840	0.0428	56	0.0328
Trust in enabling party	0.0711	0.0337	47	0.0105
Relative power of application user	0.0561	0.0194	43	0.0059
Relative power of enabling party	0.0486	0.0206	46	0.0091
External pressure	0.0170	0.0231	86	0.4253
Regulation	0.0297	0.0194	42	0.0051
Ecosystem data governance	0.0689	0.0428	76	0.2172

Table H.2: Mann-Whitney U test - local categories vegetables versus flowers & plants

	Mean		Mann-Whitney U	
Local category	Vegetables	Flowers & plants	U	Exact Sig. (2-tailed)
Technology	0.3351	0.4678	147	0.0699
Organisation	0.1870	0.2820	136	0.1820
Environment	0.4779	0.2503	43	0.0072

Table H.3: Mann-Whitney U test - local factors vegetables versus flowers & plants

	Mean		Mann-Whitney U	
Local factor	Vegetables	Flowers & plants	U	Exact Sig. (2-tailed)
Benefits	0.2269	0.2856	138	0.1583
Costs	0.0927	0.0777	89	0.5045
Complexity	0.1542	0.1754	136	0.1861
Compatibility	0.0694	0.0743	133	0.2340
Reliability	0.1222	0.1259	100	0.8467
Scalability	0.0948	0.0780	73	0.1718
Security	0.2398	0.1830	70	0.1337
Technological Readiness	0.3863	0.4017	119	0.5555
Financial readiness	0.3657	0.2101	43	0.0077
Human readiness	0.2481	0.3882	134	0.2133
Application user's readiness	0.1031	0.1185	110	0.8467
Enabling party's readiness	0.1215	0.1299	114	0.7148
Trust in application user	0.1725	0.1684	103	0.9468
Trust in enabling party	0.1518	0.1465	98	0.7800
Relative power of application user	0.1115	0.0765	68	0.1121
Relative power of enabling party	0.1003	0.0767	89	0.5045
External pressure	0.0352	0.0640	144	0.0932
Regulation	0.0646	0.0576	91	0.5613
Ecosystem data governance	0.1395	0.1619	120	0.5325

Table H.4: Mann-Whitney U test - local EDG factors vegetables versus flowers & plants

	Mean		Mann-Whitney U	
Local factor	Vegetables	Flowers & plants	U	Exact Sig. (2-tailed)
Governance mode	0.1716	0.2038	121	0.4984
Governance of data ownership & access	0.4974	0.3975	79	0.2656
Governance of data usage	0.3310	0.3987	126	0.3708

I List of respondents

Table I.1: Respondent characteristics

#	Data sharing	Crop	Crop acreage	Employees	Age
1	Not sharing	Flowers & plants	0 to 1 ha	1	Under 25
2	Not sharing	Flowers & plants	0 to 1 ha	2	46-55
3	Sharing	Flowers & plants	6 to 10 ha	26	36-45
4	Not sharing	Flowers & plants	2 to 4 ha	30	46-55
5	Sharing	Vegetables	2 to 4 ha	2	36-45
6	Sharing	Vegetables	50 ha or more	250	25-35
7	Sharing	Vegetables	4 to 6 ha	4	46-55
8	Not sharing	Tree nursery	4 to 6 ha	4	36-45
9	Not sharing	Vegetables	6 to 10 ha	12	46-55
10	Sharing	Vegetables	10 to 15 ha	11	46-55
11	Sharing	Vegetables	2 to 4 ha	40	46-55
12	Sharing	Flowers & plants	4 to 6 ha	8	46-55
13	Sharing	Vegetables	10 to 15 ha	25	25-35
14	Sharing	Vegetables	10 to 15 ha	30	46-55
15	Not sharing	Flowers & plants	1 to 2 ha	4	46-55
16	Not sharing	Flowers & plants	15 to 25 ha	50	46-55
17	Sharing	Flowers & plants	4 to 6 ha	25	36-45
18	Sharing	Flowers & plants	10 to 15 ha	75	36-45
19	Sharing	Vegetables	15 to 25 ha	12	25-35
20	Not sharing	Flowers & plants	2 to 4 ha	4	36-45
21	Sharing	Vegetables	6 to 10 ha	3	46-55
22	Sharing	Vegetables	4 to 6 ha	8	36-45
23	Sharing	Vegetables	15 to 25 ha	15	46-55
24	Sharing	Flowers & plants	6 to 10 ha	14	46-55
25	Sharing	Vegetables	6 to 10 ha	12	46-55
26	Sharing	Vegetables	4 to 6 ha	3	46-55
27	Sharing	Flowers & plants	10 to 15 ha	25	46-55
28	Not Sharing	Flowers & plants	1 to 2 ha	4	36-45
29	Not Sharing	Flowers & plants	4 to 6 ha	12	46-55
30	Not Sharing	Flowers & plants	10 to 15 ha	15	36-45

J List of interviewees

Table J.1: Interviewee characteristics

#	Data sharing	Crop	Crop acreage	Employees	Age	Job title
A	Not sharing	Flowers & plants	0 to 1 ha	2	46-55	Owner
B	Sharing	Flowers & plants	6 to 10 ha	26	36-45	Owner
C	Not sharing	Flowers & plants	2 to 4 ha	30	46-55	Owner
D	Sharing	Vegetables	2 to 4 ha	2	36-45	Owner
E	Sharing	Vegetables	50 ha or more	250	25-35	Manager Energy, Purchasing and Innovation
F	Sharing	Flowers & plants	2 to 4 ha	4	36-45	Owner

K Interview notes

Interviewee A - 12/09/2018

On the categories:

- Technologie is meest belangrijk. De veiligheid en het te gebruiken data platform zijn belangrijk. Financiële middelen dat vind ik nou niet zo spannend. Als het iets is, dan moet je daar gewoon in investeren. En misschien het personeel om data te kunnen delen, dat vind ik nou ook niet zo spannend.

On the technology category:

- Je moet soms wel eens een euro uitgeven om twee euro terug te vangen. Voordelen zijn het belangrijkst.
- Stabiliteit is ook belangrijk.
- Je moet wel eens geld uitgeven, want als je dat niet doet kom je ook niet verder. [Kosten] moeten wel binnen de beperkingen blijven.

On the organisation category:

- Je gaat geen geld uitgeven als je niet overtuigd bent dat het geld gaat opleveren. Je gaat geen geld uitgeven om maar wat te doen.
- Personeel en financiën dat mag geen probleem zijn met zo'n project, het moet gewoon gebruiksvriendelijk zijn, uitvoerbaar zijn, dat zijn de belangrijkste dingen.

On the environment category:

- Ik vind dat eigenlijk wel het belangrijkste [gereedheid data gebruiker], anders heb je niks. Dan kan je wel zeggen, ik doe mee, en dan doen ze maar wat, dan heb je er ook niks aan.
- Als jij het niet ziet zitten, dan kan die bemiddelende partij, die staat dan met z'n handen in z'n haar, die kan dan niks. De gebruiker (de tuinder) daar draait het toch wel om, als die zegt: ik doe het niet, dan doet hij het niet.

On ecosystem data governance:

- Het is leuk als je ziet, die jongen haalt zo'n product met zoveel gasverbruik en zo weinig arbeid, als je die lijn, en zoveel mest en zoveel bestrijding, als je die hoofdpunten bij elkaar in een rijtje zet, dan heb je nog steeds niet het gewas gezien. Het is een soort wake-up call voor je bedrijf ook, als je van die jongens die data ziet, die presteren beter, ik heb minder productie, ik heb meer gasverbruik, ik heb meer bestrijdingsmiddelen gebruikt, ik heb meer arbeid gebruikt. Dus data gebruik is het belangrijkst [van data bestuur].
- Het is niet over de bestuursvorm waarover je je druk moet maken, het moet gewoon een partij zijn die dat gaat regelen. [Maakt niet uit wie]. Je moet het gewoon kunnen gebruiken, je gooit er wat in en je haalt er wat uit. Je moet je niet over allerlei randzaken druk gaan maken, daar zit niemand op te wachten. Het moet zo snel mogelijk gaan. Je ziet ook met die platformen van de veiling, waar ze mee bezig zijn, dat duurt ook allemaal vrij lang vind ik. Voordat dat eventje de lucht in is en draait.

Other comments:

- Als die grote bedrijven hun data gaan delen, zijn ze hun voorsprong kwijt, denken ze. Het is allemaal veel zakelijker geworden, vroeger was het heel anders, toen was de mentaliteit van de tuinders heel anders. Het is ieder voor zich. Ik denk dat het ook heel moeilijk is om ergens binnen te komen.

- De laatste jaren, de prijsvorming in de groente, was gewoon slecht. Als iemand wat met hun kennis gaat doen, dan help je iemand in het zadel. Als iedereen nog meer gaat produceren, ze weten nu al niet waar ze met hun tomaten heen moeten. Dan gaat de prijs nog verder naar beneden. Vroeger was dat anders, dan was er het grootste gedeelte van het jaar tomaten tekort. Dan zag je het voordeel er van in, als je meer ging produceren dan had je ook meer. De situatie is gewoon heel anders.

- [In het verleden is er geïnvesteerd in technologie waar geen geld voor geregeld hoefde te worden, en dit zou ook niet terug verdiend worden maar het leverde veel gemak op wat het de investering waard maakte.] Niet alleen wat het opbrengt qua geld is belangrijk bij investeringen.

- Vroeger was het zo met die teeltgroepjes, dan had je gegevens, de cijfers, maar dan ook zag je het gewas erbij. Alleen cijfers, daar heb ik niks aan. Dat is hetzelfde als 's ochtends als je de prijzen van de veiling krijgt, en je hebt er geen bloemen bij gezien. Ik ga een keer per week kijken naar de bloemen, dan weet je welke prijs bij de bloemen hoort.

- Ik zie ook zo 1,2,3 niet meer dat je zegt, in Nederland kan je nog een slag maken qua efficiency. Ja qua arbeid, dat is eigenlijk je grootste kostenpost.

- Nu wordt er niks gedeeld [door ons], er zijn wel wat excursie groepjes. Ik heb het idee dat het nu in de bloemen meer gesloten is dan in de groente vroeger. In de groente, toen lag alles op straat. Ik proef een beetje [bij excursie groepen], als ik teveel vertel dan gaan ze met mijn kennis aan de haal. Dan help ik ze in het zadel. Omzet delen gaat niet gebeuren.

- Als het niveau van de hele groep omhoog gaat, dan heb je kans dat je prijsniveau [ook omhoog gaat]. Als mensen alleen maar goed spul kopen, gaan ze meer kopen.

- Ik heb sensoren voor m'n watergeef strategie, en daar wil ik wel wat meer over weten, wel eens willen weten hoe anderen dat doen. Ik heb er een soort bij zitten, en die groeide niet zo lekker, en die had mijn collega en die ging super. Dan zou ik wel eens willen weten hoe hij dat voor elkaar gekregen heeft.

Interviewee B - 25/09/2018

On the categories:

- [Technologie gekozen als meest:] Veiligheid van de data vind ik echt heel belangrijk dus dat zet ik als meest belangrijk. Je realiseert je in feite niet hoeveel informatie je bij je hebt. Alleen al op je mobiel, een mapje, binnen je bedrijf en ik denk dat dat echt een onderschat dingetje is. Het is gigantisch als ik zie hoeveel teeltinfo, wat er allemaal aan de hand is, dat is bizar. Dat zou ik eigenlijk wel dichterbij, veiliger houden. Ik vertrouw daar helemaal niemand in wat dat betreft, bij mij komen de chinezen hier ook binnen.

- Binnen bedrijf is minst belangrijk omdat dit misschien al bij ons goed werkt. Wifi werkt in kassen vaak niet goed, wij hebben van die systemen bijvoorbeeld met terminals. Daar gaan wij heel veel data al mee delen, maar dat is allemaal met bedraad netwerk.

- Ik denk dat de techniek binnen je bedrijf makkelijk te organiseren is, zolang ze niet binnen kunnen komen dan is het best.

On the technology category:

- [Voordelen meest belangrijk] Uiteindelijk gaat het daar [de voordelen] allemaal om.
- [Over kosten] Of het nou 40 of 80 euro in de maand kost, het moet gewoon werken. Als je er mee werkt dan moet het werken. Als het één dag even niet werkt dan maakt het even niet meer uit wat het kostte. Als het altijd werkt dan heb je natuurlijk het liefst de goedkoopste.
- Stabiliteit is ook wel gebruiksgemak uiteindelijk.
- Ik ga er stiekem een beetje vanuit, ik deel al online voorraad, en dat zet ik toch al niet voor niks in de cloud of ver weg omdat klanten daarbij moeten kunnen. Dus hoe erg is het dat mensen dat kunnen zien, dus daar is veiligheid niet zo belangrijk. Maar als kijkt naar andere services hier dan wil ik dat liever wel hier houden.

On the organisation category:

- [Financiële middelen minst] Als het voor het bedrijf rendabel is, dan is de keuze gemaakt.
- [over Personeel] Het is gewoon een extra tool die ze krijgen, dus ik zie dat niet echt als een beperking voor het personeel. Dat zullen we ze dan gewoon aanleren. Bijna iedereen kan [overweg met] facebook, dus dan kan dit ook.

On the environment category:

- Data bestuur vind ik niet heel belangrijk, iedereen zegt op dat soort dingen gelijk ja. Iedereen gaat als je bijvoorbeeld ook een appje download gelijk akkoord met de voorwaarden. We zeggen wel dat we het belangrijk vinden maar uiteindelijk vindt niemand dat belangrijk. Triest genoeg gebeurd dat niet [dat er rekening mee wordt gehouden in de beslissing]. Maar het is misschien belangrijker als dat we nu vinden.
- [Over macht van bemiddelende partij] ja wat doet hij met zijn macht, als hij het positief gebruikt dan is het goed, maar gebruikt hij het niet positief dan niet. Macht is eigenlijk een negatief woord. Als het een groot bedrijf is en die gaat z'n macht misbruiken dan is het heel belangrijk. Maar als je vertrouwen hebt in de bemiddelende partij dan zal dat wel goed komen. Vertrouwen overtreft macht.

On ecosystem data governance:

- Data bestuur aspecten zijn dingen waar ik niet over nadenk.

Other comments:

- Met sensor data kan men niet heel veel mee, dat moet je toch wel weer interpreteren. Als je alles hebt dan kan je toch wel dingen gaan zien.
- We zijn erg onderontwikkeld hierin [beslissingen over data delen] in onze business. We zijn er nog helemaal niet meer bezig.
- [In het verleden is er wel eerder gedeeld:] Dat is heel technisch gericht, kan je leren van elkaar?
- Wij kijken zelf [als tuinders] meer naar grote lijnen, en niet zo specifiek [als de aspecten in de enquete].
- Data wordt gedeeld met het bedrijf (leverancier) van de robot, die kunnen van afstand zien/inloggen. Ze kunnen met een VPN verbinding erin voor storingen enzo.

Interviewee C - 28/09/2018

On the categories:

- Voordelen van het delen van de data, dat is gewoon het meest belangrijk. Het gaat voornamelijk om de technologie, de externe aspecten zijn niet direct van invloed op je data.

On the technology category:

- De voordelen dat is echt puur waar je het voor doet.
- Aansluiting niet belangrijk, als het werkt die aansluiting, dan werkt het toch. Als ik eraan mee doe dan wil ik data delen. En dan verwacht ik uit die data wat te halen.
- En daarna vind ik ook wel heel belangrijk het gebruiksgemak, we hebben allerlei soort systemen ook voor energie en op een gegeven moment wordt het gewoon heel veel. En om dan wat te vergelijken moet het niet te moeilijk worden. Dus het gebruiksgemak vind ik daarna dan wel heel belangrijk.
- Het moet gebruiksvriendelijk zijn, anders denk ik gooi maar aan de kant.
- Het moet wel stabiel zijn maar dat is niet even belangrijk. Uitbreidingsmogelijkheden is gewoon een praktisch iets, als je er weer iets bij verzint dan moet het er gewoon bij kunnen [maar niet essentieel].
- Kosten zijn natuurlijk altijd wel belangrijk.

On the organisation category:

- Voor mij wel het belangrijkste dat het personeel wel snapt hoe het werkt. De mensen moeten er natuurlijk mee kunnen werken anders kan ik er niks mee.

On the environment category:

- Op een gegeven moment wil je gaan draaien en dan wil ik mij niet meer druk maken over wie je vertrouwt. Bij LetsGrow hadden we bepaalde afspraken gemaakt en dat ging toen in die tijd via Hoogendoorn, klimaatcijfers en opbrengstcijfers die gingen er allemaal in en dan is de afspraak gemaakt dat dat binnen die groep blijft. En dan ga je er vanuit dat dat zo is en dan ga ik mij daar niet meer druk over maken, dan gaat het eigenlijk alleen nog maar over die data, dat is waar het om te doen is. Door die data moet je verder komen. Als het eenmaal goed geregeld is, je stapt in en dan maak je bepaalde afspraken en dan ga ik er van uit dat dat nageleefd wordt.
- Vertrouwen is minder belangrijk; ik neem aan dat als je aan zoiets gaat beginnen er bepaalde overeenkomsten getekend worden door iedereen. Welke data ga je delen en met wie ga je het delen, en als dat verandert, dan moet iedereen daar eerst zijn goedkeuring aan geven denk ik. Maar als je daar goedkeuring aan geeft dan weet je dat je met partijen in zee gaat die je vertrouwt. En dan zeg je verder, draai maar met dat systeem.

On ecosystem data governance:

- Je wilt wel ten alle tijden controle hebben wie er toegang heeft tot jouw gegevens, dat is wel het meest belangrijk. Ook dat je naderhand nog kan zeggen, nu ben ik er klaar mee, de data die jullie hebben moet nu gewist worden. Als iemand uit zo'n groep gaat waar je data mee deelt dat die dan ook geen toegang meer heeft.

- Bestuur verantwoordelijke maakt niet heel veel uit, als het maar iemand is die het goed regelt. Het hoeft niet perse een cooperatie te zijn, het kan ook een bedrijf zijn. Ligt er wel aan wat voor bedrijf. Als KPN dat wilt gaan doen dan hebben wij daar niet zoveel vertrouwen in. Slechte ervaringen met KPN.

- Als je bijvoorbeeld met KPN werkt qua telefoon, dan ben je gewoon klant als een van de honderd duizenden en als je dan iets gedaan wil krijgen, dan is het vechten zeg maar.

- En zoiets als wat wij nu bij Priva hebben, dan heb je vrij korte lijntjes en dan zeg je dat wil ik en dan gaan ze kijken of ze dat in kunnen passen en dan heb je dat vrij snel voor elkaar.

- Als je zoiets puur voor tuinbouw gericht gaat maken dan is de markt sowieso niet zo heel groot. En dan worden die lijntjes vanzelf wel wat korter. Ik denk dat tuinbouw wel heel specifiek is.

Other comments:

- Ik wil zoiets wel doen maar dan wil ik er wijzer van worden, anders heeft het geen zin. Dat hebben we bijvoorbeeld met onze collega's met LetsGrow ook gedaan.

- Ik denk dat het belangrijk is om die data goed te digitaliseren zodat je er heel makkelijk iets mee kan doen. Big data is natuurlijk ook een issue, maar de meeste data zit natuurlijk wel in die klimaatcomputer ook, maar je moet natuurlijk weten hoe moet je dat makkelijk handzamen. Ik denk dat het speerpunt zal zijn waar je je op zou moeten richten.

- De hoofdlijn is gewoon, ik wil echt wel graag data delen en dat moet gebruiksvriendelijk zijn en ik wil er het liefst niet teveel omkijken naar hebben. Moet goed geregeld zijn, en veilig geregeld zijn en niet te veel omkijken naar hebben. En genoeg voordelen hebben anders heeft het helemaal geen zin. Wij vergelijken eigenlijk altijd al jaren alles en dat heeft wel voordelen, dat weet ik wel zeker.

- [Gestopt met LetsGrow:] dat had als reden dat we dat een aantal jaar gedaan hadden, en eigenlijk wat erin zat eruit gehaald hadden, en eigenlijk het was meer om te zien, de onderlinge verschillen tussen de kwekers. En die waren allemaal verklaarbaar of aangepast, dus het voegde niet meer zoveel toe. En toen vonden we de kosten te hoog ten opzichte van wat het opbracht. En toen waren er nog een aantal telers die ermee stopte en toen zeiden we dan stoppen we ermee. Het is maar goed, je krijgt de laatste jaren steeds meer sensoren waar je van alles uit kan halen, er komen steeds meer onduidelijkheden. Ik vind het alleen al moeilijk, we zien heel veel ontwikkelingen in led lampen ook, dan denk ik wel weer, dan zou je wel heel veel willen met elkaar om te kijken wat dat dan doet. [vinden wat het optimale is om te gebruiken, zeker met nieuwe technieken]

- Dat is eigenlijk wat voor ons het belangrijkst is, data delen moet gebruiksvriendelijk zijn, en het moet goed in elkaar zitten het systeem en niet te veel er naar hoeven om te kijken. [bevestigend] aspecten zoals data bestuur zijn meer randvoorwaarden.

- Als ik iets nieuws zou gaan doen, bijvoorbeeld een hele nieuwe teelttechniek, dan zou ik graag data delen om te zien hoe dat bij anderen gaat. Of met een leverancier, of toeleverancier of een toelichter, dan zou ik dat wel graag doen.

- [Bij vergelijking tussen verschillende platformen:] is het gebruiksvriendelijk, is het goed geregeld en wat kost het. En dan heeft het ook wel een beetje te maken met wat voor bedrijf zit daar achter, heb je daar vertrouwen in. En dan vind ik het ook wel belangrijk dat er een beetje korte lijntjes [zijn], dat als het hele grote bedrijven zijn, dan werkt dat wel eens niet makkelijk. [Niet vanwege macht] Dat er niet snel genoeg iets doorgevoerd zou worden wat wij zouden willen.

Interviewee D - 03/10/2018

On the categories:

- [Keuze voor de groep Tech:]Dat je binnen het bedrijf vooral het meeste voordeel eruit kan halen door de data te analyseren en zo (dat is erg belangrijk)
- [over minst belangrijk:]Die aspecten buiten het bedrijf vind ik ook wel redelijk belangrijk (vandaar binnen bedrijf minst belangrijk)

On the technology category:

- Kwaliteit moet goed zijn en de betrouwbaarheid [van platform]. De veiligheid die is dan belangrijker [dan aansluiting].
- Als het eenmaal draait, dan draait dat dus dan is de aansluiting minder belangrijk.
- [uitbreidingsmogelijkheden zijn belangrijk] Wel voor de toekomst, hoe meer data erbij komt, en zeker als je met andere bedrijven die data gaat delen [ook bijvoorbeeld voor financiële data].

On the organisation category:

- [personeel minst belangrijk:] dat valt wel te trainen, daar hoeven we geen zorgen over te maken.

On the environment category:

- Als je data deelt dan ben je dat in principe ook kwijt, en daar kan dan de andere partij waarmee je het gedeeld hebt doen wat ze willen. Denk niet dat het gaat om negatief gebruiken, meer gebruik, dat hoeft niet negatief te zijn. Er moet dan meer vertrouwen zijn. Er zit gewoon heel veel data in een tuinbouw bedrijf. En die partij waarmee je het dan deelt, wat gebeurt er dan met die data? Of dat nou macht is of er vertrouwen, dat ligt ook wel dicht bij elkaar.
- Externe druk om data te gaan delen zie ik ook niet zo snel gebeuren, maar daar zouden wij ook ons niet zoveel van aantrekken.
- Het is echt het vertrouwen en de macht dat doorslaggevend is. Voorkeur ligt erbij om te kunnen kiezen met welke specifieke partijen op het platform gedeeld wordt. Geen situatie waarbij iedereen alles met elkaar deelt. Het heeft ook een bepaalde waarde de data die in een tuinbouwbedrijf zit. Dus dan is het niet handig om dat met iedereen te delen nee. We doen nu ook al bijvoorbeeld onderling dingen delen. Dat is puur onderling, daar komt geen externe partijen aan te pas. Binnen Prominent bijvoorbeeld, dat is puur vanuit vertrouwen.

On ecosystem data governance:

- Bestuur verantwoordelijke is de belangrijkste. Dat heeft ook te maken met vertrouwen. Als deze partij wordt vertrouwd, wordt er ook vertrouwd dat de juiste beslissingen worden genomen.
- Eigenaarschap van de data willen wij bij ons zelf houden. Dat is belangrijk. Zeggenschap houden.

Other comments:

- Binnen Prominent doen we bijvoorbeeld klimaatgegevens vergelijken. We gebruiken LetsGrow bijvoorbeeld om klimaatgegevens met elkaar te delen. Delen niet met andere partijen buiten. We doen wel eens klimaatgegevens delen met andere partijen buiten Prominent maar dat gaat dan weer via Excel ofso, niet via een platform (eenmalig, achteraf, niet continue, om te vergelijken). Data wordt ook gebruikt om nieuwe inzichten te krijgen (optimalisatie). Dat doe je vooral zelf, je bekijkt de data en je loopt bij elkaar op excursie en dan ga je de plant stand vergelijken met de data die uit de klimaatcomputer komen. De conclusies trekken we er zelf uit. Teeltvoorlichter kan wel eens meekijken bijvoorbeeld. We vergelijken ook financieel dingen met elkaar.
- Wordt geen data gedeeld met leveranciers [zaden of apparatuur]. Met zaden sowieso niet, omdat ze die data toch wel zelf willen houden, dat de voordelen bij hun liggen, dat zij het gaan gebruiken. Als het delen met ze echt veel waarde heeft dan zou het misschien wel kunnen.
- Dit zijn wel echt de aspecten maar ik over na zou denken, zoals wie is de eigenaar enz. Alles doet er eigenlijk wel toe. Mis nog wel een beetje of de telers echt bewust zijn dat de data ook waarde heeft, maar dat zijn ze denk ik wel.
- Achter het platform moet een partij zitten die te vertrouwen is, en een partij van binnen de industrie heeft wel de voorkeur. Met korte lijnen bijvoorbeeld, zoals met Prominent zijn de lijnen kort. LTO Glaskracht zou ook zo'n partij kunnen zijn bijvoorbeeld. Heeft wel voorkeur boven een externe partij [zoals KPN of Microsoft bijvoorbeeld], dat staat veel verder van je af.

Interviewee E - 04/10/2018

On the technology category:

- Veiligheid vind ik heel belangrijk [even belangrijk als voordelen]. Wat de kansen zijn zeg maar ervan dat is denk ik het belangrijkste, dus ik ben het van geld of personeel is ook wel een voorwaarde maar wat je er uiteindelijk aangaat hebben dat is denk ik het belangrijkste.
- Ik vind kosten niet zo belangrijk, het gaat er niet om wat het kost, het gaat erom wat het oplevert.
- Aansluiting vind ik ook redelijk belangrijk, zodat je niet je hele werkwijze moet aanpassen om data te delen. Het moet data delen vanuit je huidige processen zijn.
- Stabiliteit, natuurlijk is dat belangrijk maar niet doorslaggevend. Uitbreidingsmogelijkheden vind ik ook niet super belangrijk.

On the organisation category:

- Als het echt belangrijk is dan huur je iemand in.

On the environment category:

- Maar je wilt natuurlijk als sector voorkomen dat bijvoorbeeld Priva daar mee aan de haal gaat. We willen voorkomen dat zo'n Lely bijvoorbeeld, of Priva, al onze klimaatdata pakt en een teeltsysteem op gaat zetten en Dat gaat verkopen China. [Vertrouwen en data bestuur erg belangrijk]
- Als Monsanto onze data krijgt bijvoorbeeld, die zullen ook nooit wat delen met Rijkzwaan bijvoorbeeld. Zaad leveranciers zijn we wel huiverig over. Dan heb je het over de grootte der aarde. Het kan natuurlijk ook in het product zitten uiteindelijk dan gaat hij leverancier die waarde inschatten en dan wordt het een duur product.

On ecosystem data governance:

- Bestuurder is niet zo belangrijk. Regels belangrijker dan wie het uitvoert.

Other comments:

- De tuinbouw is wel een hele harde zakelijke sector, het lijkt wel alsof we een paar boeren zijn die het doen vanuit passie, is ook zo maar in de basis draait het allemaal om de euros.
- Water zie ik niet zo hele grote stappen in, energie wel, maar dan meer in het vervangen. En verder zitten we op arbeidskosten [als grootste kostenpost].
- [Door ons oppervlakte] hebben wij genoeg data om conclusies uit te trekken. De grootste tomaten bedrijven, die hebben niet nog eens van 200 hectare data nodig om dat te kunnen doen, die kunnen als Willen dat op een eigen locaties gebruiken.
- Nederlandse tuinders zijn sowieso wel heel erg intern gericht, alles wat uit het Westland komt is goed, en alles van daarbuiten is slecht, even heel zwart-wit.

Interviewee F - 19/10/2018

On the categories:

- Als je het binnen je bedrijf niet op orde hebt dan kan je heel veel data naar buiten sturen maar dan kan je er zelfs niets mee.
- Als de technologie ook niet zoveel voorstelt dan is dat ook niet super.

On the technology category:

- Het belangrijkste is de voordelen van de data delen maar als de stabiliteit van het platform helemaal niks is dan kan je er ook niet mee werken.
- Ik zeg altijd liever, een euro erin en als er dan 2 euro uit komt, dan maken de kosten niet uit.
- Aan de ene kant is de veiligheid van het platform het belangrijkste, maar ik ga er gewoon vanuit dat dat gewoon standaard is tegenwoordig. Veiligheid is ook wel weer het belangrijkste [naast voordelen] want je wilt ook niet dat je data weet ik waar allemaal terecht komt, of dat het niet veilig is.
- Als dat data delen nou heel belangrijk is maar als ik nou een platform krijg dat helemaal niks is, dan zie ik wel dat het data delen heel belangrijk is maarja [dan gaat het niet gebeuren]. Als je het bijna niet kan gebruiken dan haak je ook af. Als het te moeilijk is, ik zal een voorbeeld geven, we hebben een sorteermachine staan voor bosjes rozen, daar hebben ze een nieuw computersysteem op verzonnen. Nou, dat computersysteem is best wel goed, maar dat is zo moeilijk om te gebruiken, dat je eigenlijk echt een super HBO'er moet aannemen om te gebruiken. En die kan elke dag in 5 minuten die computer even goed bijstellen, en daarna heeft ie heel de dag niks meer te doen. Ze zeiden, ja je moet een slim iemand aannemen, maar die gaat dat maar 5 minuten doen en dan gaat hij daarna heel de dag werk doen wat zwaar onder zijn niveau is. Als jullie dat nou even iets gebruiksgemakkelijker maken zodat de mensen die er normaal mee werken er normaal mee kunnen werken.

On the organisation category:

- [Personeel is lastig] Hoe hoog zou het opleidingsniveau moeten zijn, met die sorteermachine, ik wil best investeren in mensen om dat te gaan leren, maar iemand die dat een beetje kan, die kan dan 5 minuten per dag wat gaan doen. En voor de rest moet hij heel de dag onder zijn niveau werken. Dan gaat zo iemand hier niet lopen. En dat is hetzelfde met dit. Het kan heel moeilijk zijn en dan neem je iemand aan die dat kan doen, maar als hij er elke dag maar 5 minuten naar om hoef te kijken, en de rest van de dag zit hij onder zijn niveau te werken, dan ga je zo iemand nooit houden.
- [Financiële middelen hetzelfde als over kosten:] dat wordt wel geregeld.

On the environment category:

- [Data bestuur] vind ik eigenlijk omvatten wat daar allemaal boven staat, hoe we omgaan met de data op het platform, dus hoe er mee om wordt gegaan, dus de vaardigheden zitten daar in. Dat is gewoon het belangrijkste, hoe die regels zijn. Data bestuur is gewoon het aller belangrijkste wat er is, gewoon hoe je met elkaar afspraak hoe en wat.

On ecosystem data governance:

- [Bevestigend:] maakt niet heel veel uit wie verantwoordelijk is voor het bestuur als het maar goed geregeld wordt.

L | Survey examples

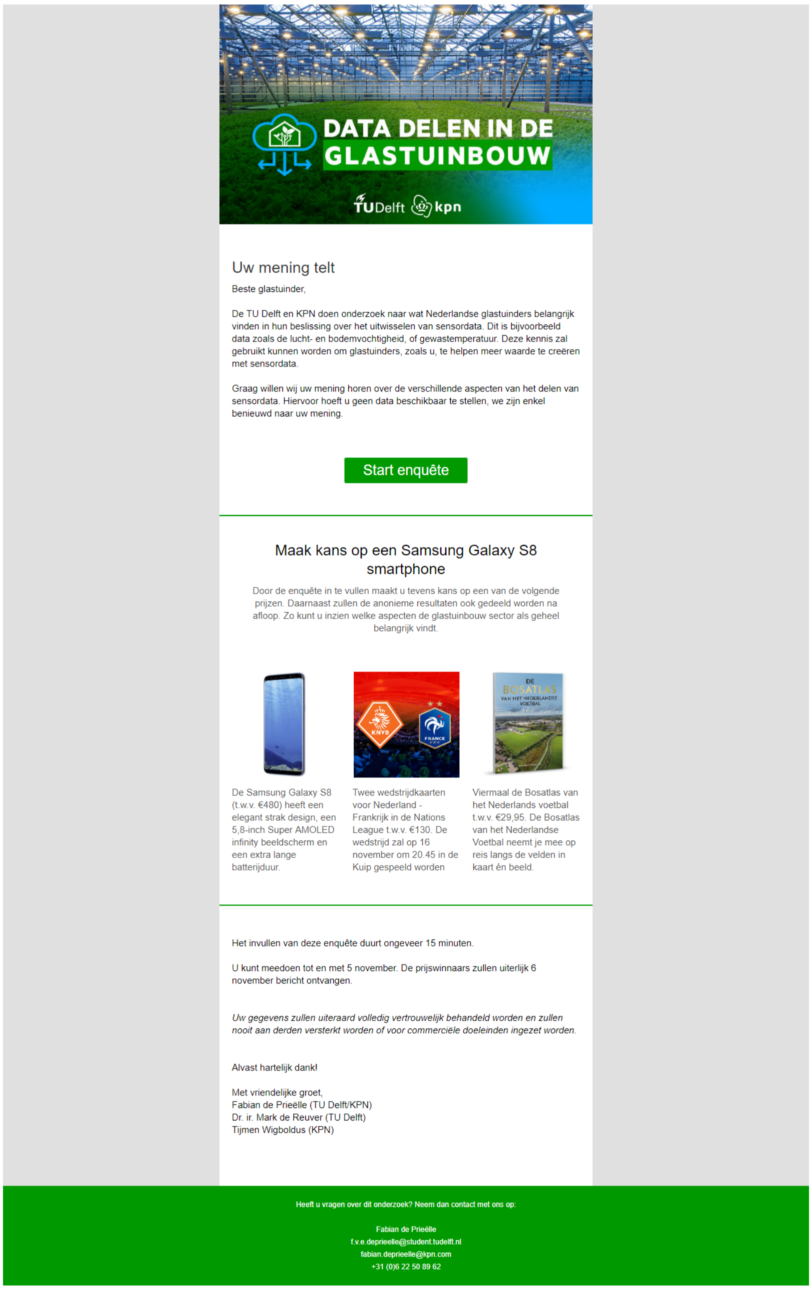


Figure L.1: Example of survey invitation

DATA DELEN IN DE GLASTUINBOUW TUDelft kpn

Laad onvoltooide enquête

0%

Beste glastuinder,

Allereerst willen wij u hartelijk danken voor uw tijd om deze enquête in te vullen.

Doordat kassen steeds digitaler worden door o.a. sensoren, worden grote hoeveelheden data gegenereerd. Data zoals de lucht- of bodemvochtigheid zijn enkele voorbeelden hiervan. Dit soort data zullen we vanaf nu '*sensor data*' noemen.

Door sensor data te delen ontstaan nieuwe kansen voor glastuinders, zoals u, om meerwaarde te creëren met de data. Zo kan bijvoorbeeld afgestemd advies geleverd worden om het energieverbuik of verliezen van gewasbeschermingsmiddelen zo laag mogelijk te houden.

Het delen van sensor data wordt mogelijk gemaakt door dataplatformen, zoals LetsGrow. Uw mening als Nederlandse glastuinder is erg waardevol om dataplatformen succesvol te kunnen (door)ontwikkelen en het mogelijk te maken meerwaarde te creëren met data.

Na afloop van het onderzoek zullen de resultaten gedeeld worden, zodat u ook kunt inzien hoe uw mening zich verhoudt ten opzichte van de volledige sector. De resultaten zullen uiteraard volledig anoniem zijn.

Tevens worden na afloop onder de deelnemers de volgende prijzen verloot:

- 1x - Samsung Galaxy S8 smartphone (t.w.v. €480)
- 1x - 2 wedstrijdkaarten voor Nederland - Frankrijk op 16 november in de Kuip (t.w.v. €130)
- 4x - De Bosatlas van het Nederlandse voetbal (t.w.v. €29,95)

Met vriendelijke groet,

Fabian de Prieëlle (TU Delft/KPN)

Dr.ir. Mark de Reuver (TU Delft)

Tijmen Wigboldus (KPN)

Het invullen van de enquête zal ongeveer 10 tot 15 minuten in beslag nemen.

Deze enquête is onderdeel van het onderzoek 'Data delen in de glastuinbouw', dat door de TU Delft en KPN wordt uitgevoerd. Het doel van dit onderzoek is om inzicht te creëren in wat tuinders in de Nederlandse glastuinbouw belangrijk vinden om data te delen. Dit inzicht kan gebruikt worden om data platformen te realizeren met de belangen van tuinders voorop.

Uw antwoorden zullen ten alle tijden vertrouwelijk en anoniem verwerkt worden. De antwoorden zullen uitsluitend voor dit onderzoek gebruikt worden en nooit voor commerciële doeleinden.

Alle data zal veilig bewaard worden op de TU Delft met een bewaartermijn van 10 jaar. Deze bewaartermijn is in lijn met de Nederlandse Gedragscode Wetenschapsbeoefening.

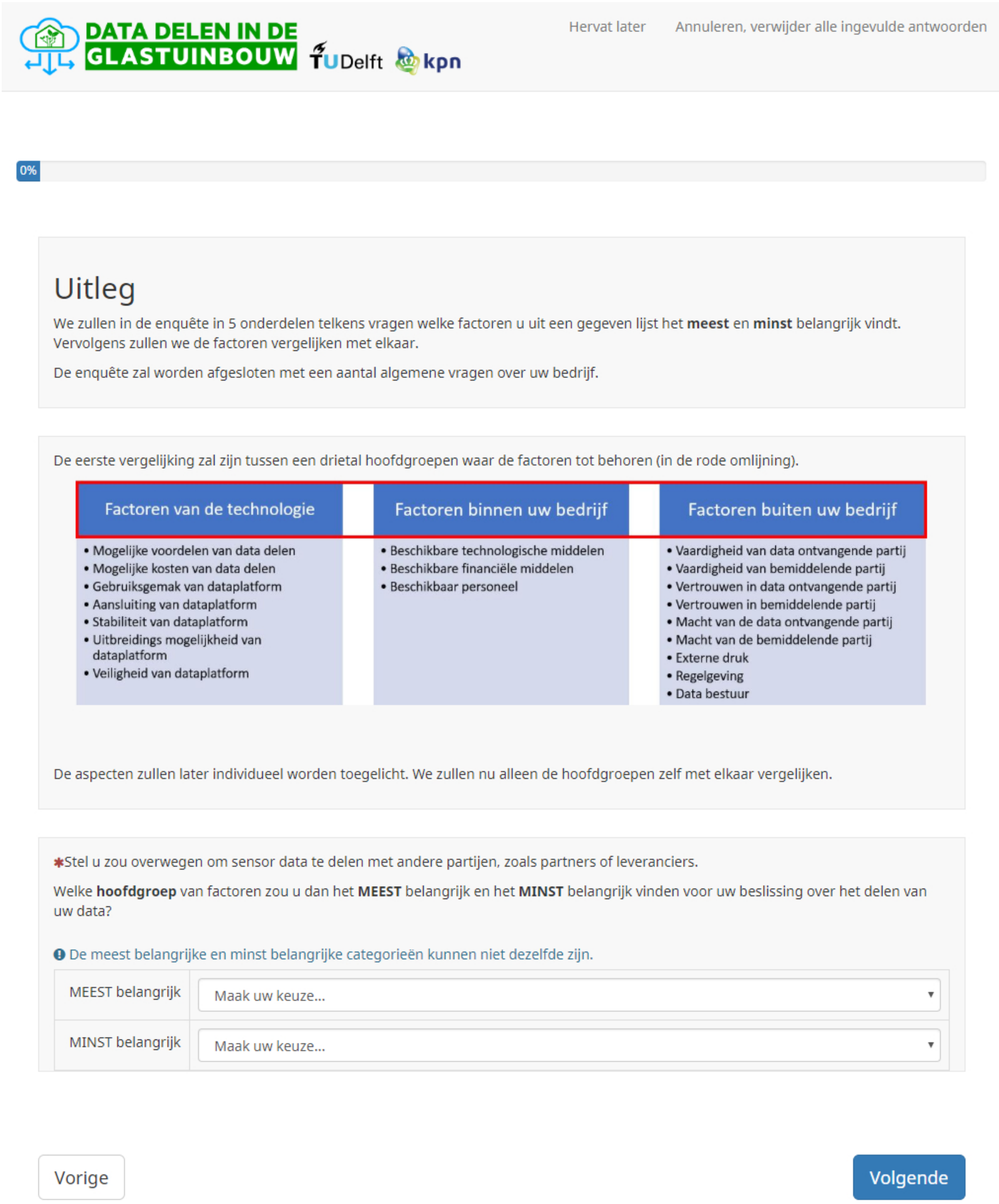
Uw deelname aan dit onderzoek is volledig vrijwillig en u kunt zich ten alle tijden terugtrekken van deelname.

Mocht u vragen hebben over het onderzoek of uw gedachte veranderen over uw deelname, neem dan contact op met Fabian de Prieëlle via: f.v.e.deprieelle@student.tudelft.nl of 06 22 50 89 62.

Door op *'Volgende'* te klikken gaat u ermee akkoord dat wij uw antwoorden zullen beschermen en verwerken zoals hierboven is beschreven.

Volgende

Figure L.2: Example of survey page 1



DATA DELEN IN DE GLASTUINBOUW TUDelft kpn

Hervat later Annuleren, verwijder alle ingevulde antwoorden

0%

Uitleg

We zullen in de enquête in 5 onderdelen telkens vragen welke factoren u uit een gegeven lijst het **meest** en **minst** belangrijk vindt. Vervolgens zullen we de factoren vergelijken met elkaar.

De enquête zal worden afgesloten met een aantal algemene vragen over uw bedrijf.

De eerste vergelijking zal zijn tussen een drietal hoofdgroepen waar de factoren tot behoren (in de rode omlijning).

Factoren van de technologie	Factoren binnen uw bedrijf	Factoren buiten uw bedrijf
• Mogelijke voordelen van data delen • Mogelijke kosten van data delen • Gebruiksgemak van dataplatform • Aansluiting van dataplatform • Stabiliteit van dataplatform • Uitbreidings mogelijkheid van dataplatform • Veiligheid van dataplatform	• Beschikbare technologische middelen • Beschikbare financiële middelen • Beschikbaar personeel	• Vaardigheid van data ontvangende partij • Vaardigheid van bemiddelende partij • Vertrouwen in data ontvangende partij • Vertrouwen in bemiddelende partij • Macht van de data ontvangende partij • Macht van de bemiddelende partij • Externe druk • Regelgeving • Data bestuur

De aspecten zullen later individueel worden toegelicht. We zullen nu alleen de hoofdgroepen zelf met elkaar vergelijken.

*Stel u zou overwegen om sensor data te delen met andere partijen, zoals partners of leveranciers.

Welke **hoofdgroep** van factoren zou u dan het **MEEST** belangrijk en het **MINST** belangrijk vinden voor uw beslissing over het delen van uw data?

De meest belangrijke en minst belangrijke categorieën kunnen niet dezelfde zijn.

MEEST belangrijk	Maak uw keuze...
MINST belangrijk	Maak uw keuze...

Vorige Volgende

Figure L.3: Example of survey page 2

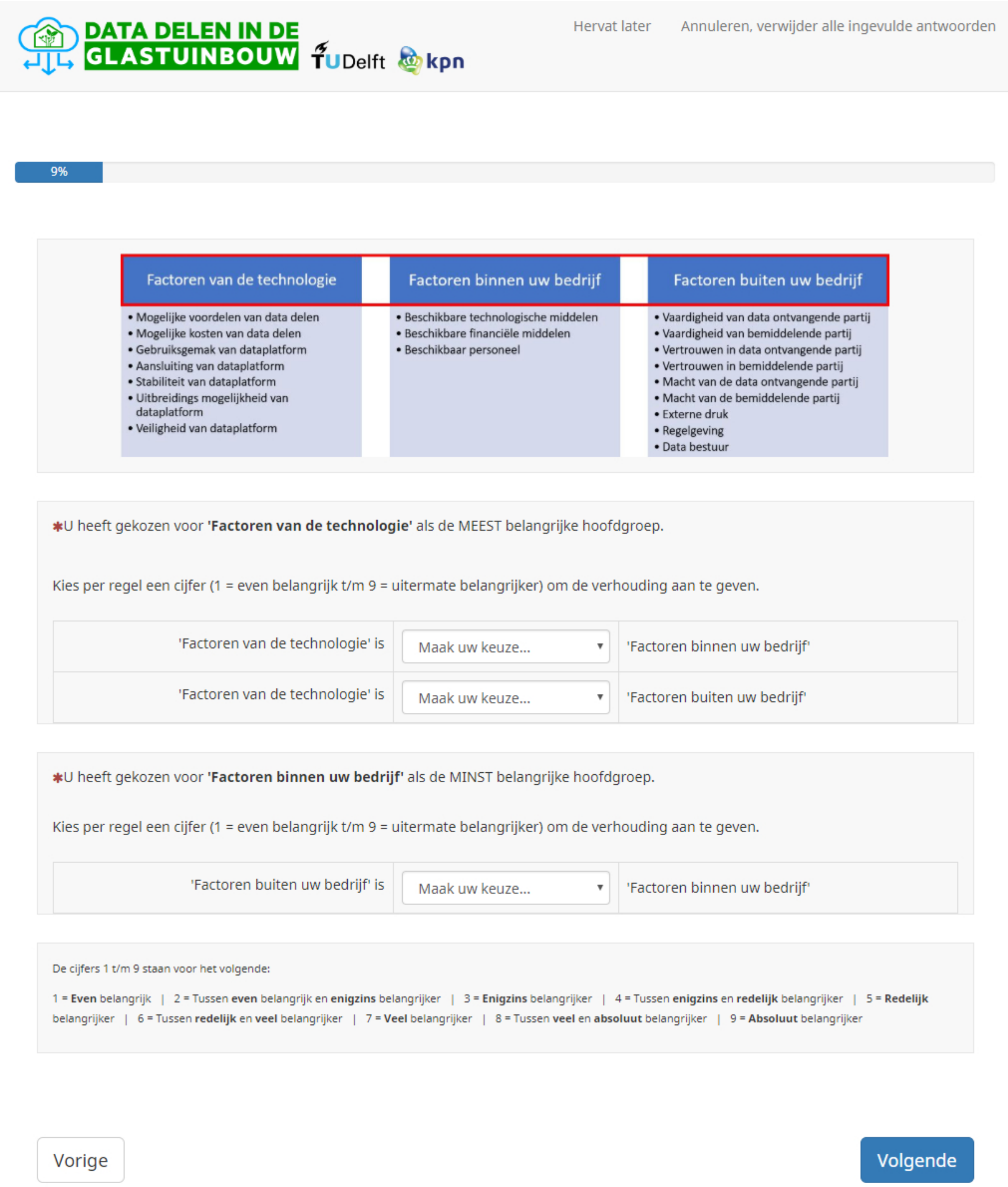
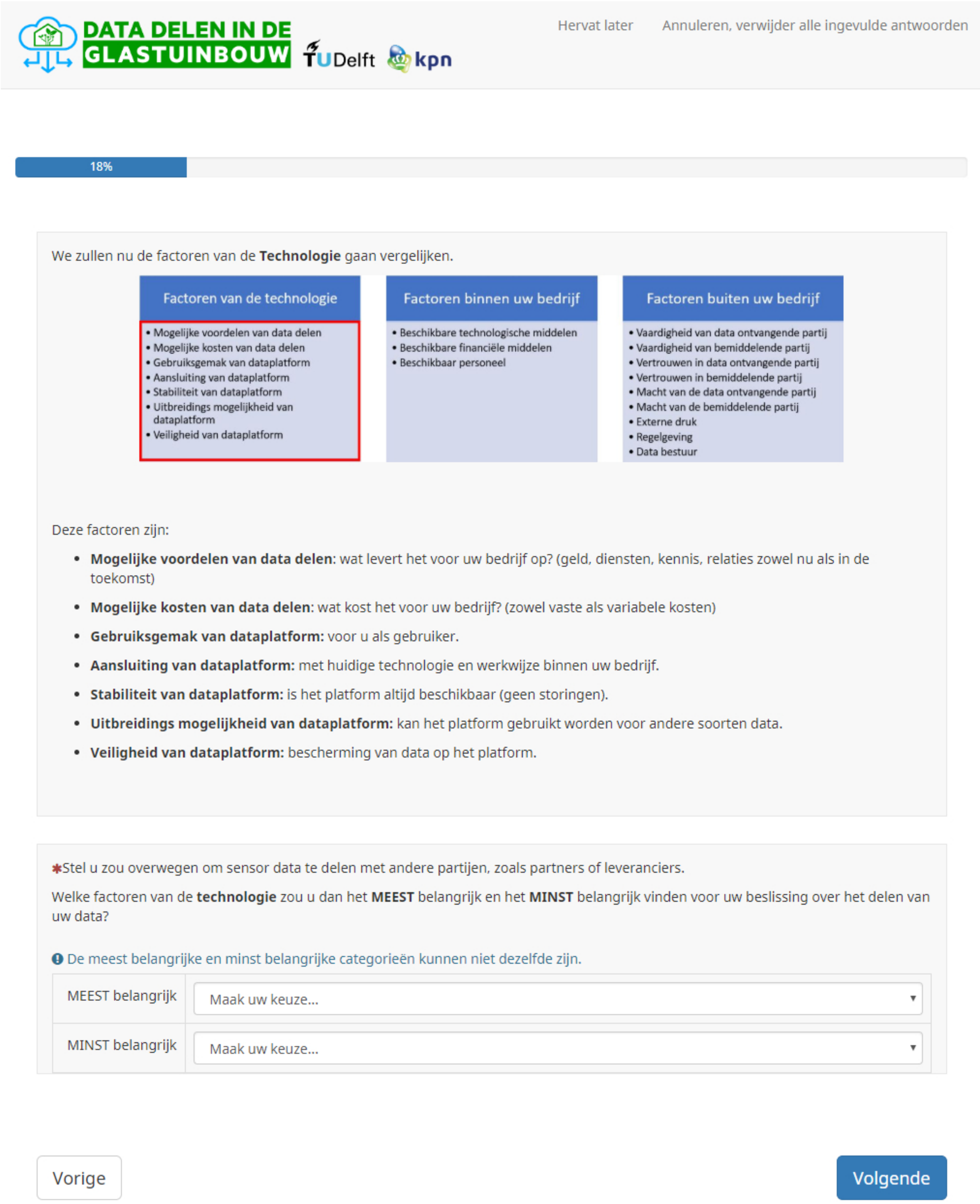


Figure L.4: Example of survey page 3



DATA DELEN IN DE GLASTUINBOUW   TU Delft   kpn

Hervat later   Annuleren, verwijder alle ingevulde antwoorden

18%

We zullen nu de factoren van de **Technologie** gaan vergelijken.

Factoren van de technologie	Factoren binnen uw bedrijf	Factoren buiten uw bedrijf
• Mogelijke voordelen van data delen • Mogelijke kosten van data delen • Gebruiksgemak van dataplatform • Aansluiting van dataplatform • Stabiliteit van dataplatform • Uitbreidings mogelijkheid van dataplatform • Veiligheid van dataplatform	• Beschikbare technologische middelen • Beschikbare financiële middelen • Beschikbaar personeel	• Vaardigheid van data ontvangende partij • Vaardigheid van bemiddelende partij • Vertrouwen in data ontvangende partij • Vertrouwen in bemiddelende partij • Macht van de data ontvangende partij • Macht van de bemiddelende partij • Externe druk • Regelgeving • Data bestuur

Deze factoren zijn:

- **Mogelijke voordelen van data delen**: wat levert het voor uw bedrijf op? (geld, diensten, kennis, relaties zowel nu als in de toekomst)
- **Mogelijke kosten van data delen**: wat kost het voor uw bedrijf? (zowel vaste als variabele kosten)
- **Gebruiksgemak van dataplatform:** voor u als gebruiker.
- **Aansluiting van dataplatform:** met huidige technologie en werkwijze binnen uw bedrijf.
- **Stabiliteit van dataplatform:** is het platform altijd beschikbaar (geen storingen).
- **Uitbreidings mogelijkheid van dataplatform:** kan het platform gebruikt worden voor andere soorten data.
- **Veiligheid van dataplatform:** bescherming van data op het platform.

*Stel u zou overwegen om sensor data te delen met andere partijen, zoals partners of leveranciers.

Welke factoren van de **technologie** zou u dan het **MEEST** belangrijk en het **MINST** belangrijk vinden voor uw beslissing over het delen van uw data?

De meest belangrijke en minst belangrijke categorieën kunnen niet dezelfde zijn.

MEEST belangrijk	Maak uw keuze...
MINST belangrijk	Maak uw keuze...

Vorige   Volgende

Figure L.5: Example of survey page 4

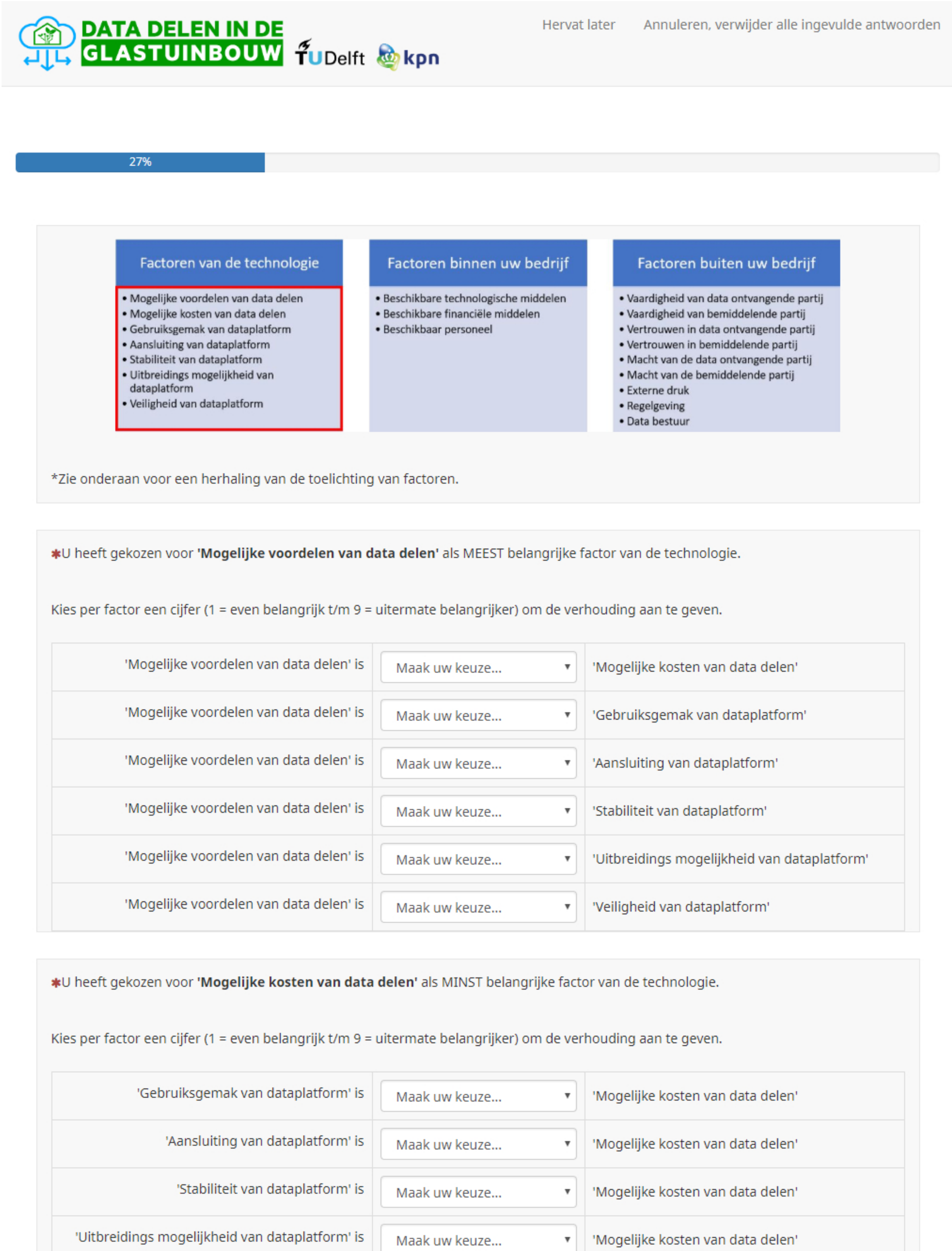


Figure L.6: Example of survey page 5

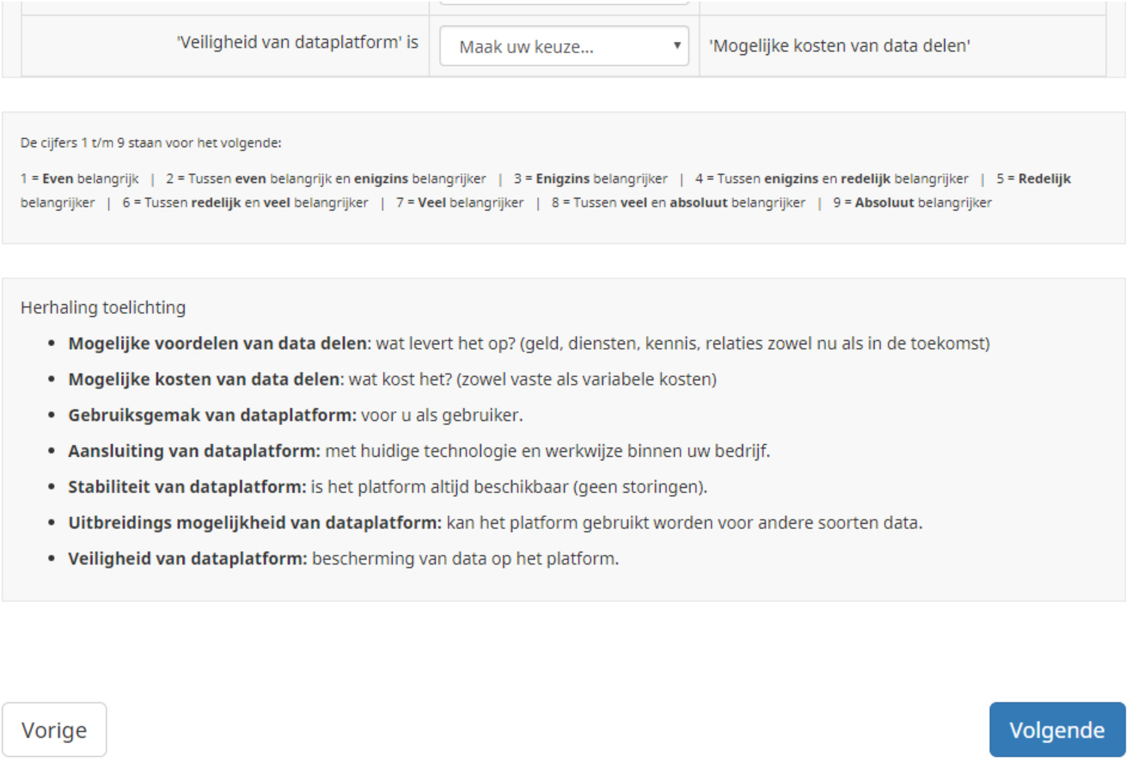
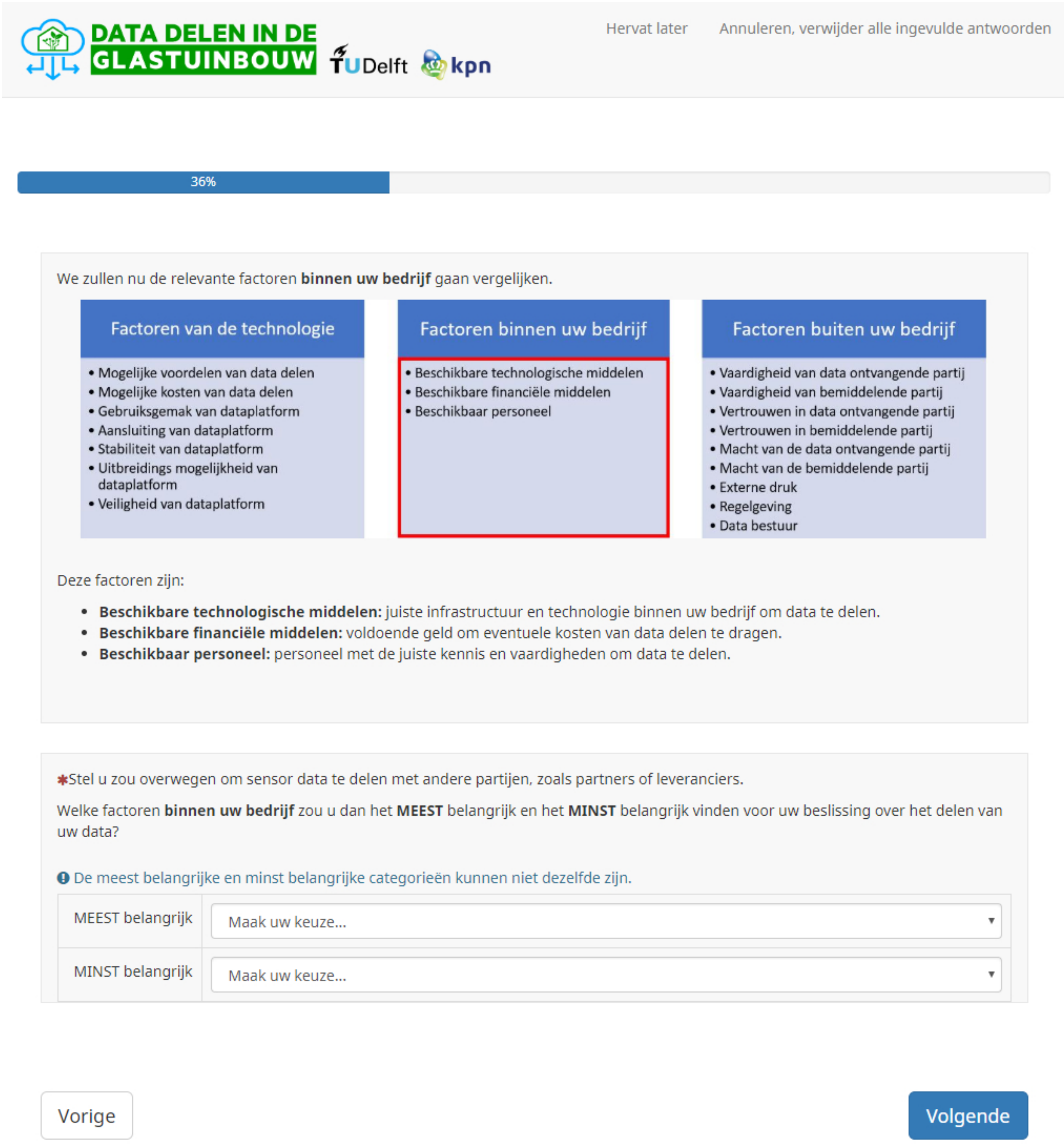


Figure L.7: Example of survey page 5 (continued)



DATA DELEN IN DE GLASTUINBOUW TUDelft kpn

Hervat later Annuleren, verwijder alle ingevulde antwoorden

36%

We zullen nu de relevante factoren **binnen uw bedrijf** gaan vergelijken.

Factoren van de technologie	Factoren binnen uw bedrijf	Factoren buiten uw bedrijf
• Mogelijke voordelen van data delen • Mogelijke kosten van data delen • Gebruiksgemak van dataplatform • Aansluiting van dataplatform • Stabiliteit van dataplatform • Uitbreidings mogelijkheid van dataplatform • Veiligheid van dataplatform	• Beschikbare technologische middelen • Beschikbare financiële middelen • Beschikbaar personeel	• Vaardigheid van data ontvangende partij • Vaardigheid van bemiddelende partij • Vertrouwen in data ontvangende partij • Vertrouwen in bemiddelende partij • Macht van de data ontvangende partij • Macht van de bemiddelende partij • Externe druk • Regelgeving • Data bestuur

Deze factoren zijn:

- **Beschikbare technologische middelen:** juiste infrastructuur en technologie binnen uw bedrijf om data te delen.
- **Beschikbare financiële middelen:** voldoende geld om eventuele kosten van data delen te dragen.
- **Beschikbaar personeel:** personeel met de juiste kennis en vaardigheden om data te delen.

*Stel u zou overwegen om sensor data te delen met andere partijen, zoals partners of leveranciers.

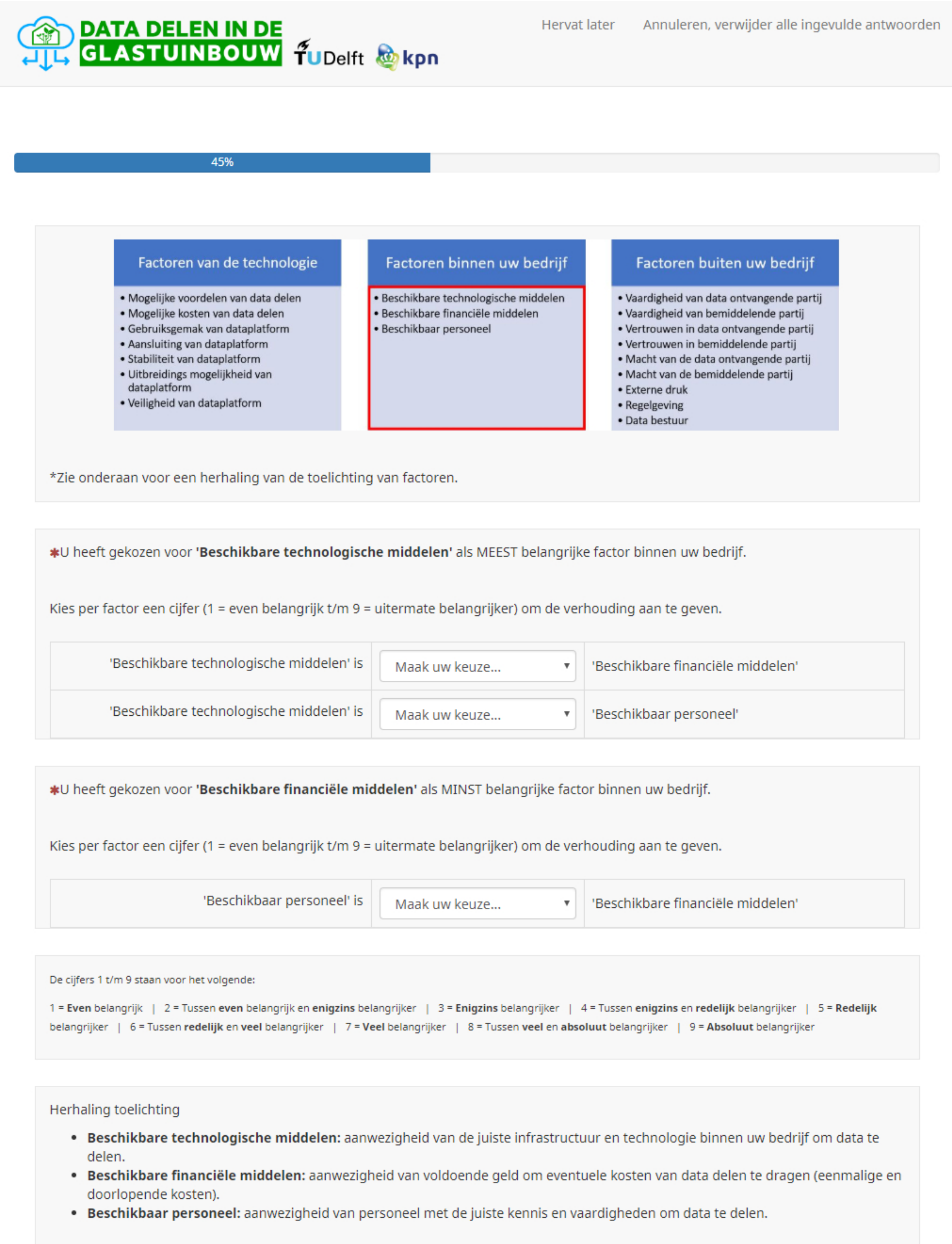
Welke factoren **binnen uw bedrijf** zou u dan het **MEEST** belangrijk en het **MINST** belangrijk vinden voor uw beslissing over het delen van uw data?

De meest belangrijke en minst belangrijke categorieën kunnen niet dezelfde zijn.

MEEST belangrijk	Maak uw keuze...
MINST belangrijk	Maak uw keuze...

Vorige Volgende

Figure L.8: Example of survey page 6



DATA DELEN IN DE GLASTUINBOUW

TUDelft kpn

Hervat later   Annuleren, verwijder alle ingevulde antwoorden

45%

Factoren van de technologie	Factoren binnen uw bedrijf	Factoren buiten uw bedrijf
• Mogelijke voordelen van data delen • Mogelijke kosten van data delen • Gebruiksgemak van dataplatform • Aansluiting van dataplatform • Stabiliteit van dataplatform • Uitbreidings mogelijkheid van dataplatform • Veiligheid van dataplatform	• Beschikbare technologische middelen • Beschikbare financiële middelen • Beschikbaar personeel	• Vaardigheid van data ontvangende partij • Vaardigheid van bemiddelende partij • Vertrouwen in data ontvangende partij • Vertrouwen in bemiddelende partij • Macht van de data ontvangende partij • Macht van de bemiddelende partij • Externe druk • Regelgeving • Data bestuur

*Zie onderaan voor een herhaling van de toelichting van factoren.

*U heeft gekozen voor **'Beschikbare technologische middelen'** als MEEST belangrijke factor binnen uw bedrijf.

Kies per factor een cijfer (1 = even belangrijk t/m 9 = uitermate belangrijker) om de verhouding aan te geven.

'Beschikbare technologische middelen' is	Maak uw keuze...	'Beschikbare financiële middelen'
'Beschikbare technologische middelen' is	Maak uw keuze...	'Beschikbaar personeel'

*U heeft gekozen voor **'Beschikbare financiële middelen'** als MINST belangrijke factor binnen uw bedrijf.

Kies per factor een cijfer (1 = even belangrijk t/m 9 = uitermate belangrijker) om de verhouding aan te geven.

'Beschikbaar personeel' is	Maak uw keuze...	'Beschikbare financiële middelen'

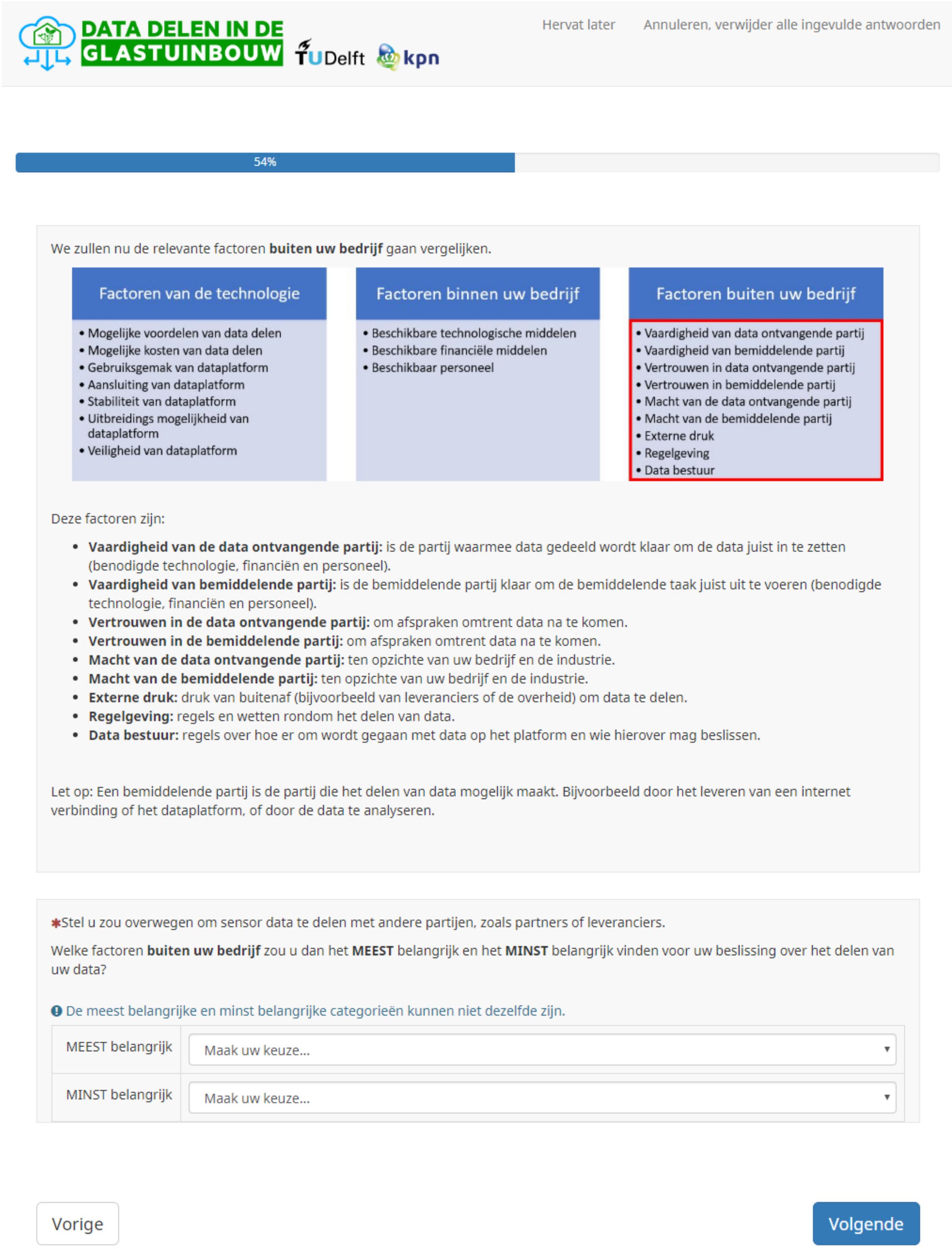
De cijfers 1 t/m 9 staan voor het volgende:

1 = **Even** belangrijk | 2 = Tussen **even** belangrijk en **enigzins** belangrijker | 3 = **Enigzins** belangrijker | 4 = Tussen **enigzins** en **redelijk** belangrijker | 5 = **Redelijk** belangrijker | 6 = Tussen **redelijk** en **veel** belangrijker | 7 = **Veel** belangrijker | 8 = Tussen **veel** en **absoluut** belangrijker | 9 = **Absoluut** belangrijker

Herhaling toelichting

- **Beschikbare technologische middelen:** aanwezigheid van de juiste infrastructuur en technologie binnen uw bedrijf om data te delen.
- **Beschikbare financiële middelen:** aanwezigheid van voldoende geld om eventuele kosten van data delen te dragen (eenmalige en doorlopende kosten).
- **Beschikbaar personeel:** aanwezigheid van personeel met de juiste kennis en vaardigheden om data te delen.

Figure L.9: Example of survey page 7



DATA DELEN IN DE GLASTUINBOUW TUDelft kpn

Hervat later   Annuleren, verwijder alle ingevulde antwoorden

54%

We zullen nu de relevante factoren **buiten uw bedrijf** gaan vergelijken.

Factoren van de technologie	Factoren binnen uw bedrijf	Factoren buiten uw bedrijf
• Mogelijke voordelen van data delen • Mogelijke kosten van data delen • Gebruiksgemak van dataplatform • Aansluiting van dataplatform • Stabiliteit van dataplatform • Uitbreidings mogelijkheid van dataplatform • Veiligheid van dataplatform	• Beschikbare technologische middelen • Beschikbare financiële middelen • Beschikbaar personeel	• Vaardigheid van data ontvangende partij • Vaardigheid van bemiddelende partij • Vertrouwen in data ontvangende partij • Vertrouwen in bemiddelende partij • Macht van de data ontvangende partij • Macht van de bemiddelende partij • Externe druk • Regelgeving • Data bestuur

Deze factoren zijn:

- **Vaardigheid van de data ontvangende partij:** is de partij waarmee data gedeeld wordt klaar om de data juist in te zetten (benodigde technologie, financiën en personeel).
- **Vaardigheid van bemiddelende partij:** is de bemiddelende partij klaar om de bemiddelende taak juist uit te voeren (benodigde technologie, financiën en personeel).
- **Vertrouwen in de data ontvangende partij:** om afspraken omtrent data na te komen.
- **Vertrouwen in de bemiddelende partij:** om afspraken omtrent data na te komen.
- **Macht van de data ontvangende partij:** ten opzichte van uw bedrijf en de industrie.
- **Macht van de bemiddelende partij:** ten opzichte van uw bedrijf en de industrie.
- **Externe druk:** druk van buitenaf (bijvoorbeeld van leveranciers of de overheid) om data te delen.
- **Regelgeving:** regels en wetten rondom het delen van data.
- **Data bestuur:** regels over hoe er om wordt gegaan met data op het platform en wie hierover mag beslissen.

Let op: Een bemiddelende partij is de partij die het delen van data mogelijk maakt. Bijvoorbeeld door het leveren van een internet verbinding of het dataplatform, of door de data te analyseren.

*Stel u zou overwegen om sensor data te delen met andere partijen, zoals partners of leveranciers.

Welke factoren **buiten uw bedrijf** zou u dan het **MEEST** belangrijk en het **MINST** belangrijk vinden voor uw beslissing over het delen van uw data?

De meest belangrijke en minst belangrijke categorieën kunnen niet dezelfde zijn.

MEEST belangrijk	Maak uw keuze...
MINST belangrijk	Maak uw keuze...

Vorige   Volgende

Figure L.10: Example of survey page 8

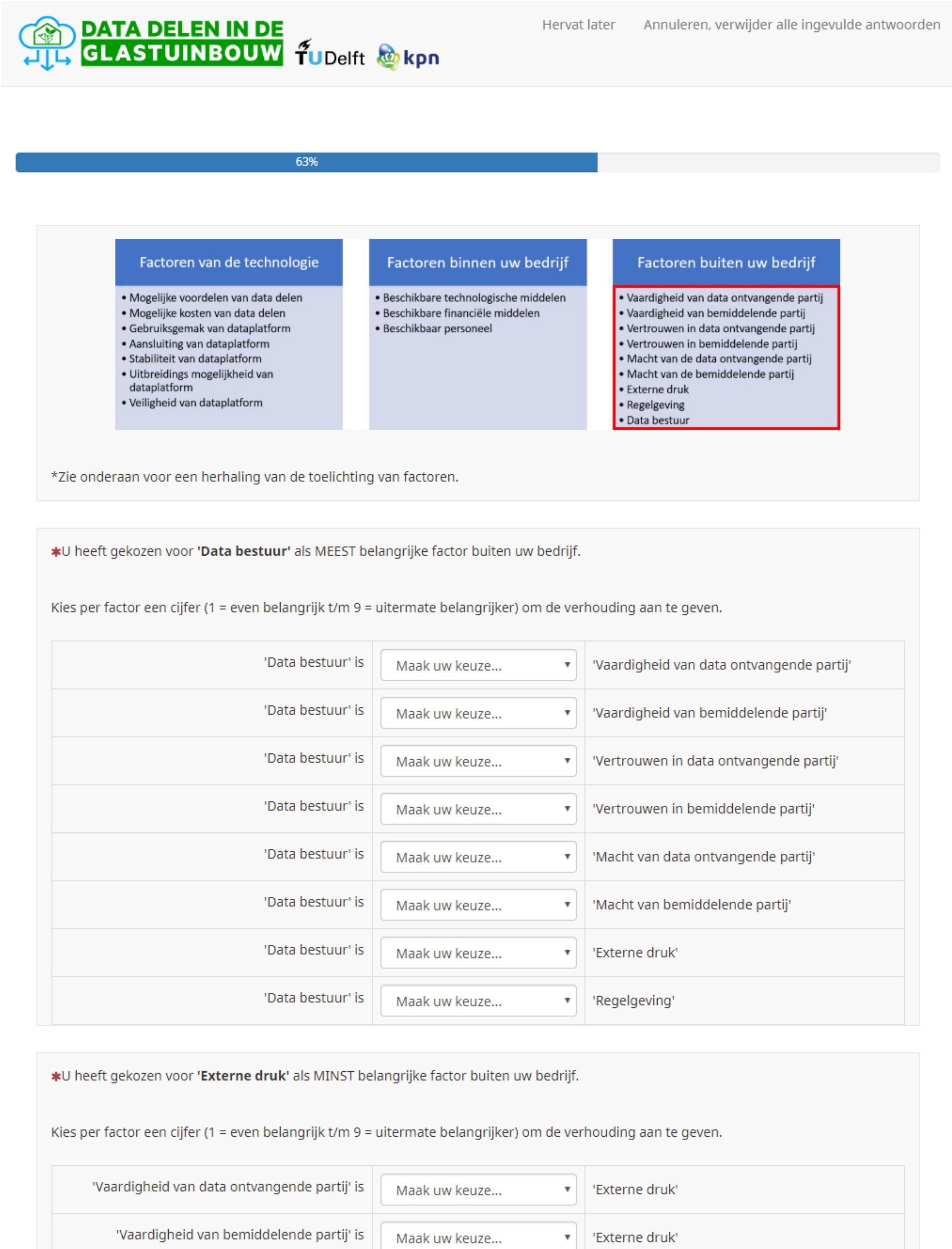
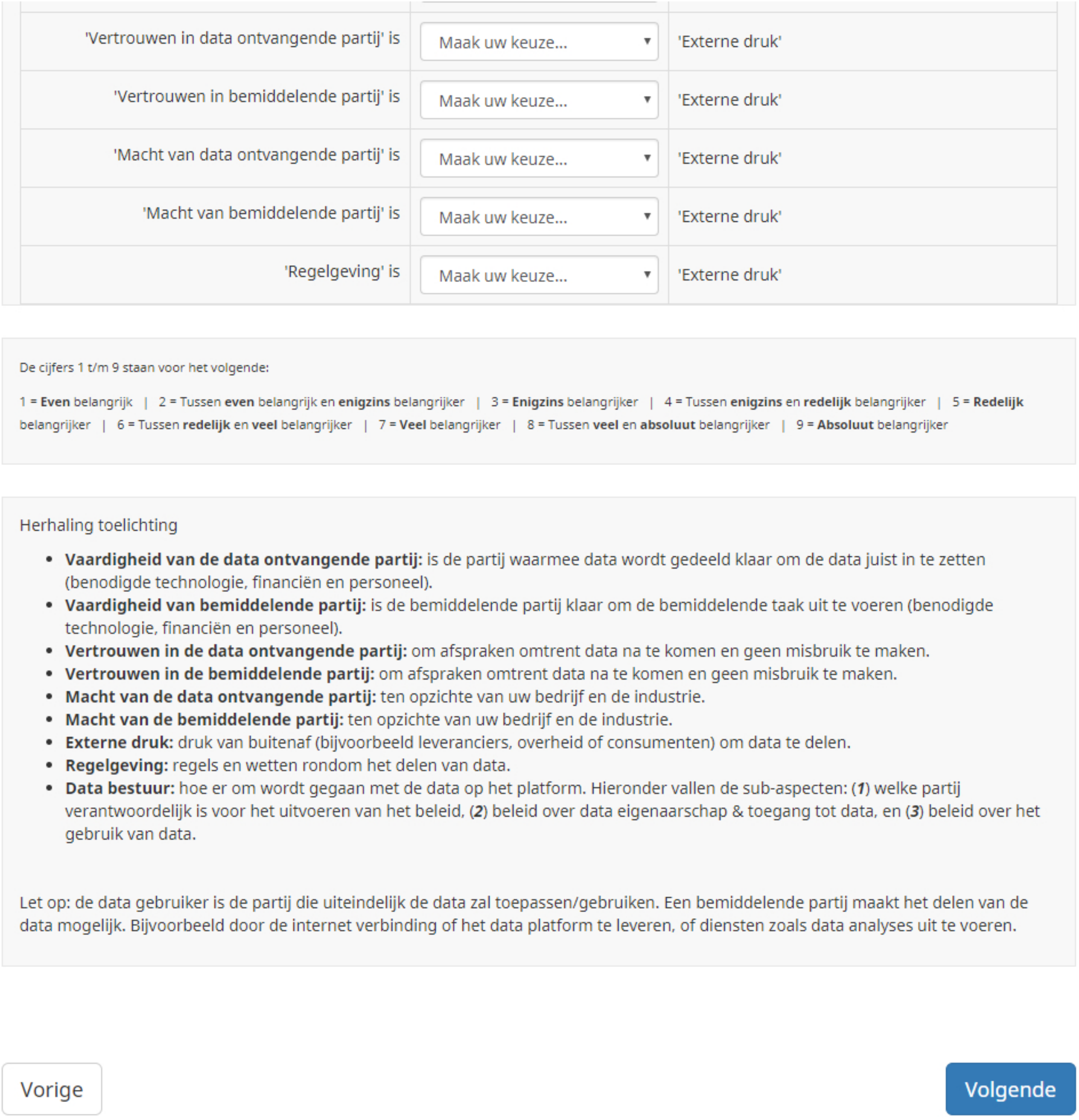


Figure L.11: Example of survey page 9



'Vertrouwen in data ontvangende partij' is	Maak uw keuze...	'Externe druk'
'Vertrouwen in bemiddelende partij' is	Maak uw keuze...	'Externe druk'
'Macht van data ontvangende partij' is	Maak uw keuze...	'Externe druk'
'Macht van bemiddelende partij' is	Maak uw keuze...	'Externe druk'
'Regelgeving' is	Maak uw keuze...	'Externe druk'

De cijfers 1 t/m 9 staan voor het volgende:

1 = **Even** belangrijk | 2 = Tussen **even** belangrijk en **enigzins** belangrijker | 3 = **Enigzins** belangrijker | 4 = Tussen **enigzins** en **redelijk** belangrijker | 5 = **Redelijk** belangrijker | 6 = Tussen **redelijk** en **veel** belangrijker | 7 = **Veel** belangrijker | 8 = Tussen **veel** en **absoluut** belangrijker | 9 = **Absoluut** belangrijker

Herhaling toelichting

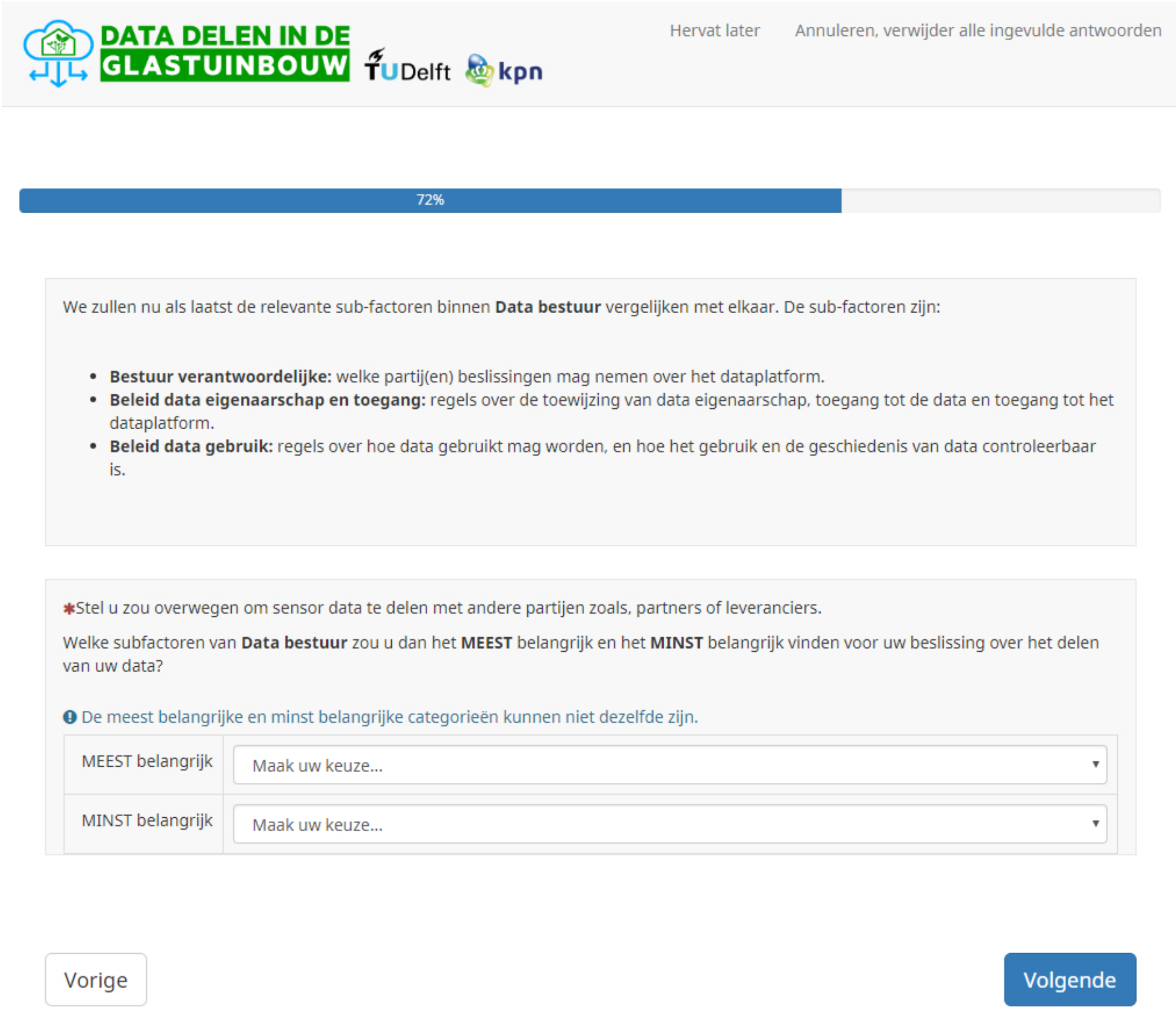
- **Vaardigheid van de data ontvangende partij:** is de partij waarmee data wordt gedeeld klaar om de data juist in te zetten (benodigde technologie, financiën en personeel).
- **Vaardigheid van bemiddelende partij:** is de bemiddelende partij klaar om de bemiddelende taak uit te voeren (benodigde technologie, financiën en personeel).
- **Vertrouwen in de data ontvangende partij:** om afspraken omtrent data na te komen en geen misbruik te maken.
- **Vertrouwen in de bemiddelende partij:** om afspraken omtrent data na te komen en geen misbruik te maken.
- **Macht van de data ontvangende partij:** ten opzichte van uw bedrijf en de industrie.
- **Macht van de bemiddelende partij:** ten opzichte van uw bedrijf en de industrie.
- **Externe druk:** druk van buitenaf (bijvoorbeeld leveranciers, overheid of consumenten) om data te delen.
- **Regelgeving:** regels en wetten rondom het delen van data.
- **Data bestuur:** hoe er om wordt gegaan met de data op het platform. Hieronder vallen de sub-aspecten: (***1***) welke partij verantwoordelijk is voor het uitvoeren van het beleid, (***2***) beleid over data eigenaarschap & toegang tot data, en (***3***) beleid over het gebruik van data.

Let op: de data gebruiker is de partij die uiteindelijk de data zal toepassen/gebruiken. Een bemiddelende partij maakt het delen van de data mogelijk. Bijvoorbeeld door de internet verbinding of het data platform te leveren, of diensten zoals data analyses uit te voeren.

Vorige

Volgende

Figure L.12: Example of survey page 9 (continued)


DATA DELEN IN DE GLASTUINBOUW TUDelft kpn

Hervat later Annuleren, verwijder alle ingevulde antwoorden

72%

We zullen nu als laatst de relevante sub-factoren binnen **Data bestuur** vergelijken met elkaar. De sub-factoren zijn:

- **Bestuur verantwoordelijke:** welke partij(en) beslissingen mag nemen over het dataplatform.
- **Beleid data eigenaarschap en toegang:** regels over de toewijzing van data eigenaarschap, toegang tot de data en toegang tot het dataplatform.
- **Beleid data gebruik:** regels over hoe data gebruikt mag worden, en hoe het gebruik en de geschiedenis van data controleerbaar is.

*Stel u zou overwegen om sensor data te delen met andere partijen zoals, partners of leveranciers.

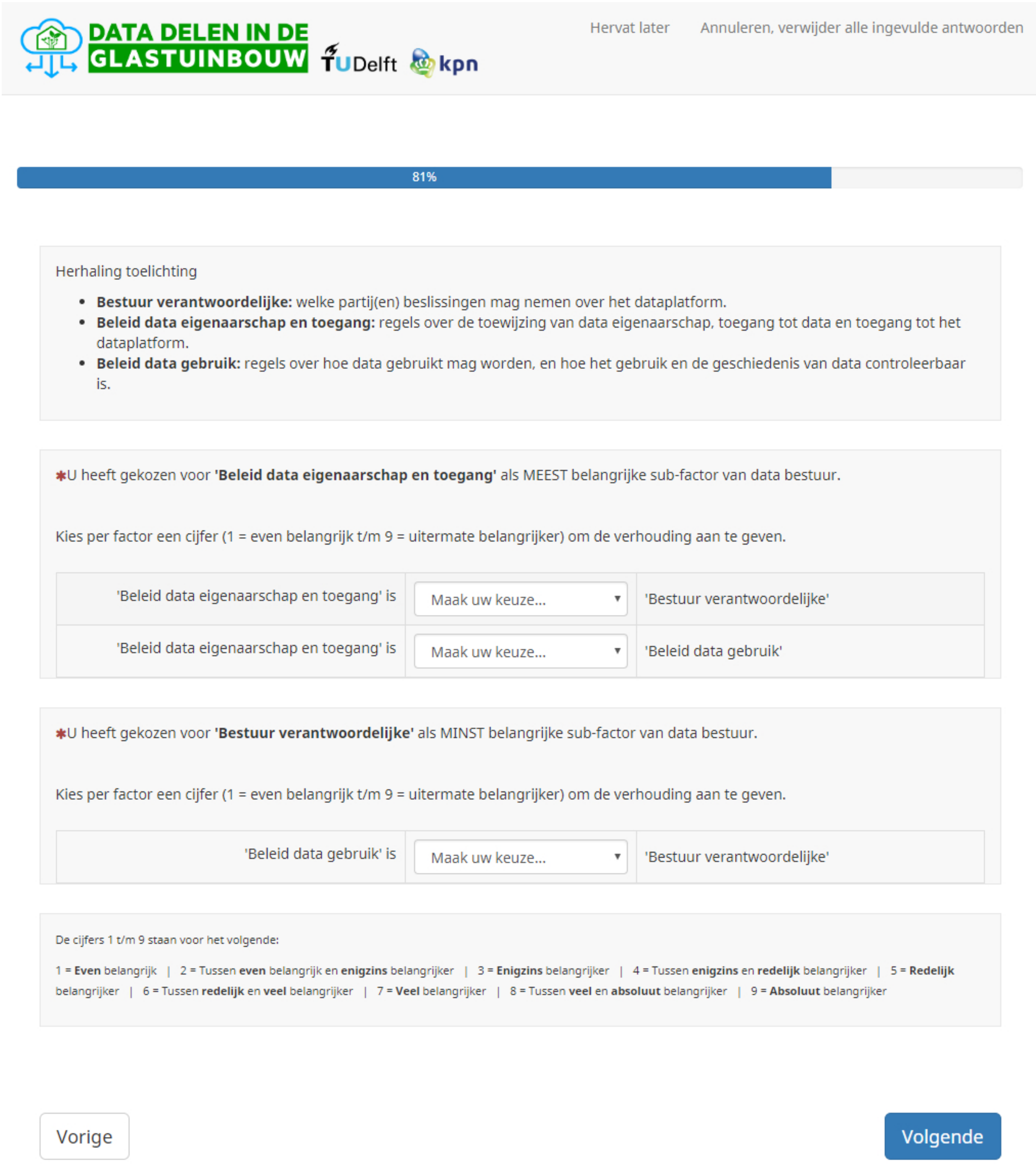
Welke subfactoren van **Data bestuur** zou u dan het **MEEST** belangrijk en het **MINST** belangrijk vinden voor uw beslissing over het delen van uw data?

De meest belangrijke en minst belangrijke categorieën kunnen niet dezelfde zijn.

MEEST belangrijk	Maak uw keuze...
MINST belangrijk	Maak uw keuze...

Vorige Volgende

Figure L.13: Example of survey page 10



DATA DELEN IN DE GLASTUINBOUW TUDelft kpn

Hervat later

Annuleren, verwijder alle ingevulde antwoorden

81%

Herhaling toelichting

- **Bestuur verantwoordelijke:** welke partij(en) beslissingen mag nemen over het dataplatform.
- **Beleid data eigenaarschap en toegang:** regels over de toewijzing van data eigenaarschap, toegang tot data en toegang tot het dataplatform.
- **Beleid data gebruik:** regels over hoe data gebruikt mag worden, en hoe het gebruik en de geschiedenis van data controleerbaar is.

*U heeft gekozen voor **'Beleid data eigenaarschap en toegang'** als MEEST belangrijke sub-factor van data bestuur.

Kies per factor een cijfer (1 = even belangrijk t/m 9 = uitermate belangrijker) om de verhouding aan te geven.

'Beleid data eigenaarschap en toegang' is	Maak uw keuze...	'Bestuur verantwoordelijke'
'Beleid data eigenaarschap en toegang' is	Maak uw keuze...	'Beleid data gebruik'

*U heeft gekozen voor **'Bestuur verantwoordelijke'** als MINST belangrijke sub-factor van data bestuur.

Kies per factor een cijfer (1 = even belangrijk t/m 9 = uitermate belangrijker) om de verhouding aan te geven.

'Beleid data gebruik' is	Maak uw keuze...	'Bestuur verantwoordelijke'

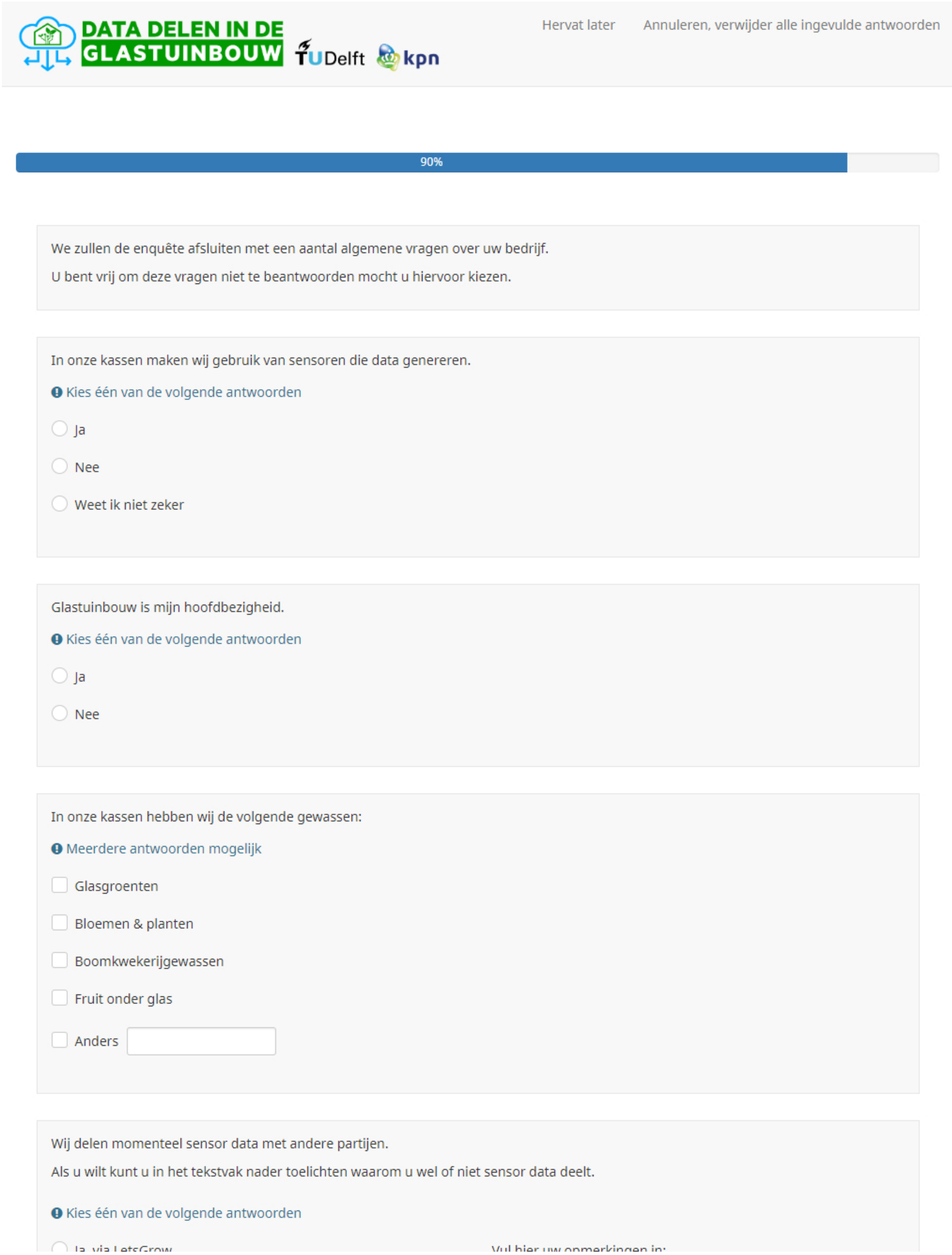
De cijfers 1 t/m 9 staan voor het volgende:

1 = **Even** belangrijk | 2 = Tussen **even** belangrijk en **enigzins** belangrijker | 3 = **Enigzins** belangrijker | 4 = Tussen **enigzins** en **redelijk** belangrijker | 5 = **Redelijk** belangrijker | 6 = Tussen **redelijk** en **veel** belangrijker | 7 = **Veel** belangrijker | 8 = Tussen **veel** en **absoluut** belangrijker | 9 = **Absoluut** belangrijker

Vorige

Volgende

Figure L.14: Example of survey page 11


DATA DELEN IN DE GLASTUINBOUW

TUDelft kpn

Hervat later

Annuleren, verwijder alle ingevulde antwoorden

90%

We zullen de enquête afsluiten met een aantal algemene vragen over uw bedrijf.

U bent vrij om deze vragen niet te beantwoorden mocht u hiervoor kiezen.

In onze kassen maken wij gebruik van sensoren die data genereren.

Kies één van de volgende antwoorden

- Ja
- Nee
- Weet ik niet zeker

Glastuinbouw is mijn hoofdbezigheid.

Kies één van de volgende antwoorden

- Ja
- Nee

In onze kassen hebben wij de volgende gewassen:

Meerdere antwoorden mogelijk

- Glasgroenten
- Bloemen & planten
- Boomkwekerijgewassen
- Fruit onder glas
- Anders

Wij delen momenteel sensor data met andere partijen.

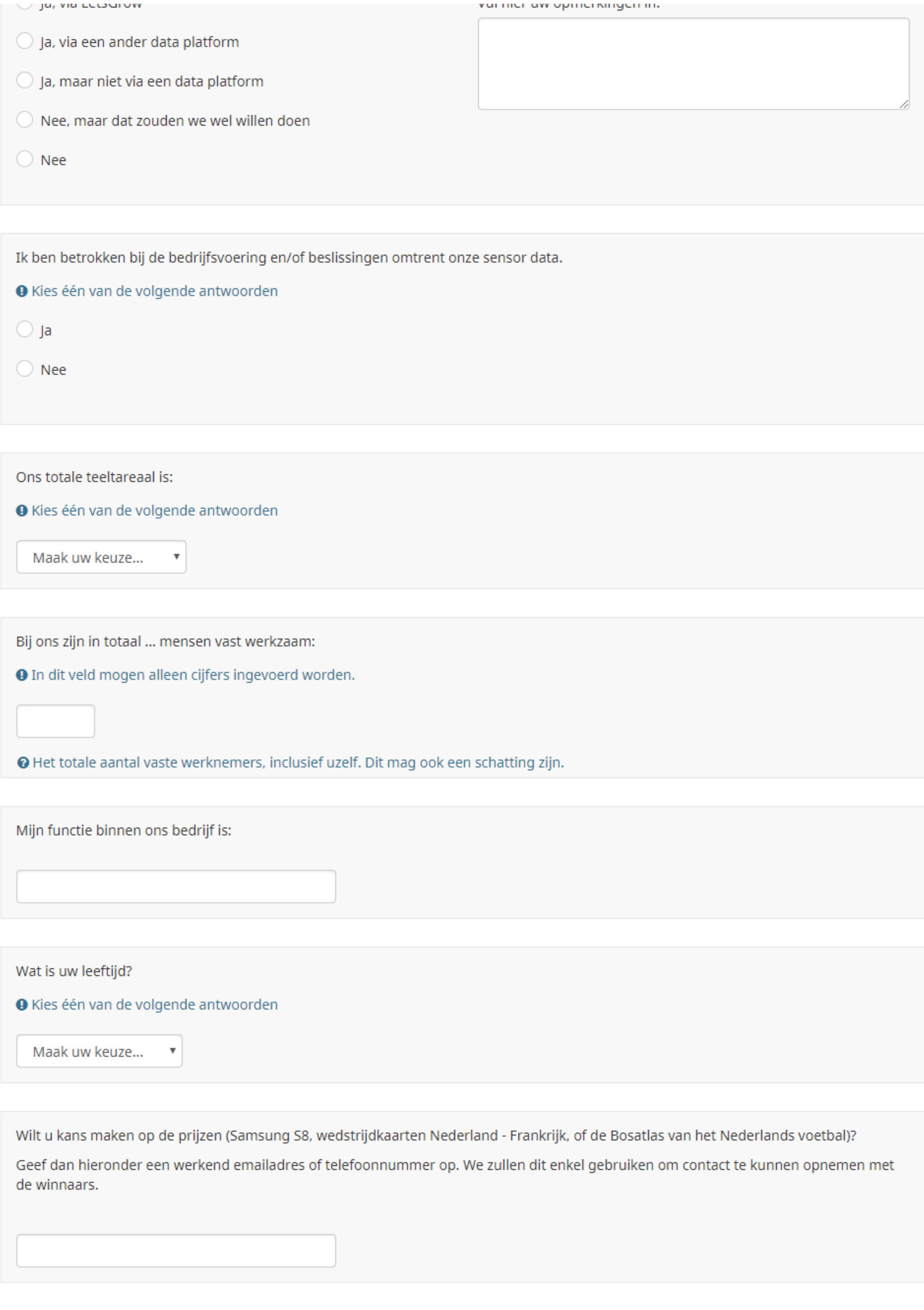
Als u wilt kunt u in het tekstvak nader toelichten waarom u wel of niet sensor data deelt.

Kies één van de volgende antwoorden

Ja, via LetsGrow

Vul hier uw opmerkingen in:

Figure L.15: Example of survey page 12



Ja, via LetsGrow

Ja, via een ander data platform

Ja, maar niet via een data platform

Nee, maar dat zouden we wel willen doen

Nee

Vul hier uw opmerkingen in:

Ik ben betrokken bij de bedrijfsvoering en/of beslissingen omtrent onze sensor data.

Kies één van de volgende antwoorden

Ja

Nee

Ons totale teeltareaal is:

Kies één van de volgende antwoorden

Maak uw keuze...

Bij ons zijn in totaal ... mensen vast werkzaam:

In dit veld mogen alleen cijfers ingevoerd worden.

Het totale aantal vaste werknemers, inclusief uzelf. Dit mag ook een schatting zijn.

Mijn functie binnen ons bedrijf is:

Wat is uw leeftijd?

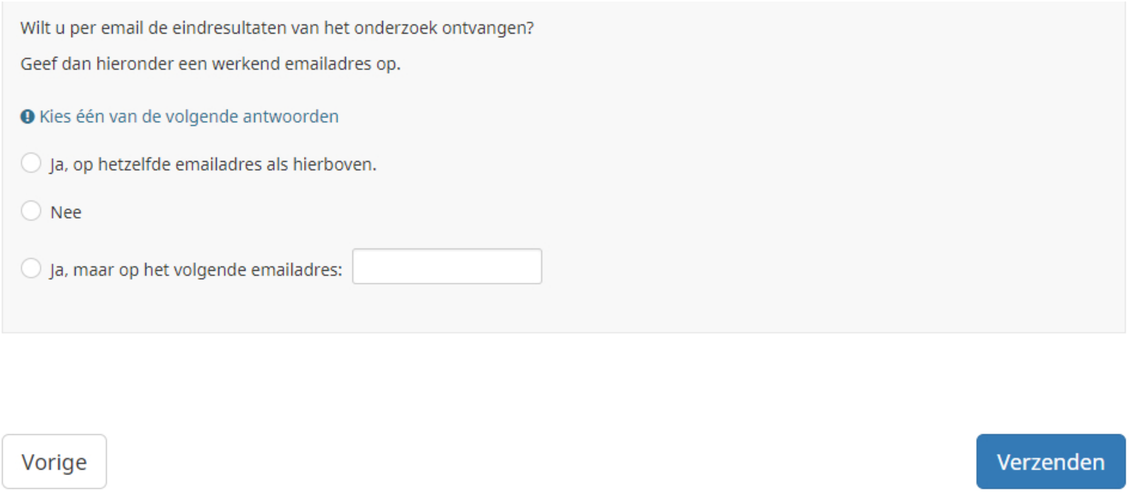
Kies één van de volgende antwoorden

Maak uw keuze...

Wilt u kans maken op de prijzen (Samsung S8, wedstrijdkaarten Nederland - Frankrijk, of de Bosatlas van het Nederlands voetbal)?

Geef dan hieronder een werkend emailadres of telefoonnummer op. We zullen dit enkel gebruiken om contact te kunnen opnemen met de winnaars.

Figure L.16: Example of survey page 12 (continued)



Wilt u per email de eindresultaten van het onderzoek ontvangen?

Geef dan hieronder een werkend emailadres op.

Kies één van de volgende antwoorden

Ja, op hetzelfde emailadres als hierboven.

Nee

Ja, maar op het volgende emailadres:

Vorige

Verzenden

Figure L.17: Example of survey page 12 (continued)

DATA DELEN IN DE GLASTUINBOUW

Bedankt voor het invullen van de enquête!

Als u collega's kent die wellicht geïnteresseerd zijn om ook aan dit onderzoek deel te nemen willen wij u graag verzoeken de enquête door te sturen (www.datainglastuinbouw.nl).

Als u nog vragen of opmerkingen heeft over dit onderzoek of uw gedachte heeft veranderd over uw deelname, neem dan contact op met Fabian de Prieëlle via [redacted] of [redacted]

Met vriendelijke groet,

Fabian de Prieëlle

Dr.ir. Mark de Reuver

Tijmen Wigboldus

Figure L.18: Example of survey page 13