

1. INTRODUCTION

Recent studies estimated that from the year 2014 in a best-case scenario, in which a solid cyber resilient ecosystem accelerates digitization, the internet of things (IoT) firstly has the potential of creating a total value of US\$ 3,750 trillion by 2020 worldwide (Marcus, O'Halloran, Kvochko, & Vora, 2014), and secondly has the potential of bringing back big economic growth in western countries (Mandel, 2013). For firms this means there is a lot to gain in this business area though few firms have an idea of what IoT is, what it is capable of and how it can be implemented in their services. Before I will discuss the IoT in more detail understanding of this 'value' is needed because value does not come out of the blue (Ballantyne & Varey, 2006), value is created (Ravald, 2001).

This value is the value-in-use dimension and I adopt the definitions of value-in-use from the article of Macdonald (2011): Value-in-use is a customer's outcome, purpose or objective that is achieved through service (Woodruff & Flint, 2006) and service as the provider's process of using its resources for the benefit of the customer (Vargo & Lusch, 2008a); (Macdonald, Wilson, Martinez, & Toossi, 2011). This means that value creation is ongoing. These definitions belong to the service-dominant logic (S-D Logic). Before the S-D Logic was accepted the goods-dominant logic (G-D Logic) was in place. In this last logic economic exchange was primary focused on goods and services were seen as either a type of good or an add-on that enhances the value of a good (Vargo & Lusch, 2004a). In that time the scope of marketing was to facilitate exchange, persuading customers to buy (Bagozzi, 1975). What happened after the sale was outside the scope of marketing (Calonius, 1986). The value creation in this case is not ongoing. In regard to the G-D Logic the S-D Logic puts the marketing focus on the customer experience, managing processes and continuous flows (Vargo & Lusch, 2004a). Customers are both producers and consumers who determine what is of value (Gummesson, 1993). Customers determine what they value-in-use and the marketer can only offer value propositions (Holbrook, 1999). I define 'value proposition' as a suggestion or promise about something that has not been materialized for the customer yet (Vargo & Lusch, 2004). This way of thinking also enables co-creation between customers and companies (Vargo & Lusch, 2006). The biggest difference between the G-D Logic and the S-D Logic is that the S-D Logic takes marketing and consumption into the same area and views them as processes, which enables the co-creation process just discussed (Grönroos C. , 2006). The products become services by themselves. In this context service becomes the unifying process of any business relationship, seen as resource procurement, production, distribution and consumption (Lusch & Vargo, 2006b). Service defined as the application of competences (knowledge and skills) for the benefit of another party (Vargo & Lusch, 2008). This S-D Logic is of the utmost importance for this research because it is the starting point of looking at the products equipped with IoT. These products will create new service possibilities.

Now we have a common understanding of the value-in-use as treated in the S-D Logic we need to define the IoT. IoT is 'a network of things or objects which, through unique addressing schemes, are able to interact with each other and cooperate with their neighbors to reach common goals' (Giusto, Iera, Morabito, & Arzori, 2010). A second definition to make it better understandable is the IoT as 'a worldwide network of interconnected objects uniquely addressable, based on standard communication protocols' (Nanostystems, 2008). This network creates new service possibilities and changes the way the processes in the S-D Logic work. An example is the data that flows back immediately from the users and is ready to be

processed and interpreted. This data is also known as big data and IoT is considered as a big data technology which is a new generation of technologies (Gantz & Reinsel, 2011).

Epistemologically, the goal of the research justifies the use of a phenomenographic approach and the use of a purposive sampling technique with the objective to find as much aspects of IoT and its value-in-use as possible. In depth prestructured interviews were conducted in order to see how the IoT is perceived in the market. The results provide further knowledge off IoT and the value-in-use and how it can be used in the value proposition of firms.

In this paper, I investigate what the introduction of devices equipped with IoT techniques mean for the value-in-use of users. I investigate how the data, which they disclose can help firms to craft their value proposition in such way that the firms can benefit from the aspects of the products equipped with IoT. The research question is '*How can the IoT help firms to craft their value proposition based on value-in-use data real time collected from users*'.

For as far I am aware of there has been no research jet in this field out of the value-in-use and S-D Logic viewpoint that researches IoT.

The remainder of this paper is structured as follows. Firstly I discuss the theoretical framework of the study, after that I will discuss the method used in this study where the data selection, data collection and data analysis are discussed, after that I discuss the results of the study where all different aspect of IoT and the products equipped with IoT come forward, after that in the final section I summarize the findings and conclude the research where we will see that it is hard to craft a value proposition based on the results of this paper. I will finish with a discussion and I will present some future research possibilities.

2. THEORETICAL FRAMEWORK

In order to answer the research question we need a broader understanding of value-in-use and especially how it can be assessed. Value for customers is created during use of resources. Value creation takes place in an interactive usage process through which the customer becomes better off in some aspect, as judged by the customer (Grönroos C. , 2008). Value-in-use provides a missing link between service qualities on the one hand and relationship outcomes on the other (Macdonald, Wilson, Martinez, & Toossi, 2011). As stated in the introduction the IoT will have a big impact on how business is done and how value is created. The value proposition comes from the organization and is offered to their (potential) customers. The value proposition discussed in this paper is made for products equipped with IoT technology and is about what and how the company promises to deliver benefits, costs and value to their customers (Vargo & Lusch, 2004).

The assessment of the customer's perceived value usually was done by comparison of customers' perception of tangible goods attributes against expectation (Kirmani & Rao, 2000); this is according the G-D Logic. The S-D Logic sees value as something that is not created at the factory gate (Vargo & Lusch, 2004a). The S-D logic defines quality as the ongoing process of building and sustaining relationships by assessing, anticipating, and fulfilling stated and implied needs (Judd 1994). The S-D logic also defines quality as the quality of their relationship with their suppliers (Ballantyne & Varey, 2006). As stated value creation is an ongoing process. To assess value-in-use we therefore need to take into account the supplier-customer relationship in defining what the supplier's contribution can be, including the supplier's support for the customer's own usage processes (Macdonald, Wilson, Martinez, & Toossi, 2011). To know the contribution and

support options we need to know what IoT will change in aspects that the firm can offer, and what the customer can expect of these offerings from the firm. This is the value-in-use for the customer.

The most important aspect of products equipped with IoT is the generation of data. Big data technologies, like IoT, are new generation architectures, designed to economically extract value from very wide varieties of data, by enabling the high-velocity capture, discovery and analysis (Gantz & Reinsel, 2011). This means that new services can be discovered when IoT is implemented which are generating this data. The services have in their turn impact on the organization. Big data and predictive analytics can be applied to a much wider range of processes in the firm, including those that have traditionally relied on human judgment and expertise (Earley, 2014). Predictive maintenance and real time monitoring are enabled by IoT. IoT is also an enabler of remote control abilities (Gubbi, Buyya, Marusic, & Palaniswami, 2013). Real time monitoring enables firms to retrieve facts of their products (Liu & Zhou, 2012). These facts can be used for various things, like take action on them or use them for product development goals. If a firm can offer better products and services the customer receives a higher value-in-use. IoT is a technology that generates facts which can be used for improved product development that may result in a higher value-in-use.

It is the capabilities of the technology, just as much as the choices people make about how to use those capabilities, which explain the ultimate effects that technologies have on social structures (Leonardi, 2013). These social structures are active in the internal organization of a firm and can have an effect on the people and how to use the IoT. When a firm addresses the capabilities on their best ways the products and services become better and the value-in-use for the customer may increase. How a firm uses the IoT out of their internal organization is an important aspect of the value proposition. How a firm can offer the products equipped with IoT technology out of their internal organization and the services the products enable.

A customer assesses the network quality of the provider, which is the provider's strength in accessing and making use of other suppliers. The provider is not only delivering resources as products and services but is also a resource integrator (McColl-Kennedy, Vargo, Dagger, & Sweeney, 2009). Here the value-in-context is important. When a customer attains a relationship with a firm the improvements in a systems well-being are important, and we can measure value in terms of a systems adaptiveness or ability to fit in its environment. Value-in-use in terms of the customer's goals, purposes or objectives, arises from a variety of resources within the customers network, including the network of their providers (Vargo, Maglio, & Akaka, 2008). One aspect of the value-in-use therefore is how the firm that offers products equipped with IoT is located in his external environment.

IoT and other technology types can generate a new revenue stream from its potential to increase service offerings (Haller, Karnouskos, & Schroth, 2009). Contracts for IoT services typically specify both price structures and service-level agreements (Liu, Methapatara, & Wynter, 2010). For the value proposition it is interesting to look at the revenue model. When a firm delivers services it wants to get something in return in the form of money which comes from the revenue model. The way a firm uses the revenue model can convince customers to stay or choose for the firm.

The S-D Logic itself firstly brings the focus of marketing to the experience of the customer (Vargo & Lusch, 2004a), as in value-in-use that the customer experiences, secondly it enables co-creation (Vargo & Lusch, 2006), thirdly

it takes marketing and consumption to the same area (Grönroos C., 2006) and sees it as a process and fourthly products become services on their own (Lusch & Vargo, 2006b). When a technology complies with these four aspects of the S-D Logic we can say that it is a good example of it.

Summarizing, in order to assess the value-in-use we need to know what kind of offerings IoT enables the firm to offer the customer and what kind of services the customer wants. New technologies, like the IoT, have their effect on internal organization of firms and how a firm is able to adjust can influence the value-in-use of the customer. I assume that a firm that adjusts its internal organization better that its opponent can offer better services and by this lead to higher value-in-use of the customer. The network quality of the firm also influences the value-in-use of the customer. Facts can be used for products development goals which can in their turn improve the value-in-use of the customer. The revenue stream and model can change when new technologies are taken into account. They can have an effect on the value proposition.

3. METHOD

The conceptual framework shows that there are a lot of different aspects going on with IoT that all can contribute to a firms value proposition and the value-in-use of their customers. In this section the methods used in the study is discussed.

The approach of the research is interpretive, which is a qualitative way of collecting data by understanding the experiences and interpretations of actors (Angen, 2000). Within this approach the phenomenographic set up is used to research and explore the qualitative different ways in which people think about 'something' (Miles & Huberman, 1994), which is in this case IoT. Semi-structured in-depth interviews, like in (Ritchie & Lewis, 2003), were conducted using an interview guide to organize the conversation. In order to get the same starting point at every interview a short introduction is given to the interviewees. Firstly an explanation is given which makes clear what the intensions of the study are. Secondly two short definitions are given about IoT, where the first one is more technically than the second one. Thirdly two examples are presented in the form of videos where the interviewee sees simple IoT solutions that are present in today's market. The first example is the Nest thermostat where a video is shown about how the Nest thermostat works and the second example is a promotional video from the firm Lively. Both are simple examples of firms that have products equipped with the technology IoT. The interview consists of fifteen questions and has two theorems. The first is that we assume that 'the IoT is already part of the services and products of the firm' which is postulated after question seven and the second is that we assume that 'the firm is in the middle of the implementation process' which is postulated after question twelve. This is done to get better insights in what kind of organizational changes will appear, like stated in the theoretical framework.

3.1 Data selection

In order to select cases for the research the sampling technique purposive is used. Limited numbers of companies have knowledge about IoT and therefore only appropriate cases for the study have been chosen (Kuzel, 1992). The boundaries for the case selection are already defined by the firm from out of which the study is conducted. All the customers and potential customers of the firm are potential cases to perform the interviews on. The cases are active in the logistics industry, which is interesting because it is an example of the birth and development of new service-based offerings (Chapman, Soosay, & Kandampully, 2003) where IoT applications are

possible, in the industrial automation industry, which is interesting because there are a lot of opportunities in the development of next-generation embedded devices resulting from increasing intelligence (Jammes & Smit, 2005) enabling IoT applications, and the energy industry, where huge potential for ICT investments within the single stages of the energy value chain like management of the grid itself are possible (Wissner, 2011). Besides these areas there is much to gain in almost every other business area where also some of the cases are active in (Marcus, O'Halloran, Kvochko, & Vora, 2014).

Because of the limited time for this research a pre-structured design is recommended (Miles & Huberman, 1994), besides that also the pool of cases is limited. For a phenomenographic study the appropriate number of interviews to perform is five to twenty-five (Creswell, 1998). In order to contain ninety percent of all information about a subject in qualitative studies at least ten interviews need to be conducted. In order to cover the other ten percent of the information ninety other interviews need to be conducted and redundancy becomes a big disturbance factor in the data (Mason, 2010). For this study ten respondents were taken into account which matches with abovementioned.

The prestructured questionnaire has been set up with information out of the literature, the theoretical framework and from information I gained from a roundtable organized with the firm from out of the research is conducted and a customer of this firm. At this roundtable session a large group of people from different functions were present. The group of seventeen persons contained product managers, strategic development managers, marketing managers, 'lead and embedded software managers', sales directors and analysts. This diverse group talked for four hours about the concept of IoT and what kind of implications it has, which are incorporated in the theoretical framework. The framework is used for making the interview questions.

3.2 Data collection

For this study semi structured in-depth interviews were conducted using an interview guide to organize the conversation (Ritchie & Lewis, 2003). The interviews were conducted at the companies and took an average of one hour. The guideline contains sections about vision on IoT, the meaning of IoT, possibilities and implications of IoT, implementation questions, internal and external changes for the firms and data management. The interviews are not totally prespecified in order to let the interviewees do their story. This design is made to explore the concept of IoT with the interviewees and therefore the interviews are open for changes. The interviews are based on the theoretical framework in section 2 of this paper. In total ten interviews were executed in the Netherlands during six weeks. The firms that I visited were very varied, from hardware companies, to original equipment manufacturers (OEM), with and without distributors working for them and from service companies to a governmental institution and lastly 'product and service companies'. I spoke with persons that had the functions 'manager product management', marketing manager, business development manager, purchase and production, R&D software and electronics manager, system architect, lead architect, program manager and manager operations. The diversity in both firms and functions helps to get a broad understanding of the phenomenon IoT which is the objective of this study.

3.3 Data analysis

The phenomenologist approach used in this study does not deliver covering laws, but rather practical understanding of meanings and actions. Some interview

questions are analyzed by making them quantitative instead of qualitative by changing the information. The questions that are less clear will get coded answers. The prestructured case method for coding is used (Miles & Huberman, 1994). Out of the coded answers I will distillate propositions that are important for answering the research question. The interviews are all totally wrote out and analyzed for interesting statements.

The codification of the different aspects of the value-in-use and the value proposition stated in the theoretical framework is done in order to make tables to answer the research question which are presented in section 4; the results. We need to assess the value-in-use and have better understanding of the value proposition when we take IoT into account. Below the relations between the different aspects of the value-in-use and the value proposition with the IoT are discussed.

To know the contribution and support options of IoT (Macdonald, Wilson, Martinez, & Toossi, 2011) we need to know what IoT will change in what the firm can offer, and what the customer can expect of these offerings of the firm, like the support services. This is the value-in-use for the customer. To find these contributions and support option the questions 'what for possibilities do you see for the firm, and what do they mean?', 'what for possibilities do you see for your customers, and what do they mean?' and 'what for challenges do you see for the firm, and what do they mean?' were asked to the interviewees. The challenges are aspects of the products equipped with IoT techniques that, when exploited better than the competitor, can lead to a better value proposition and better value-in-use of the offerings a firm can offer.

The capabilities of the IoT technologies have impact on social structures for internal organizations of firms (Leonardi, 2013). To find the changes in the internal organization that can be used for how the firm offers the products in their best ways the question 'what does the IoT mean for your internal organization?' is asked to the interviewees.

The network quality of the provider of the product with IoT techniques, the firm, contributes to the value-in-use of the customer (McColl-Kennedy, Vargo, Dagger, & Sweeney, 2009). The question 'what does IoT mean for your external organization; the ecosystem?' is asked to the interviewees.

The facts that are generated by the big data that the IoT generates can be used to improve products by which the value-in-use may become higher (Liu & Zhou, 2012). The question 'what does the IoT mean for the product development of the firm?' is asked to the interviewees.

IoT can generate a new revenue stream from its potential to increase service offerings (Haller, Karnouskos, & Schroth, 2009). These offerings can be better services and more services. How the revenue model is handled can be used in the value proposition. The question 'what does IoT mean for the firms revenue model?' is asked to the interviewees.

The answers on these questions are presented in the results section, section 4, along with whether or not the firms believe IoT is a hype or believe that it is really going to happen. The question 'do you really think the IoT is going to happen?' is asked to the interviewees.

4. RESULTS

In this section the results of the study are presented in the form of tables with explanations. To answer the research question in section 5 of this paper the answers of the question are coded like stated in section 3.3 and presented in tables. This section is divided in eight parts that all have their own subject. In the introductions of the sub-sections I will repeat how the relation is to IoT and value-in-use and/or value proposition.

4.1 Firm opportunities

In order to find the value-in-use aspect of the customer the opportunities the interviewees see for the firms when they use IoT techniques are presented in table 1. I want the contributions and support options to come forward with the question ‘What for possibilities do you see for the firm, and what do they mean?’ to assess the value-in-use of the customer.

Table 1: Opportunities enabled by IoT

Opportunities firms	Total (N=10)
Remote services	6
Predictive maintenance	6
Monitoring performance	6
Easier connection with customer	4
Assistance of customers	4
Threshold actuator	4
Monitoring history	4
Remote control	3
Higher customer satisfaction	3
Sharing information internal	2
Assistance on the right time	2
Less waste of money	2
Using facts (product development/sales)	2
Finding relations	2
Combining datasets of location	1
New (unknown) services	1
Less disruptive organization	1
Customer specific	1

The diversity in answers in table 1 shows that a lot of different aspects come forward when looking at IoT. The most important aspects are standing above in the table and are in agreement with the theoretical framework. Remote services, predictive maintenance and monitoring performance are the three most mentioned opportunities. From the remote services 50 % of them also mentioned remote control, the ability to take over products from distance. This means firstly that the mechanics of firms do not have to go over anymore to the broken product and this saves time and money. Besides that, one mechanic can be a stage manager of more problems of several customers at the same time. The firm is also capable to update their software of the machinery agilely when it is connected. Again nobody has to go to the customer, they can do it remotely. One interviewee also mentioned *the ability to remotely wipe information from devices* which is very important for security situations which will be discussed in table 2. When monitoring the performance also history is important. Why is the machine broken? If you can find relations in the history you know what happened to the machine and firms can anticipate on this information. These can be useful for insurance situations when for example a machine was not used properly. With this technique you can proof with facts that this was the case. Not only are the relations in the history useful but also the real time

relations. Combining the relations with a threshold actuator in the machine can eliminate men hours and make jobs easier. They can warn mechanics when something is deviant; above or under the threshold, just the way it is programmed to. The services make the organization less disruptive, there will be less waste of money, and there will be a higher customer satisfaction. With the predictive maintenance firms can predict when, for example, a machine will break down and they can anticipate on it. This will lead to higher usage of the machine, and better performance. When firms can monitor, for example, machines they know when a machine is broken and can anticipate on this real time. The firm can send replacement equipment to the customer in advance. When the machine brakes down the customer can replace it immediately or replace it before it breaks down. This gives a higher up time of the machine.

Secondly the customer is a highly mentioned subject under the opportunities. The firms say that they are able to connect to the final customer and are able to give better assistance and assistance on the right time to the customer. Firstly because firms are able to keep backups of the setting of the machines from their customers on servers and secondly firms are better able to really supply on the demand of their customers (they know when something will breakdown and are able to anticipate on that; they can see the usage of the customer and predict the future usage). One of the interviewees confirms this when it said that *IoT will set the point of focus of the firm on the customer like never before*. One interviewee said that IoT might *enable new services we now do not even know are possible*, complemented by another interviewee who said that *with new services you create future resistance*. The business and revenue models of these services are still hidden in the datasets that could be discovered when used. Another interviewee said that *it would become easier to target on the right customers with higher scores of success*. All examples of the opportunities the interviewees see. In the data their might be relations that when known can be used for attracting customers.

The opportunities with the data that IoT generate are almost infinite. Some interviewees mentioned that *the combination of datasets from different locations are very interesting*, others said that *information sharing internal will become easier*. Where some firms still find it hard to combine data because it is still local in the firm, IoT enables easy extraction of data and easy cloud storage of data. This in its turn enables easier data analysis. Efficient data analysis is able to find relations with a higher score of success. When the data is easier extracted and stored it is also easier to share the data internally. A firm can combine the data sets of two different plants and search for relation. Differences between two similar plants might be interesting for further evaluation. The data generates facts which are useful for product development and sales. Firms do not have to ground their arguments on predictions or feelings because IoT gives firms hard proof. When a firm knows what their new products or services are capable of they can use those facts in their value proposition. I will come back to the product development later on in section 4.6.

4.2 Firms challenges and/or obstacles

Besides the opportunities it is important to know the challenges and/or obstacles that lie ahead when taking IoT into account. Exploiting the challenges and obstacles better than the opponent can lead to a better value proposition and in their turn lead to better value-in-use for the customer. Knowing the challenges and obstacles are key for firms to anticipate on them and to make sure in their value proposition that they are taken

care of. The question asked is ‘what for challenges do you see for the firm, and what do they mean?’

Table 2: Obstacles and/or challenges for IoT

Challenges	Total (N=10)
Security	6
Authentication	4
Clear interface and usability	4
Misuse	4
Privacy	4
Uptime internet	4
Openness of systems	3
(Conventional) infrastructure	2
Acceptation	2
Bandwidth	2
Data analysis	2
Technical changes required / retrieve data	2
Trust in data exchange	2
Cultural internal changes	1
Data interconnection	1
False information	1
Redundancy	1

Just like in table 1 the diversity in the answers in table 2 shows that a lot of different aspects come forward when looking at the challenges and/or obstacles firms encounter taking into account the IoT.

The most important aspects all deal with technological aspects of IoT like security, authentication, ‘clear interface and usability’, uptime of the internet, openness of systems and further below in the table bandwidth, conventional infrastructures and ‘the technical changes required / retrieving data’ from machines. The most important aspect that came forward is the security of the data along with authentication. The first aspect is about how the data of the customer is protected and the second is about who is able to see the data and just as important who is not. With security, privacy goes hand in hand which is also an aspect of the data. Is the data anonymous and how is the data stored. And how is the data still useful if it is converted anonymously. Another challenge is how to show the data on clear interfaces in order to achieve high usability. When customers are not able to use the products its value is not assessed by the customer. One of the interviewees said that *this is one of the biggest challenges they face*. Another challenge for firms that work worldwide is that they work in areas with no or little connection to the internet. Machines that need ongoing access in these areas are less useful and the IoT techniques in these areas do not come to their right. The openness of systems is an important challenge when you work with a lot of different partners and firms need to integrate different parts into one machine. One of the interviewees sees this as *the real added value of IoT when firms are able to easily integrate different products*. These machines need to be able to

‘talk’ to each other. When using standardize IoT protocols this becomes easier.

The other challenges are derived from the previous ones and have more sentiment in them, like misuse of the data, acceptance, trust in the data exchange, cultural internal changes in the organization, false information and redundancy. What is the damage the firm can get when third parties gets the data in possession and misuses it. Will it bring the firm at risk or harm it. One interviewee stated that *one of the most important things of IoT is the emotional aspect of it, when customers do not want it, there is no acceptance and they will not buy it*. This is an aspect that a lot of firms wanting to adopt IoT techniques run into. How can a firm persuade the customer to adopt the techniques? When will the customer accept the techniques? Another interviewee said *my customers do not want machines with all kinds of bells and whistles; they can only break down more often*. This is very important because acceptance helps build a good value proposition; when you know why they accepted it you know what the key triggers are for a customer to adopt IoT. The next challenge is that when you are retrieving a lot of data you need a lot of bandwidth that is able to cope with the data stream. Big firms who have a lot of machines worldwide could have a problem applying all the technical changes required to make the connection and to retrieve the data. When firms build machines that last for years and the initial costs are high they will not replenish them for machines equipped with IoT when the benefits of it are lower than the costs. Unrolling the IoT could be hard for these firms. The biggest advantages of IoT appear when IoT is addressed to a high number of machines. Starting with a few machines the firm might not be able to offer the services he wants the IoT techniques to deliver. The conventional infrastructures lie close against this. Firms do not just replenish old techniques. Another aspect is the trust different parties need to have in each other. Without trust the data exchange is hard to be set up. Three aspects that go hand in hand are data analysis, redundancy and false information. When a lot of data is retrieved from objects the challenge is to analyze it into useful data, by using sophisticated algorithms and data models. One interviewee said *the need for the best model to analyze and use data is of the utmost importance*. How do you develop such kind of model and how do you use it? When this model fails the possibility is present that the firm gets false information which can harm the firm but also their customers when they get wrong advices. This can lead to a worse customer relation or even lead to losing the customer. If the model is not working properly the chance of having a lot of data and with that data redundancy is real. Data redundancy makes it hard for firms to use the data in a good way. When you work with IoT firm’s internal organization change and this is also a challenge. How does the firm change and in what form does the firm need to change? In section 4.4 I will come back to this aspect. First I will explain the customer’s opportunities seen from the firm’s perspective, which is the real customer’s value-in-use.

4.3 Customers opportunities

In this study firms that work business to business were studied and these firms want to sell their equipment to their customers. What the customer can expect of these offerings of the firm, like the support services is the value-in-use for the customer. Table 3 presents the results on the question ‘what for possibilities do you see for your customers and what do they mean?’

Table 3: Opportunities for customers

Opportunities customers	Total (N=10)
Access from everywhere to their own data	3
Predictive services	3
Better performance (of machines)	2
Discounts on service contracts	2
Opportunity to combine data from plants	1
All kind of forms of information available	1
Money savings	1
Condition based maintenance	1
Standing central	1

The diversity in answers on this question is a lot lower and also the magnitudes of the answers are low. It is important to say that these opportunities are mentioned by the firms themselves and not by their customers; they might have answered differently. The biggest opportunities mentioned are access from everywhere to their own data and predictive services. When machines are equipped with IoT techniques not only firms but also the customers of the firms could get access to the data. The firms can use it for predictive services and the customers can use it to track their objects they have in use. These opportunities lead to better performances of the machines because of the predictive services like predictive maintenance and optimization based on the data. Firms can see the condition of the machines and are able to give ‘condition based maintenance’ as a service to their customers. Customers can count on discounts on service contracts when they open up their data to the firms. When the customers do this they can get access to other kind of datasets and can combine data from different plants. Customers get better insights on how different plants are functioning and are able to anticipate on that. Combining this with other data can also lead to interesting outcomes. When customers open up to the firm they are in business with, they can get a central place within the firm, because the firm can deliver, like seen in table 1, customer specific offerings and even new services. The IoT services are continuous which means that the firm stays in contact with the customer the whole time delivering customer specific offerings. The services are continuously delivered to the customer that is receiving them. For example, the firm can monitor the customer and give real time feedback. In the end it can also lead to money savings. The initial costs can disappear and the better performance of the products can lead to cost savings. This is confirmed by one interviewee that mentioned that *the initial purchase disappears for the customer, which makes it easier for them to buy*. I will come back to this in section 4.7.

4.4 Internal organizational changes

We now have seen the value-in-use for the customer and how it is set up by the opportunities for the firms as well as for the customers. IoT technologies have an impact on the internal organization of a firm (Leonardi, 2013). IoT has its effect on the social structures in a firm. A firm that is able to exploit the capabilities of IoT better than its competitors can offer better products and better services with higher value-in-use for the customer. The way a firm uses the IoT out of their internal organization is an import aspect of the value-

proposition. Table 4 presents the results on the question ‘what does the IoT mean for your internal organization?’

Table 4: Changes in firm’s internal organization

Internal changes	Total
Data analysts	6
Closer to the customer	3
The right people in house	3
More marketing capacity	2
Manage ICT of customers	1
Target the right customers	1
Cultural change	1
Co-creation	1

By far the most mentioned aspect the internal organization needs to change in is the use of data analysts. The data that IoT techniques generate are useless when firms do not know how to use it, or worse, use it wrongly like seen in table 2. Whether firms hire these people into the firm or outsource this competence the interviewees have no agreement in, it depends on what kind of firm it is. The second change which lies close to the first one is that the right people need to be in the firm. One interviewee mentioned that *they need young people with fresh thoughts with knowledge of the newest techniques*. The mindset that is needed for integrating IoT in the firms is different from traditional internal organizations; one interviewee mentioned that *younger people are more used with connectivity and therefore are able to use it to its fullest possibilities*. Besides young people one interviewee mentioned that *more professionals that have knowledge of the complex IoT techniques need to be attracted*. Both young and professional people are needed. Like mentioned in table 1 and 3 firms have the opportunity to get closer to the customer and their internal organization has to be changed to be ready to do so. The workforce of the firm needs to be trained for interaction with the customer. One interviewee mentioned that *capacity we now use for sales will be put into marketing capacity*; they are now able to focus on the right customers. Instead of focusing on sales the firm should focus on marketing to attract new and more customers. Some IoT services will give firms the ability to manage the ICT and data storage of their customers and those firms need to change to be able to do so. One interviewee mentioned that *IoT asks for a cultural change*. Taking all the changes into account and all the opportunities it has an effect on the culture of a firm and how business is done. Another interviewee mentioned that *IoT really enables co-creation*. Firms can work closer together with customers when they share information and when firms get more customer specific. One of the main things the S-D logic enables.

4.5 Firms ecosystem changes

Besides changes in the firm’s internal organization also changes in the external organization, the ecosystem, may appear. The network quality of the provider of the product with IoT techniques, the firm, contributes to the value-in-use of the customer (McColl-Kennedy, Vargo, Dagger, & Sweeney, 2009). Here the value-in-use of the customer comes from the value-in-context. Table 5 presents the results on the question ‘what does it mean for your external organization, the ecosystem?’

Table 5: Firm's ecosystem changes

Ecosystem changes	Total N=10
Partnerships / outsourcing	7
No changes	2
New ICT partners	2
Cloud outsources	1
Standardization	1
Partnership as marketing tool	1
Higher efficiency	1

It is clear what the most important external change is and that is new partnerships and outsourcing. One interviewee said that *IoT will bring firms back to their core business and therefore more and more will be outsourced*. Another interviewee said *firms need to work differently together with different partners*. Two other respondents said that *there will be no changes at all*. They think that they can keep on doing their business the way they do it after implementing IoT. Two interviewees mention that they will need new ICT partners because they do not have the competences to do it themselves. For small and big companies this is different. One interviewee sees the cloud that can be used in IoT as an aspect they need to outsource. To effectively use IoT standardization is needed which leads to higher efficiency when the whole value chain uses the same protocols. The customer that has the choice of firms with the same offerings might choose the one with the best network quality. By doing business with a business gives them access to the partners of the firm and they might be able to use them. This is not directly mentioned by the interviewees, though the partnerships and also the outsourcing of the firms they do business with covers the quality aspect of the network. The firm that the customer chooses to do business with might outsource parts of the contract. The better the network quality is the better the results might get. They can lead to a higher value-in-use of the customer.

4.6 Product development changes

The facts that are generated by the big data that the IoT techniques generate can be used to improve products (Liu & Zhou, 2012). The facts can be used for variable things, like product development goals which can lead to better products and services that can generate higher value-in-use. Table 6 presents the answers on the question 'what does the IoT mean for the product development of the firm?'

Table 6: Changes for product development

Product development changes	Total N=10
Technical readiness of machine to retrieve the data	5
Facts based improvements	3

The first and obvious change in the product development is to make the products ready to retrieve data out of them. More importantly is the second change which is the ability to do facts based improvements. One interviewee mentions that *firms can see real time what people are doing on the products and adapt their product development on that*. This

is interesting for both firms as customers because it is improving the products, which leads to better performance and higher customer satisfaction. When a machine is equipped with a feature that none of the customers uses, it can be removed from future machines. The IoT makes it possible to see this. The customer has a better machine and for the firm it is cheaper to make the machine. One interviewee confirmed this when it said that *the data analysis can be used for the improvements of machines*. The value-in-use of the customer is able to get higher in the future by applying IoT techniques.

4.7 Changes in the revenue model

IoT can generate new revenue streams from its potential to increase service offerings (Haller, Karnouskos, & Schroth, 2009). How the revenue model is handled can be used in the value proposition a firm offers. Table 7 presents the answers on the question 'what does IoT mean for the firms revenue model?'

Table 7: Changes in the revenue model

Revenue model	Total (N=10)
Pay per use (continuous cash flow)	8
More services	6
Outsourcing	1

Looking at the table we see that a high majority sees a change in the revenue model to a pay per use model with a continuous cash flow. Like stated earlier the firms can put their machines or products for free in the market and the customer pays in a pay per 'something' way taking out the initial costs and ensuring a certain cash flow. This also means that the firms keep the ownerships of the machines and need to take care of the products which improve the state of the products; the firm needs to ensure the products perform well. This results in better products and easier replenishments of the products. Besides this more than 50 % of the respondents see the ability of applying more services to their business model. One of the respondents mentioned that *products itself become services when you apply them to IoT techniques*. With a revenue model like pay per use this is true. Only when you use the service of the product you pay, which is in alignment with the S-D Logic.

4.8 IoT, is it going to happen?

Finally a question about whether or not the IoT is really going to happen is asked and the results of this question are presented in table 8.

Table 8: Is IoT going to happen?

Is the IoT going to happen?	Total (N=10)
Yes	8
No	1
Perhaps	1

It is clear to see that 80 % of the interviewees believe IoT is not just a hype but that it is going to happen and that it is going to stay. This is a clear statement for all in favor of IoT and firms that are trying to make a business in the IoT. It also shows again the relevance of this paper, there is a real need for understanding of IoT.

5. CONCLUSION

The IoT has a lot of opportunities for firms and customers of these firms. Table 4.8 shows that 80 % of the respondents think that IoT is not a hype but that it is really going to happen. To answer the research question, 'how can the IoT help firms to craft their value proposition based on value-in-use data real time collected from users', I am going to divide the answer in four parts. The first part is about how the value-in-use of the products and services IoT generates is established and what the most important aspects of the value-in-use are. The second part is an elaboration of how this value-in-use data can be used for the value proposition of firms for products equipped with IoT techniques, thirdly I will answer the research question based on above-mentioned and fourthly I will reflect whether or not the IoT is a good example of the S-D Logic and what it has to offer.

5.1 Value-in-use data

The value-in-use data is generated by the products that are equipped with IoT techniques. As seen in section 3.1 this data can be used for predictive maintenance, monitoring performance and remote services. This data comes back real time from the products of the users. They might even generate new services that we now do not even know off. Before it can be used the data has to be analyzed and processed by people and models to make it useful. The better this process works the higher the value of the data is and the higher the value-in-use of the products and services that come forward out of this data will be. These services can lead to better assistance for the customer and assistance on the right time which lead to higher customer satisfaction and by this a higher value-in-use of the services, like we have seen in section 4.3. The fact that the services result in a higher value-in-use can be used in the value proposition. The data that flows back real time can be used to monitor the products and be used for services like discussed in this paper. The data can be used for product development which results in better products and so higher value-in-use of the products in the future like discussed in section 4.6. It leads to different revenue models where initial costs are taken away and service contracts are signed. The firms that deliver the products stay in possession of the product and need to make sure the quality of the products is good. For the firm themselves this is important to keep the customers satisfied. This will lead to better performance of the products due to the services IoT brings and higher value-in-use for the customers like discussed in section 4.7. What we can conclude out of this part is that IoT raises the value-in-use for the customer.

In the next section the value proposition itself is discussed.

5.2 Value proposition

The value proposition is a promise that is made by the firm to the customer about something that is not materialized yet (Vargo & Lusch, 2004). When firms offer a proposition to their customers they need proof that the savings are higher than the costs like one of the interviewees said *there needs to be something in return, otherwise customers will not buy it*. This can be in the form of products and services or money savings. A reference case that shows what IoT can facilitate, like money savings and higher value-in-use of products and services, will make the value proposition stronger.

As a firm you need to convince the customer that you are the right firm for the job and that you know the best way to apply the IoT and its products and services. We saw in section 4.4 the internal changes an organization may have to go through in order to apply IoT. The most important aspects are to convince the client your firm has the right people in house and

know how to analyze the data. In section 4.5 the external changes an organization may have to go through in order to apply IoT are discussed. By doing business with a firm the customer gets access to the network of the firm. This network can be of value for the customer. Using this in the value proposition will make it stronger. The firm might be able to deliver better products and services because of its network which result in higher value-in-use of the customer.

Not only have the opportunities needed to be taken into account into the value proposition. Just as important are the challenges and obstacles IoT brings along. Like discussed in section 4.2 the most important things firms need to secure in their value proposition are the security of the data, authentication of the data, clear interfaces to show the data on and usability of the data, and how to deal with data analysis and interpretations. One of the interviewees said that *using data in an objective way makes your value proposition better*. IoT facilitates this data which can be used by firms in their value proposition.

5.3 How can the IoT help firms to craft their value proposition based on value-in-use data real time collected from users?

This paper has shown that the IoT facilitates new products and services. They have the potential of getting higher value-in-use levels than other products and services that do not use IoT technologies. The value-in-use data that is real time collected can be used for predictive maintenance, monitoring performance and remote services. This data is retrieved from the products of the customer in order to deliver services. The firm can monitor with the IoT the products it has in the market and see the value-in-use of its customers. Is the firm achieving the customer's outcomes, purposes or objective through its services? The close relationship that comes along with IoT between the firm and the customer makes it easier to talk about the value-in-use the customer experiences. Combining this with the data the firm retrieves gives the firm the perfect opportunity to use them in the value proposition, what the firm promises to deliver in benefits, costs and value to their customer. In the case of IoT the firm can offer many benefits like discussed in section 4.1 and section 4.3. The cost might be lower like discussed in section 4.7 and the value-in-use has great potential of getting higher.

IoT products and IoT services are very customer specific. It is not for a reason they enable firms to get in better and easier contact with their customers. The way IoT can help firms to craft their value proposition therefore is customer dependent. A firm needs to make a value proposition customer specific adjusted to the customer's specific features and objectives. Not all aspects of the IoT apply on every situation and not all firms' internal and external organizations need to change in the same way. Close and good agreement about the value proposition is very important for the firm as well as for the customer. The firm knows what it should deliver and the customer knows what to expect.

5.4 Is IoT a real example of the S-D logic?

To answer this question I will repeat the four most important aspects of a S-D Logic like discussed in the introduction of this paper. The S-D Logic firstly brings the focus of marketing to the experience of the customer (Vargo & Lusch, 2004a), as in value-in-use that the customer experiences, secondly it enables co-creation (Vargo & Lusch, 2006), thirdly it takes marketing and consumption to the same area (Grönroos C. , 2006) and sees it as a process and fourthly products become services on their own (Lusch & Vargo, 2006b). The first aspect

we see back in the fact that more budget of the sales should be based on marketing, section 4.4, because IoT enables to put the customer first and central. Although only one interviewee mentioned co-creation it is one of the things that IoT is enabling, section 4.4. IoT brings different actors in the value chain closer together and data exchange goes easier over standardized platforms, all enablers of co-creation. Thirdly with the ability of closing service contracts the firms enters into a long-term relationship which turns marketing in a process to keep the customer happy all the time bringing marketing and consumption into the same area. At last the S-D Logic says that products itself become services. If one technology really enables this it is IoT. Taking all these four most important aspects of the S-D Logic in thought IoT is a perfect example of what the S-D Logic is up to and what it means. IoT might be a true catalyst for the S-D Logic development.

6. DISCUSSION

Like every study there are some points of attention that need to be discussed. Some interviewees I spoke to had already a huge understanding and pre knowledge upon IoT, while others had little. This has highly influenced the results numbers in the tables which makes it a lot less reliable to make contributions about the magnitude of the different outcomes. The magnitude therefore is less important than you would say at first. What is important are all outcomes, it just depends on what kind of firm you are and what kind of responsibilities you have in your function you have to attend to. This brings me to the second fact that I spoke to totally different firms and totally different functions of people in these firms making the magnitudes also less useful. All the different perspectives of the firms and people gave an as total picture of the phenomenon IoT, rather than magnitudes in tables that are useful to say anything about.

In this study I tried to find an answer on the research question 'how can the IoT help firms to craft their value proposition based on value-in-use data real time collected from users'. To make a good value proposition it needs to be based on the firm's specific knowledge and specific competences it has. This study though generalized the data of many types of firms to find the most important aspects of the value proposition needed for IoT products. Future research in firm specific areas like OEM's or real service companies can be of the utmost importance for these business areas. Firstly they will be able to craft their value proposition more specifically for their business area and secondly to see where they differ in value propositions with other business areas. Finding these differences could mean that the firm misses an aspect in their value proposition and they might need to change it.

One of the biggest aspects that came forward in the research was that the customers of the firms did not see the need for applying IoT to their products. The firms that I spoke to never understood why they did not see the need even after talking about it and discussing the possibilities. Future research into why the customer is not adopting the technique IoT even when they know all the benefits they could get would be very interesting to combine with the outcomes of this research. The value proposition of the firms individually could be made even better. A second thing that is in alignment with this point of attention is that some IoT techniques scare of customers because they are afraid of the techniques. Future research in why they are afraid of the IoT techniques could elucidate the fundamental reasons which than can be encountered by firms with along others their value propositions. A third thing that goes hand in hand with this is how to get acceptance. It is one of the aspects that came forward more often than other aspects.

Future research in how to generate the acceptance of IoT could be interesting to combine with the results of this paper.

The customers of the firms, the real final customers might think differently about IoT. Future research in the end customer's thoughts of IoT would be interesting to combine with the results of this research. In that case you know what the firms can offer and what the customer's expects, two very important aspects for crafting a good value proposition. In this study only the viewpoint of the firms were used to find the opportunities for their customers.

One of the aspects that are not discussed in this paper is the quality of data itself. It is kind of mentioned in table 2 as false information. Without a good model for data analysis false data might be used to generate outcomes. How to check whether or not your data is useful is of the utmost importance for products equipped with IoT and its services. When you are not able to get useful data IoT is of no use for your firm.

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