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PERCEPTIONS OF SMART OBJECT/SERVICES
A QUALITATIVE INQUIRY

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ABSTRACT

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The Internet, as we know it, is transforming again. Since its creation in the 60's, popularization in the late 80's to the information society of today, the next step will set humans as the minority users of the Internet. This is because of the Internet of Things (IoT). In the near future and already today, objects are equipped with the ability to communicate over the Internet and will accommodate the majority of traffic over the Internet. With added senses, such as seeing and hearing, objects are able to produce information for new innovative purposes. An object with the ability to sense and communicate over the internet is in this research defined as a smart object/service. It brings users service-like experience and enables automatized everyday tasks. This change will affect our lives for good.

In light of the above, the purpose of this research is to explore and analyze the customer perspective to smart object/services made possible by the IoT. The purpose is achieved through research questions aimed to explore first insight from a specific group of future adopters, to whom the age of Internet and technology is no anomaly. This research is qualitative and its philosophic foundation built on interpretivism. The data is gathered utilizing a questionnaire where respondents are asked to describe their ways of using three smart object/services.

For this research a theoretical synthesis is built based on former literature on IoT and research conducted utilizing technology acceptance model and its extensions. First, IoT is explained in its current form and development phase. Second, smart object/service attributes are described using examples to describe the phenomenon. Third, the technology acceptance model (TAM) and its extensions form the theoretical synthesis around studies conducted of perceptions. Three aspects of perceptions are used: perceived usefulness, relative advantage and perceived risk. In the concluding chapter, a revised synthesis is presented.

Based on this research, two major findings arise from the data in relation to the theoretical synthesis. First, smart object/services are seen to improve the everyday life within the group of respondents, thus supporting the relative advantage perception. Also, perceived usefulness was closely interconnected to it, even though the lack of trialability. Second, the perceived risks were high to the extent that was surprising. Especially reliability and safety & security aspects seem to affect respondents. The findings show that further analysis of perceived risk and its dimensions needs to be conducted. Based on the results as managerial implications, producers need to take into account the high risk perceptions and focus on trust building as part of innovating smart object/services.

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1 INTRODUCTION

1.1 Internet of Things – the future

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

The citation is from Mark Weiser (1991, 94), considered by many as the father of the concept of ubiquitous computing. His words somehow today summarize our affection to mobile phones and the Internet, as everyday convenience, a seamless extension to our lives. The quotes meaning to this research is to help the reader ease into the inevitability of change and how those magnificent technological advances have changed our lives in the past and will in the future.

For the past couple of years, Internet of Things (IoT) and smart objects have been a trending discussion in service management and service marketing. However, having this recent rise in interest, the topic itself has been around since the late 1980s when companies used digital applications and embedded sensors in computers and elevators. It is in fact the radical change in the ability to create new services and provide multi-channel experiences to customers, that has created the fuss around IoT and smart objects. (Wünderlich & al. 2015)

It is important to notice that IoT is a concept of the 21st century, whereas sensors and processing power has been embedded in machines, "things", for the past 30 years. The processing power and solutions inside things have been developed steadily throughout the past decades. What makes IoT today and tomorrow such an interesting topic, is the current phase of the digital evolution. In fact, we stand on a brink of digital revolution, as was the case during the industrial revolution over a hundred years ago.

Even though the topic of IoT is on top of blogs and related media, academia is still catching up. "Future directions" –papers have been published to help navigate the field towards common language and further understanding of the phenomenon. The complexity of the field and need for common definitions in relation to IoT and smart objects needs multidisciplinary research to fully comprehend the phenomenon. To name a few, such multidisciplinary views are suggested in: frameworks of different domains of service management research, human resources management directions and research priorities for the science of service. (Ostrom & al. 2010, Bowen 2015, Subramony & Pugh 2014)

1.2 Research phenomenon

The research phenomenon rises from the ability to provide a set of new types of services and products by utilizing IoT and smart objects. As the development and fuss around the topics is fast and complex, research needs to be conducted in order to categorize and fully understand the phenomenon.

The interest towards IoT and smart objects is pervasive. Researchers in different fields, bloggers in their own right and players in different markets are looking for ways to benefit in the best possible way in the context of IoT. This interest can already be seen in the market, where making business is changing. Traditional firms selling industrial products are selling services and firms selling modern products such as software, are also doing the same thing. (Iansiti & Lakhani, 2014) Global players in the technology industry, such as Google, Facebook and Apple, are designing consumer products in order to get ready for an IoT revolution. Their strategies are delineated around IoT, where major capital investments will occur in the near future. (Borgia, 2014)

It is not just companies that focus on IoT, it is a driving force for strategic innovation development in the biggest economies in the world as well. China, US, EU and Japan have all initiated their IoT strategies during the 21st century. This predicts a market for IoT and smart objects worth over 7 trillion USD in 2020. (Hsu & Lin, 2016) Impacts are seen to affect both working and domestic fields, for example in health care, urban living and housing. Whereas the positive possibilities are widely accepted, many downsides and aspects to consider still remain.

Privacy and security are often mentioned in the consumer view, technological restrictions in the production view. (Atzori, Lera & Morabito, 2010)

1.3 Identifying the research gap

In this research, customer perceptions are empirically studied. The reasoning behind opting for the customer view, is that many of the articles in academia, media and blogs are centered around the possibilities for companies, without asking if the customer is ready for this change or even knows of what is happening. Thus, further insight on customer perceptions is needed.

As stated earlier, customer centricity is still in its infancy in relation to IoT. There is a gap or even a controversy between being loud about customer-centricity today and at the same time fussing about the technical possibilities IoT and smart objects provide for companies especially. For engineers and service developers to provide sustainable solutions through IoT and smart objects, further insight into customer perceptions is needed. If customer is not put first, there is a risk of losing added value through new services.

To further shed light on the research gap and its existence, in Ostrom & al. (2015, 4) ten different research priorities for service management were identified. The latter list of priorities is based on their research: *fostering service infusion and growth, improving well-being through transformative service, creating and maintaining a service culture, stimulating service innovation, enhancing service design, optimizing service networks and value chains, effectively branding and selling services, enhancing the service experience through co-creation, measuring and optimizing the value of service, leveraging technology to advance service*.

In support of this research and its purpose, Ostrom & al. (2015) define "*leveraging technology to advance service*" as a pervasive service priority. Its meaning is such a dominant force, it pierces all of the priorities and puts pressure both on academia and companies. The customer view was also emphasized through technological developments as an additional priority: "*Accelerating adoption and acceptance of new, service-oriented technologies."* This is exactly the niche this study aims to study in the empirical part. The intention is to get the perceptions towards new innovative services and products to better understand their expectations.

The choice of words of Ostrom & al. (2015) is arguable. The tone is somewhat related to the problem this research sees in the current discussion: the customer view is volatile. To accelerate adoption and acceptance, studies truly need to focus on the customer and their perception towards IoT and smart objects.

1.4 Setting research purpose and questions

The purpose of this research is to explore and analyze the customer perspective towards smart object/services made possible by IoT. It is important to note that the IoT utilizing products and services, as they are presented in this research, are on their development phase. Respondents are future adopters and do not have real life experiences from utilizing them. This needs to be acknowledged. To fulfill the research purpose, participants will answer a questionnaire. Three different types of smart objects, products and services are chosen to the questionnaire.

The purpose is achieved through the following research questions:

How do young adults perceive themselves using a smart object/service?

What benefits young adults perceive in using a smart object/service?

What drawbacks young adults perceive in using a smart object/service?

1.5 Research structure

This research is built on four cornerstones following the introduction: theory, methodology, results and discussion. In the second chapter, theoretical considerations consist of the Internet of Things and smart object/services being presented in a past, present and future continuum. This is followed up by introducing former literature on perceptions and finalized with a theoretical synthesis creating the lens through which the data is later on looked at.

In chapter three, the methodology of this research is presented both from philosophical and practical points of view. Philosophical choices are guided by interpretivism and practicalities

arranged from a qualitative standpoint. The methodology guides and structures all choices made regarding this research, both practical and unconscious. Given the nature of this research, subjectivism is constantly present, especially because of its futuristic set of object/services studied in the empirical part.

Chapter four introduces results from the questionnaire data gathered from participants. The results are presented and themed in depth per object/service. Chapter five, conclusions and summary, presents the findings in more comprehensive themes found from the data and revisits the theoretical synthesis.

2 SMART OBJECT/SERVICES & CONSUMER PERCEPTIONS

2.1 Internet of Things (IoT)

Internet of Things (IoT) as a concept was solidified by the International Telecommunication Union (ITU) in 2005, which released a report titled "Internet of Things". The report includes an introduction to the topic, general information on enabling technologies and a discussion on opportunities as well as challenges that come with its fast popularity. According to the ITU (2005, 1) the term Internet of Things (IoT) is defined as:

> *"Today, in the 2000s, we are heading into a new era of ubiquity, where the 'users' of the internet will be counted in billions and where humans may become the minority as generators and receivers of traffic. Instead, most of the traffic will flow between devices and all kinds of 'things', thereby creating a much wider and more complex 'Internet of Things', the core subject of this report."*

At its core, IoT is not science fiction. Furthermore, it is not a new innovation, but a technology that has been developed since the late 1980s. The recent evolution and its radicalism, however, has raised the issue. As mentioned in ITU's report, Internet is widely used, but the majority of users are humans. Therefore, the Internet as we now know it, could be described as the Internet of People. It allows us to share and connect people like never before. In the future, and today already, the users of Internet will exponentially grow. People will be the minority users, and *things and objects* will share and connect more than people. Therefore, the term Internet of Things. (ITU 2005, TEDxTemecula 2014)

Porter & Heppelman (2015) view this fundamental change through things themselves. The smart, connected products are first of all a change in a wide range of *things*, not the *Internet*. In fact, the term "Internet of Things" is somewhat misleading in their point of view, since the Internet itself is merely the means to transmit information. IoT does not create a new Internet, but a new meaning for things, giving them the ability to connect and communicate with us and each other.

The definition of IoT is essentially identical in both computer science and technology-focused publications; however, the latter draws more attention to technical details, which might need to be solved before IoT can reach its full potential (Chandrakanth et al. 2014). For instance, the currently utilized InternetProtocolversion4 will not be able to accommodate all the space needed for the massive increase in things using the internet. Unless InternetProtocolversion6 and its global adoption does not happen, IoT and its potential will be delayed as well. In this research; however, the technical aspects are put aside and will not be of great importance.

IoT is a simple concept if you only need a simple answer. Since its birth in the late 1980s, IoT has turned into a complex subject due to major advances in technology which affect people's everyday lives. Next, IoT is first explained in a historical perspective, followed up by its attributes and application in the 21st century and finally a thought on future direction.

2.1.1 The three waves of Information Technology

IoT might not be a new idea; however, it is an important idea. In information technology (IT), major changes typically permanently affect our lives. To emphasize the importance of these changes, and to place IoT on an information technology continuum, this chapter describes the three waves of IT according to Porter & Heppelmann (2015).

FIRST WAVE OF IT	1960s to 1970s	automation order processing bill payment data capture
SECOND WAVE OF IT	1980s to 1990s	Internet ubiquity integration of activities paper to technology
THRID WAVE OF IT	1990s onwards	Internet of Things integration to objects big data cloud

Table 1. Three waves of Information technology. (Porter & Heppelmann, 2015)

The first wave of information technology occurred during the 1960s and 1970s. This resulted in the rise of nowadays common, automated value chain management processes. For example, order processing and bill payment moved to digital environments. The first wave gave productivity a boost and resulted in unforeseen possibilities of data capture.

The second wave was the rise of the Internet with its inexpensive and ubiquitous connectivity. This development started the information technology-driven transformation during the 1980s and 1990s. It enabled a new type of integration across companies and their activities on a global scale. Yet again, the Internet supported the rising productivity provided by information technology some twenty years earlier. This fundamental change, moving from paper to technology and the Internet, can be viewed as a revolution of its own kind.

Currently, the third wave is happening; i.e. the wave of IoT, during which information technology is becoming an integral part of sold products. This adoption is visible in a wide range of fields, from classic industries to new emerging industries relying purely on possibilities provided by the Internet and related technologies, such as embedded sensors, processors, software, and connectivity. These products are connected to clouds and data storage, where product data as well as customer data are stored in massive amounts. This data, in an optimal situation, results in better product usage, functionality and performance. However, these technological possibilities still require further development to serve an increasing amount of customers. Essentially, this research draws attention to the “third wave” products.

2.1.2 IoT results in smart object/services

The Internet of Things allows us to utilize objects in new ways. This chapter focuses on explaining how IoT makes objects smart and the end result is somewhat a mixture of an object and service.

The concept of IoT utilizing objects in this research is called smart object/service. Their features are presented in the following chapters. Below, the terminology is classified in a short and concise way to help the reader understand the concept and context. This is important, because the academia and public discussion has not yet come to a common way of discussing IoT and

its future. To further visualize the concept, in figure 3 a singe object as part of the IoT is visualized.

Internet of Things

Collection of things and objects communicating and sharing data over the Internet. It is not a new Internet, but a new group of users of the Internet, things and objects. There is no limit to the amount or type of things and objects connected to Internet. Connectivity components make it possible for a thing to be connected to the Internet. Close by terms: *Internet of Everything, Industrial Internet*

Smart

Depicts the dimension making a thing being able to exceed its normal, current way, of functioning. Being smart consists of connectivity, senses and physical existence. A mobile phone fulfills *smart* criteria. Synonym used in literature and media: *intelligent*.

Smart object

An object with smart components as described above. Has the ability to utilize its smart dimension to benefit other than its original purpose. A mobile phone is able to give you feedback on your movement and sleeping patterns for example. Synonym used in literature and media: *intelligent object.*

Smart Object/service

End result of a smart object as part of the Internet of Things. Sophisticated smart object, which produces data, turns it into knowledge as a service. Emphasizes a thing or an object changing its nature. Used specifically in this research to depict the nature of chosen future products.

Generally, smart objects consist of three common elements: *physical components, "smart" components, and connectivity components*. Physical components consist of mechanical and electronic parts; for example, the chassis of a motor vehicle. The smart components consist of sensors, microprocessors, data storage, controls, software and usually an operating system.

Their purpose is to amplify the capabilities of mechanical components and to add value to them. For example, in cars, automated windscreen wipers are connected to sensors, which detect rain and automatically turn the wipers on once rain is detected. The connectivity components allow the transmission of information to and from the product. Such components are for example ports, antennae and wireless connectivity. (Porter & Heppelman, 2015)

Connectivity is at the core of IoT, particularly in smart objects. While sensors and other physical components have been part of technical devices for many years, advances in the current third wave of IoT allow them to communicate in new ways over the Internet. The following paragraph introduces three forms of connectivity: one-to-one, one-to-many and many-to-many. One-to-one connectivity refers to the connection of an individual product to another entity; for example, a car to a computer to analyze the engine. In one-to-many connectivity, a central system is connected to many products; for example, the car company Tesla following all of its cars through a system. In the case of many-to-many connectivity, several products are interconnected, usually through a common external system. For example, a prominent example are automated cars and automated traffic in general, where cars would operate independently and be able to organize transportation by themselves. (Porter & Heppelman, 2015)

The concept of smart object is also presented in Wünderlich, Wangheim & Bitner (2013), where the researchers define smart or *intelligent* products as containing information technology in the form of microchips, software and sensors, thus providing capability to collect, analyze and produce information for the benefit of the customer and service provider. When the described smart, intelligent products and technology are used in delivering a service, the researchers define it as smart service. The researchers emphasize the fact that smart services are no anomaly of our era, but a fast growing field of service; spanning from business-to-business and business-to-customer, mechanics, producing to healthcare and communication.

The interesting notion in Wünderlich, Wangheim & Bitner (2013) paper was, that whereas the common practices in smart service are technology focused, the service providers should focus more on the users' acceptance in attitudinal and behavioral levels. This exact issue is the cornerstone of this research. Things that affect the user's activity and acceptance level should be well known before heading into mass production.

Furthermore, according to Wünderlich, Wangheim & Bitner (2013), human interaction is a vital part of even the smartest services, and service providers should then personalize and add a human touch in their offering. This is an interesting notion in regard of this research and might be visible in the data. Even if we have the technology to provide smart service without a single human being interfering, would the adoption level be high?

In Allmendinger & Lombreglia (2005) the writers emphasize the fundamental difference between smart services and the service offering of the past. A smart service is preemptive rather than reactive or even proactive. Their preemptive nature comes from the ability to use field evidence e.g. machines data through sensors as base for actions, to remove failures. This field intelligence and information from products, means better products for customer.

Furthermore, research and development information is seamlessly available for service provider, for better value offering in ongoing use. To further explain the development, companies in aviation, chemicals and other high-tech critical environments have had to have a specialist sit next to a machine following its movements and monitoring its functions. Should something have happened, the specialist was there to help but more than often it is too late at that point. A machine embedded with smart objects would have preemptively acted on the problem.

In regard of this research, the smart object/services used in the questionnaire are highly autonomous. This is a futuristic setting and therefore the chosen services require both minimal user input and minimal or neutral provider input. Of course, providers do have a lot of input in creating and maintaining the systems, but up and running operations optimally require minimal input.

2.1.3 Examples of smart object/services

As mentioned earlier in this research, IoT is seen as a major driver of change in both domestic and work environments. In this chapter applications are further explained, but as in any developing technology, it is important to accept the fact that we do not absolutely know what direction the development will take.

Borgia (2014) provides an example of a smart city, operating with multiple IoT applications. A city is an interesting ecosystem to examine IoT, since it is easy for everyone to comprehend and as it consists of multiple possible applications. The increase in population in urban areas will continue, which will result in a higher consumption of resources such as light, water and energy. Relevant topics such as security, scarcity of resources and functionality of the urban infrastructure need to be examined to answer this increasing demand.

According to Borgia (2014) future cities will function on two levels, the physical and the virtual. In a smart city, resources are efficiently managed through widespread IoT applications. Transportation can be managed through the already existing applications, but amplified through sensors and connectivity to guide and automatically manage the traffic. Autonomous traffic would be integrated to the system as well.

There would be multiple benefits of the information available. For example, in the case of a car crash on a main road. IoT applications can connect the physical reality to the virtual one and immediately guide traffic through fast routes, thus help to avoid dangerous situations as well as traffic jams. In addition, the information of the accident would reach emergency services faster and with more detailed information on the severity and the needed assistance. One step further, car crashes would be completely avoided in autonomous traffic.

The benefits of IoT would be widespread. The connection of virtual and physical levels would optimally result in massive productivity gains and better resource management. The city operating system would be responsible for managing, storing, analyzing, processing and forwarding the big data gathered through sensors, cameras, screens, speakers, smart meters and thermostats to wherever needed within the city. The data would offer benefits to the whole infrastructure rather than a single service. Whenever a citizen uses a service, they would be actively participating in creating new data to further develop the city operating system. Figure 1 below presents a city operating system. In Padova, Italy, a real-life smart city operating system is being tested and seems to bring in positive results. (Borgia, 2014; Zanella et al. 2014)

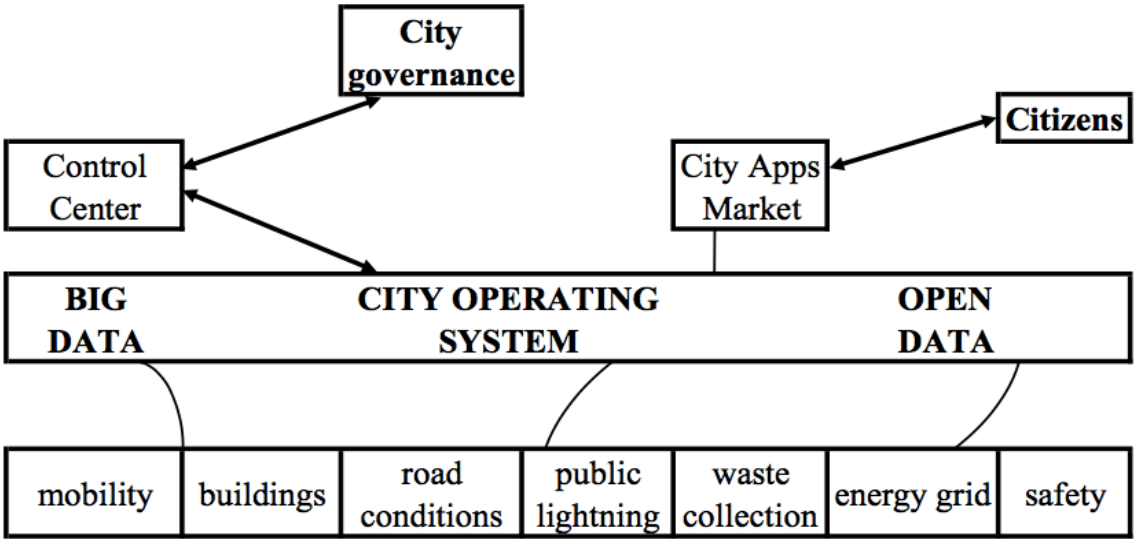


Figure 1. City operating system. Borgia (2014, 3)

2.1.4 Internet of TBA – synonyms or different concepts?

This chapter pursues to inform the reader of the multiple parallel words to describe digital ubiquity and smart objects. Altogether, Internet of Things can be considered as the principal term, a word used by many and without a clear connection to field of studies or background. In this research, IoT was chosen specifically because of its wide usage and unanimous meaning among academia. Furthermore, collecting empirical data will be easier through a term all respondent will immediately recognize and have a clear concept in mind.

One of the close-by terms is Industrial Internet (sometimes with added - *of things)*. This term refers to the industrial applications of IoT, such as solutions in manufacturing and production. In a hierarchy, Industrial Internet is below IoT and therefore excluded from this research. (Stankovic, 2014) Also, this choice further supports accessing empirical data, as participants most likely will not be familiar with the term. Last, GE (general electric) seems to be branding its offering behind "industrial internet" (https://www.ge.com/digital/blog/what-is-the-Industrial-Internet). In academic papers, IoT is more widely used.

Another concept close to IoT is the Internet of Everything (IoE). When industrial Internet is a subclass of IoT, IoE is above in the hierarchy. IoE could be considered as the vision or ideal of the development in ubiquitous computing. Compared to IoT, it is far more philosophic in nature and has not captured the academia or related media as powerfully. It seems also, that whereas GE pushes industrial Internet, Cisco has adopted IoE as part of its portfolio (http://www.cisco.com/web/about/ac79/innov/IoE.html). Because of its philosophic nature and poor adoption in academia, IoE as term is excluded from this research.

IoT makes smart object/services possible. A concept somewhat related to smart object/service is servitization. In servitization the focus is on the change of selling, instead of products, product-service systems. Essentially this means selling a product for which the service is bundled to or the service itself is the product. A classic example of servitization is Rolls-Royce selling "power by the hour" instead of engines to airplanes. Customers buy the power the engine provides, and provider takes care of the engine delivering it.

What makes servitization a similar concept to smart service, is its roots in digitalization and the ability to bundle services into product offering e.g. via sensors monitoring the product. However, servitization can be seen as a sub-concept of smart service. Whereas smart services are a multidimensional term, servitization focuses on providing services bundled with products (product-service system). (Lerch & Gotsch, 2015; http://andyneely.blogspot.fi/2013/11/what-is-servitization.html)

To conclude the chapter and to stay grounded as well, there are a lot of things happening around IoT and smart objects. First, there is a lot of infrastructure and new solutions needed before implementing for example a city operating system or another comprehensive system. In other words, there is a lot of pressure on companies. This is visible in Figure 2 where Porter & Heppelmann (2015) illustrate the technology stack around smart service. Second, there is the customer. There is limited research done of customer perceptions towards IoT and smart service as of now. Future customers, whose perceptions this research aims to study.

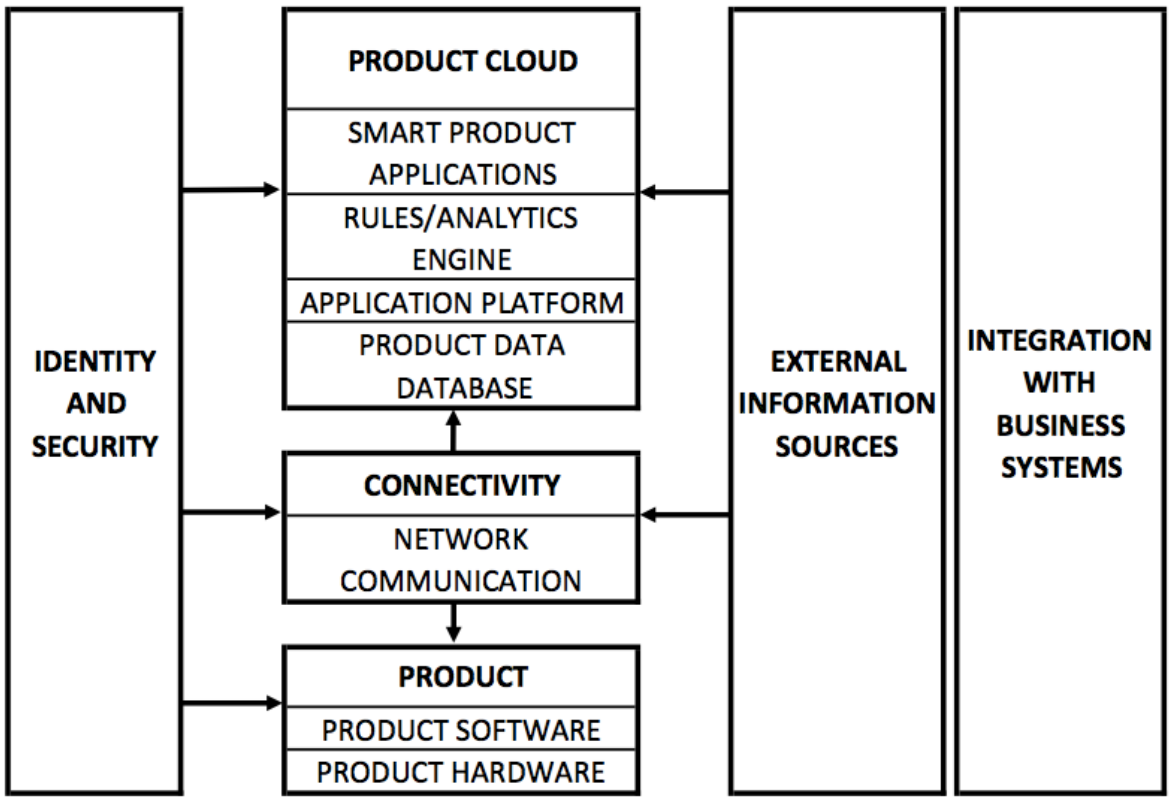


Figure 2. Technology stack around smart service. (Porter & Heppelmann 2015, 101)

2.2 Perceptions guide adoption

There is a vast amount of literature concerning both technological advances and behavioral aspects related to technological improvements and new services offering. Studies can also be found from many different fields of study: social sciences, technology, behavioral and so on. In order to maintain the red thread in this research, the scope of previous literature needs to be narrowed.

The common nominator for the chosen literature is set in the customer view. The customer view is therefore looked into in management, service marketing and service management fields of research. However, purely psychological and technical research will be excluded. The reason for this is that the researcher does not have the needed background or know-how to be able to fully utilize previous knowledge from literature.

2.2.1 Technology acceptance model and its extensions

The previous studies in the chosen scope have mainly been conducted using the technology acceptance model (TAM) and its many updates and extension since the late 1980's. TAM is an extension of Ajzen & Fishbein's theory of reasoned action, introduced by Fred D. Davis in 1989. Its main focus was to bring valid measurement scales to predicting user acceptance, especially in the age when computing was growing. The cornerstones of predicting user adoption in TAM are perceived usefulness and perceived ease of use. Furthermore, the perceived usefulness seems to be the determining factor of adoption and accepting the system. (Davis, 1989)

Perceived usefulness is defined as the extent to which a person believes that using the system will enhance job performance and perceived ease of use as the extent to which a person believes using the system will be free of effort (Davis & Venkatesh 2000, 187). There is also a correlation between perceived usefulness and perceived ease of use. The easier the system is to use, the stronger the affect on perceived usefulness.

Since the original Davis' paper, Venkatesh and Davis have extended the original TAM model by bringing more parameters in TAM2 and in the unified theory of acceptance and use of technology (UTAUT). In TAM2 the researchers added both social (subjective norm, voluntariness, image) and cognitive (job relevance, output quality, result demonstrability, perceived ease of use) influence processes in the model. They found that social influences have an impact on perceived usefulness, where people incorporate others opinion into their perception. Also, it was found that people use a system to gain status and therefore improve their job performance.

Venkatesh & Davis (2000) argue that TAM explains a substantial amount of acceptance, usage and behavior in empirical studies. It also seems to compare well with other models such as Theory of reasoned action (TRA) and Theory of planned behavior (TPB). TAM and its extension are a strong base in this research and contribute to the theoretical synthesis later on in chapter 2.3.2.

Bruner & Kumar (2005) applied the TAM model to consumer context, resulting in their proposition of c-TAM. In their research it was found that the fun of using a technological device

is even more powerful than the perceived usefulness of it. Traditional research done using TAM focuses on work environment and results often find perceived usefulness as the major driver for adoption. In c-TAM the researchers suggest the hedonic attributes also affect the perception on ease of use.

2.2.2 Perceived risk and trust

Ruyter, Wetzels & Kleijnen (2000) studied the impact of organizational reputation, relative advantage and perceived risk on perceived service quality, trust and behavioral intentions of customers. Relative advantage seems to explain a lot of the adoption. It depicts the extent to which a person believes the system is better compared to available alternatives. Alternatives include competing systems and other brands. Perceived risk is often related to trust towards the provider. People perceive companies in different ways and often the circumstances in adopting new systems has an element of unknown to them. For example, adopting an electronic service, you might not have the personal touch with the provider. This was also emphasized in Wünderlich, Wangheim & Bitner (2013) paper.

Featherman & Pavlou (2003) utilized TAM with added perceived risk theory to study e-service adoption. Perceived risk is defined as a feeling of uncertainty towards a products reliability or other negative outcome. The seriousness of the risk outcome affects for example purchase behavior. The researchers identified seven risk facets that they incorporated in their research: performance, financial, time, psychological, social, privacy and overall risk. Whereas previous perceived risk research has focused on the importance of trust building from providers' side, Featherman & Pavlou aimed to dig deeper into the construct of perceived risk. Their main findings include that performance based risks such as time, privacy and financial risks were important.

Ruyter, Wetzels & Kleijnen's main findings were that organizational reputation plays a key role in customer acceptance and this also affects the perceived risk in adopting a new e-service. Similar findings are widely produced by other studies as well. (Ruyter, Wetzels & Kleijnen 2000)

Trust seems to play a key role in customer acceptance and perception. As Ruyter, Wetzels & Kleijnen among others found in their studies, perceived risks are high and for example organizational reputation may lower the perceived risk. In the journal of network and computer applications Yan, Zhang & Vasilakos (2014) propose objectives on trust management in IoT and provide a survey on the current literature advances towards trustworthiness. Although being quite focused on technical advances, they give importance to human heuristics, and peoples high trust towards recognized brands (organizational reputation). They found that the customer (user) view remains an open issue, where the lack of knowledge of individual properties are unknown in the context of trust and risk.

2.2.3 General customer expectations and knowledge

Customer adoption has also been studied in a less theoretical, a more novel setting as well, where no attempt on producing an all explaining framework for acceptance was made. Nielsen, a company providing insight on consumer behavior and consuming behavior, did a case study on customer perceptions and knowledge of the Internet of Things.

The study was conducted by their subsidiary Affinnova (acquired by Nielsen in 2014). In their study, consumers were asked to evaluate IoT product concept variations and evaluate desired functions. Affinnova found that despite the massive hype around IoT and smart objects, consumers do not fully comprehend what smart object are. Participants felt that IoT is revolutionary (57%), but could not determine how. Almost every one of the participants (92%) could not pinpoint what they want from smart objects, but said they will know when they see one. Furthermore, the study also found that people have trust issues towards IoT. This was made clear for example in participants' answers towards smart objects as decision makers: they fear the choices a smart object might do will not be the one the user would have done (41%). Despite these quite serious hindering aspects, participants see there is a future for smart objects in twenty years (58%). The reliability of a questionnaire of this sort can be questioned for sure, but looking at the big picture, other media and marketing related sources provide similar findings. (http://www.adweek.com/news/technology/infographic-why-internet-things-hasnt-really-caught-yet-162134)

Continuing with marketing and customer data analyzing companies, another case study was conducted by the Acquity Group, an ecommerce and digital marketing company. Their case study stated IoT to be “inevitable”. Yet again the familiarity with IoT and of possibilities to utilize them was a major issue amongst participants. A great amount of participants was not familiar with the term IoT (87%) and furthermore many were unaware of the fact that products already exist in the market (64%). Smart home devices, such as thermostats and security solutions along with fitness products were perceived as the most wanted items. As with Affinnova’s study, criticism can be laid upon the validity. However, the results suggest similar findings between the two and yet again looking at the big picture around the topic, similar findings pierce the discussion. (http://www.adweek.com/news/technology/infographic-why-internet-things-hasnt-really-caught-yet-162134)

2.3 Creating theoretical synthesis

2.3.1 Smart object/service as part of the Internet of Things

The Internet of Things is a system, where things embedded with technology can sense and share information. It means the whole system, which consists of smart object/services. Smart object/services are smart because of their three aforementioned attributes: physical components, smart components and connectivity. Things being smart results in service like products, sometimes referred to as smart service. However, in this research the term smart object/service is used to emphasize the changing nature of objects.

The academia has yet to agree the terminology when talking about smart object/services. This can be confusing when reading about the topic. However, the common nominator in literature is “smart”, which more than often reflects the IoT aspect in the context. The terminology and its multilateral nature is explained in chapter 2.1.2. Once more, in this research smart object/service is used to describe the changing nature of objects because of IoT. (Wünderlich, Wangheim & Bitner 2013; Allmendinger & Lombreglia 2005; Germany’s High-Tech Strategy 2014)

In this research it is very important for the reader to understand the nature of a smart object/service. In essence, a smart object is for example a mobile phone. It has human-like senses and the ability to share this information with people and other objects as well. In an IoT system, mobile phones along with other objects communicate with other things, such as cars, homes, chairs, water pump and whatever smart objects exist.

The aforementioned IoT system produces an opportunity to offer smart object/services such as smart clothes to consumers. Once more, this is extremely important. The mobile phones of 21st century are more than mere things or objects. They have the ability to bring us services, because of being smart and connected to their surroundings. Smart object attributes as part of IoT is depicted in Figure 3. This cannot be seen as a confusing factor, but the nature of future products. In this research smart objects are part of IoT and are able to bring you service-like user experience. The attributes of a smart object are adopted from Heppelman & Porter (2015): a smart object has three main features; physical, smart and connectivity components.

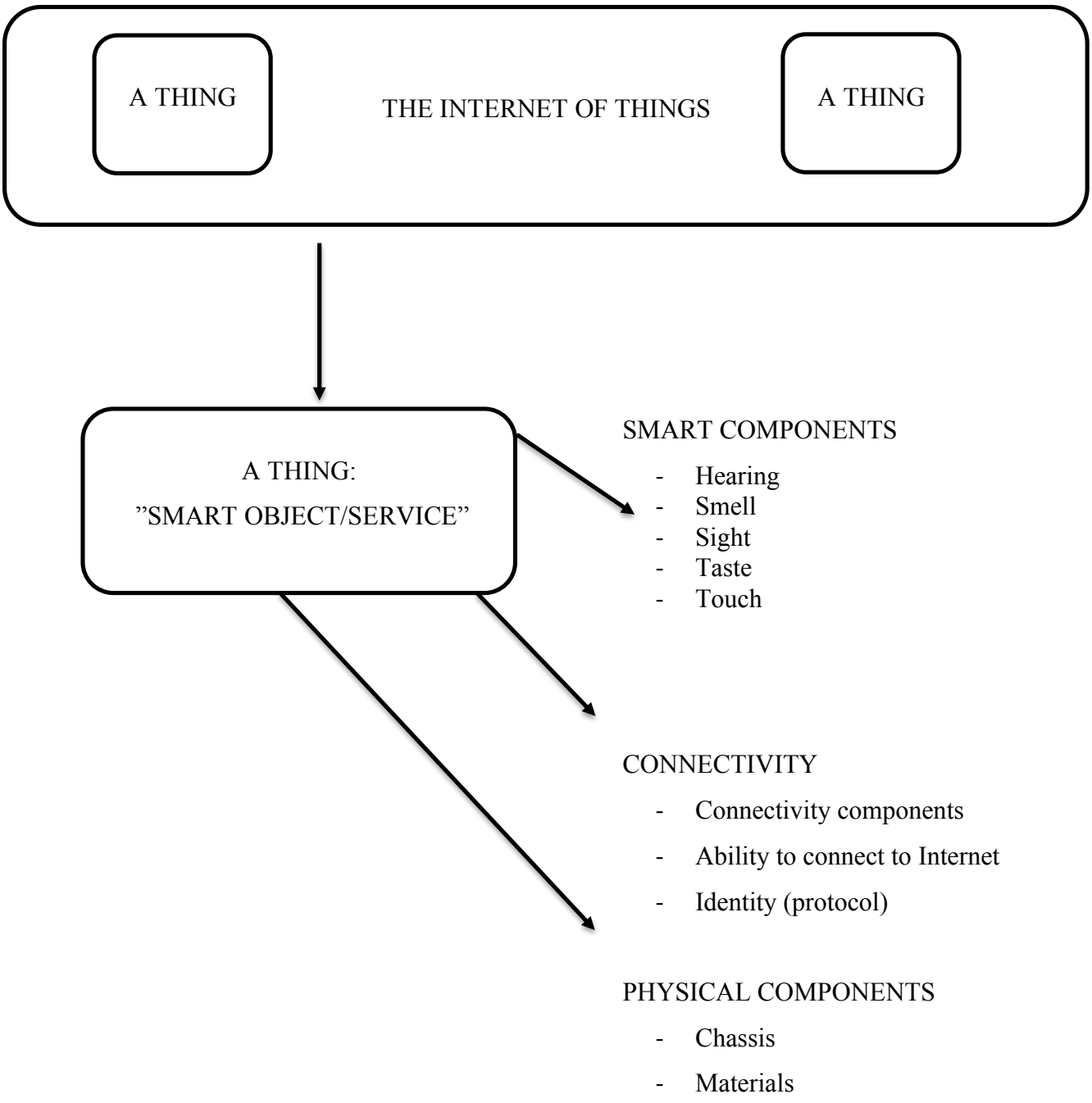


Figure 3. Researcher’s visualization of a smart object as part of the Internet of Things.

2.3.2 Theoretical synthesis

In this research, previous theory and research is used to provide a combination of understanding, which then in the empirical results is evaluated in the light of findings. The theoretical synthesis consists of adoptions from TAM with added focus on trust and perceived risks based on, for example; Ruyter, Wetzels & Kleijnen (2000). Also, the more novel questionnaires done by marketing and data analyzing companies give understanding on customer perceptions in a way they must be seen as limitations. The limitation in particular is related to respondents' knowledge of IoT, where questionnaires have found poor understanding among respondents of what IoT is.

Building from the research questions of how young adults perceive themselves using the chosen smart objects, which benefits and drawbacks they perceive in using such objects, the theoretical synthesis is built so that the questions can be reasonably answered and evaluated. Previous research gives context to evaluate and get more information in the particular group of young educated adults.

First, perceived usefulness is adopted from TAM. However, the original Davis's version defines perceived usefulness through benefits and enhancements to job performance. This research applies constructs from c-TAM focusing on the customer view and perception, also taking into account the fun related to using new products. The chosen smart object/services in the empirical part are futuristic and respondents do not have personal experience of them. Therefore, the concept of relative advantage from Ruyter, Wetzels & Kleijnen research gives insight on perceived advantages relative to current solutions. It is highly likely respondents will compare the solutions in the empirical part to current ways of using wearable technology, home and vehicles.

Second, perceived risks are of importance in this research. Given the previous research and discussions related to IoT, there is an anticipation of less privacy and security among customers as future adopters. Ruyter, Wetzels & Kleijnen emphasize trust towards the supplier. Featherman & Pavlou focused on seven risk facets digging deeper into the reasons for perceived risks. In this research the focus of perceived risk is on the smart object or service itself. The reasoning for this is in the futuristic nature of the research. The chosen smart objects or services

are not in the consumer market yet and are presented as concepts with minimal brand exposure. Therefore, only Featherman & Pavlou's facets are incorporated in the synthesis.

Unlike in many of the extended TAM frameworks, external variables are not taken into account in this research. They could include social and subjective influence processes as in TAM2. The affect of external variables is minimized through respondent selection. Respondents are chosen within a small group with similar age and background. The aim of this research is supported by this choice. In reality, it is important to note, background and individual processes affect the answers, no matter how restricted the sample.

TAM in usually used in a quantitative setting, therefore it will be intriguing to see how it supports the purpose of this research. To fulfill the purpose of exploring and analyzing customer perspective and perceptions, the following framework visualization depicts the aspects it is built on. The synthesis visualization is a continuum from perceived usefulness to further pondering on between risks and advantages. The perceptions are, based on previous literature, likely to be presented in a similar continuum and also presented in the questionnaire in a corresponding order.

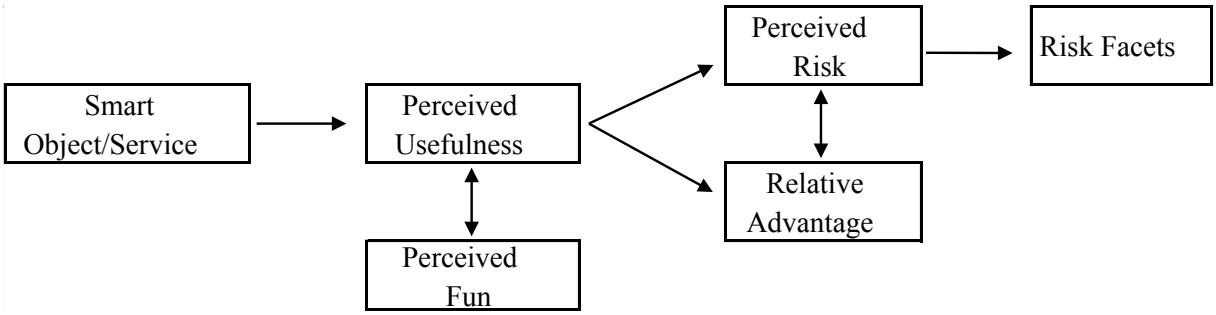


Figure 4. Theoretical synthesis.

In the theoretical synthesis smart object/service perceptions are evaluated through perceived usefulness. In the empirical part, respondents are asked to describe their way of perceived usage of the object/service at hand. Perceived usefulness and perceived fun are adopted from TAM and c-TAM. It is the degree to which respondents see the object/service bringing advantage to their current way of using similar products. Furthermore, perceived usefulness may include

perceived fun aspects, which is the degree to which respondents see the new solution being easier to use relative to current likely cumbersome solutions.

From perceived usefulness, respondents are asked to describe perceived benefits and drawbacks. Therefore, relative advantage and perceived risk are adopted from Ruyter, Wetzels & Kleijnen (2001). Relative advantage is the degree to which respondents see the object/service being superior compared to current solutions. It is highly likely respondents will elaborate on the perceived usefulness and fun in more depth. Perceived risk and risk facets are adopted from Featherman & Pavlou (2003). The facets are: performance, financial, time, psychological, social, privacy and overall risk. It is likely the perceived risks will be closely connected to the perceived usefulness and relative advantage. This is because of the nature of IoT smart object/services. The ability to gather data and knowledge through virtually any object and benefit from it is clearly a relative advantage. Simultaneously, once getting more data you lose some privacy or at least get concerned whether your data is kept away from wrong instances.

Overall, the more interesting findings in regard of this research will likely be of respondents struggling between benefits and drawbacks. This battle intuitively is between having more knowledge through data, but also losing privacy. The battle in this research excludes brand values and perceived trust towards the supplier, which makes it even more interesting and comes down to personal perception of privacy. Results in relation to the theoretical synthesis are presented in chapter 5.

3 RESEARCH METHODOLOGY

3.1 Scientific philosophy

Paradigm is in research what could be described as a set of choices, representing the researchers own decisions and values mixed with norms and theories given from external sources. Generally different fields of research have their typical paradigms constructed throughout their existence. Some fields do apply more variety in their research techniques, and some stand on a narrower set of choices. (Gummesson, 2003)

In this research, inductive reasoning is applied. It comes naturally when a new phenomenon is being studied. In Inductive reasoning the researcher works from phenomenon up, rather than theory down. In short, this research tries to shed light on Internet of things and services from the customer point of view. Using inductive reasoning ideally would lead up to theoretical contributions, but the noble purpose of this research is to get early comments from future users.

IoT is a new phenomenon, which thus far does not reach the general public in a concrete form. It is yet to reach its potential in the market place in such products or services that would burst the bubble. There is not a lot of information to construct from, but the phenomenon exists and creates what can be called tension. All is in the phenomenon and the researchers' interpretation of it, strengthened by empirical findings, hopefully leading up to some worthy remarks.

The setting of this research is very much in line with interpretivism. There are two reasons for making such a choice. First, interpretivism emphasizes reading and interpreting the surrounding existence from a subjective standpoint and accepting the fact there can not be perfect objectivism. Second, it seems very intuitive and natural in this research setting to let the thesis grow into its skin throughout the process. Subjective choices and interpretations of seen and felt things inevitably find their way between the lines. As mentioned before, the phenomenon at hand is still new and finding its existence as well. In – what is considered the opposite to interpretivism – positivism; accurate, objective observations guide the process and end result. (Gummesson, 2003)

3.2 Method

When conducting an interpretive, inductive research, the choice of method is quite hard for the massive availability of methods to choose from. As a young researcher, one can easily get stuck between finding the "correct" method rather than trusting your own judgment. In this research it was clear early on, to trust own judgment. All started very intuitively, looking at the phenomenon and reading about its antics in the near future, in other words, collecting pre-understanding. However, during the creation of this pre-understanding a lot of it stuck and will find its way to the pages of this research somehow damaging the objectivity. Without giving in to the fact that no matter how much effort put on objectivity and computer-like processing, the end result would not be waterproof.

This research is qualitative. This choice is supported by two points. *First,* the research purpose of exploring and analyzing customer perceptions is hard to measure because of the futuristic nature of chosen smart object/services. Therefore the purpose also holds projective aspect to it.. Generally, to be able to touch something one might only intuitively or subconsciously reach, purely quantitative method would not be an option. *Second,* as is made very clear, the interpretive nature of this research allows room for the researcher and the reader as well, to form their own findings. This does not by any means denote there would be lack of validity or purpose in this research. The humble remark however is, that complexity, context and persona (Gummesson, 2006) have their say in the matter.

The aim of this research is to study consumers' perceptions on smart objects, made possible by IoT. Clearly, there is a phenomenon called IoT and as has been introduced in the previous chapters, its breakthrough is yet to come. In order to touch this phenomenon, which is most likely hard for participants to grasp as well, a phenomenological approach was taken.

Based on the pre-understanding and the fact that IoT is futuristic in nature, gathering data was conducted through a qualitative questionnaire with open ended questions. This is further explained in the next chapter. The phenomenological approach relies on the respondents' ability to explain and project their expectations and worries. To support data validity, respondents were chosen from high educated (university) and highly motivated volunteers, who likely are able to grasp IoT and the topics around it as a phenomenon. (Thompson, Locander & Pollio, 1989)

3.3 Collecting the data

To collect data, a questionnaire was formed during the spring of 2016. During the period, a choice was made also, to focus on a limited group of respondents within a similar background. Three characteristics were chosen to limit the amount of respondents: background in university level studies, age between 20 to 30 years and experience from working life. All the respondents were chosen through contacting them personally.

In the questionnaire respondents were asked to imagine themselves as users of smart objects/services (note that the difference between an object and a service is vague due to the nature of IoT). The chosen object/services were smart clothing, smart home and automated traffic. Each part had three open ended questions, first asking to describe how would one use the chosen object/service, second asking to describe the benefits of the chosen object/service and third asking to describe the drawbacks of the chosen object/service.

The data was collected during May and June of 2016. Questionnaires were sent out flexibly during the period, to follow whether the themes of the answers would start recurring quickly. It became evident that no more than 9 questionnaires within the chosen group of respondents was needed as the themes were almost unanimous among respondents. Within subgroups; for example, medical students, answers were more related to their experience and expectations towards future. Also, economics students had more notions towards economical themes such as employment and growth. However, the bigger picture was close to unanimous. Within different contexts, same expectations, benefits and drawbacks were identified. Therefore, data collection was stopped early on after 9 responses. The questionnaire can be found from Appendix 1.

3.4 Data analysis

The noble purpose of this research is to get first insight on perceptions towards smart object/services, within the young adults group. It is important to note, the object/services are futuristic in nature and respondents will not have the ability to test or relate the chosen object/services to any brands. This must be kept in mind while analyzing the data. It is likely to lean the answers towards comparisons to current forms of using similar objects or services.

However, this supports the purpose of getting first insight on perceptions and can also be seen as a strength.

The research setting is qualitative, data is gathered via a questionnaire and data analyzed using interpretive methods. In this research, interpretive analysis is conducted by using practical methods. It means that the qualitative data is first looked into using almost quantitative methods. Data is first read on a general level and after that frequencies of respondents answers within using, benefits and drawbacks are put on a matrix. After gathering frequencies on the matrix, the most frequent answers are looked into again. The idea of looking deeper into answers is finding similar meaning within different wordings. This means that some of the respondents might describe similar ways of using a object/service with synonyms or other terms. After defining the answers within the quantitative matrix, the most frequent answers are themed. A theme consists of meanings, which is a bigger context are evaluated as user perceptions and further analyzed to the theoretical synthesis. This type of generalization is typical to qualitative research and extends the results and conclusions into bigger social themes (Maxwell & Chimel, 2014).

4 RELATIVE ADVANTAGE & RISK PERCEPTIONS

4.1 Customer perceptions on smart clothing

The first part of the questionnaire was of smart clothing. Respondents were asked to tell how they would use smart clothing and what benefits and drawbacks they see in them. Each question is opened up in the latter chapters.

In short, smart clothing is clothing embedded with the three components that characterize smart objects; sensors, processing power and connectivity. For example, smart clothing can measure bodily functions, process and connect the information with external objects. Altogether, respondents seemed to have a good understanding of the functionality and possibilities in smart clothing. In this part especially the comparison to mobile phones and accessories was apparent. Also, respondents seemed to not have a hard time imagining themselves using such technology and projected a lot from their free time.

Below, all answers are themed within the most frequent answers by respondent. The themes are explained in more detail in the next chapters. Also, among top answers were price and appearance. However, they were not depicted in more detail, but merely mentioned as hindering points.

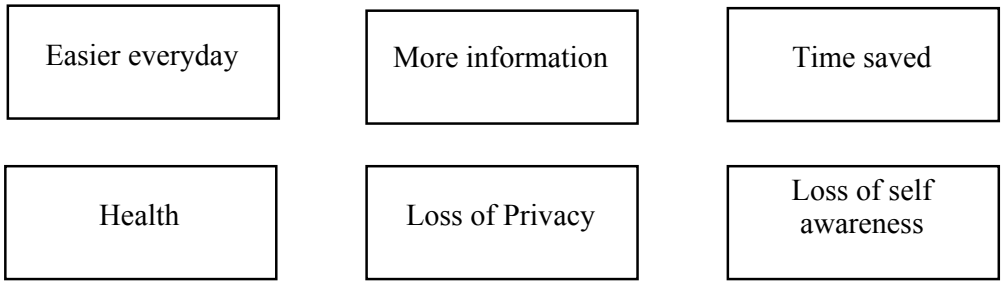


Figure 5. Themed results from questionnaire – smart clothing.

4.1.1 Benefits for the everyday life

In regard of how the respondents would use smart clothing in general, many see sports as the major future possibility. It is evident that all of the respondents have personal affection to sports, thus resulting in high frequency in the first part. Naturally, when asked to imagine, respondents turn to things familiar to them. Many already use applications such as heart rate monitors and GPS to track their performance and routines.

> *"In my opinion, putting on and wearing a heart rate monitor is such a nuisance, so a piece of smart clothing would work better for me, just as long I would not have to carry extra things along with it"*
> *-Female, 26*

In many of the answers, respondents stated that they see a lot of potential in making the everyday easier. A piece of smart clothing, which could monitor your vitality, give you guidance for eating and resting regularly, react to weather changes and help you stay healthy would help this cause tremendously.

> *"Following up on your vitamin an other nutrient levels would be interesting. I believe one can make ones' life more effective and healthier. I believe this has a future in regard of public health, which can be seen; for example, in insurance industry, where following up on clients' health is a growing trend."*
> *- Female, 25*

In general, respondents saw themselves using smart clothing to better their everyday and to support health. Furthermore, the tone within the answers regarding using smart clothing was very positive and it seemed to be easy to imagine a lot of little things they would need.

4.1.2 More information and knowledge

Very much like in the more general question of how respondents would use smart clothes, they continued similar themes in listing and describing the benefits of using. In the matrix, we can

see similar themes, but in more detail. For example, when health and sports perspectives were popular in the first question, respondents described them in more detail, thus resulting in strengthening the themes.

> *"Getting and understanding information would get easier. If one gets information of nutrients and sports habits easier, it would get easier also to know how their habits affect their health."*
> *- Male, 26*

The theme of health and getting more information stood out to be the most important aspect. In more detail, health was considered to consist of food, sports and monitoring daily activities such as work/rest/sleep/activity during a day. Furthermore, respondents saw great possibilities in pursuing better public health, through increasing information and awareness of habits. This better public health was seen as starting from individuals, rather than institutions, and information as a provider of 'security'.

> *"I believe, especially in health care and treatment, a piece of smart clothing would be great. How cool would it be, if the clothes could medicate or at least help in self treatment -- malpractice and neglecting treatment would decrease -- this could accelerate and optimize the health care industry."*
> *- Female, 25*

As discussed earlier in this research, the future of IoT seems bright and things connected to the Internet will massively increase within the next years. This will inevitably result in changes within labor market, when some tasks will be automated or robotized and new needs arise along new possibilities. Respondents felt there will be economic growth through new innovation and available information resulting from smart clothing as well.

4.1.3 Risk of losing privacy and self awareness

It became evident early on, that many of the themes given by the respondents would have both positive and negative sides to them. In the context of IoT and the massive information there

will be (and already is, if we think about cookies and GPS for example), the benefits in health care among other things come at a price, when peoples' privacy lessens. This was also the case in regard to smart clothing. Better security means also less security, when on the other hand you are able to monitor your actions, but on the other hand someone else might have access to this information through hacking or simply providing the service.

> *"Loss of privacy. Information gathered by smart clothing will surely be easily shared and stolen. Most people probably do not want, that their information ends up to an outsider."*
> *- Male, 26*

Another drawback clearly linked to the positive side as well was the loss of self awareness. Respondents felt that it is good to have more information available of your daily activities and ability to monitor your health, but also see there is a big issue in losing self awareness. In more detail, the loss of self awareness is linked to the possibility of a malfunction in a piece of smart clothing. Should something go wrong in the system, will the user know how to react or simply trust the smart clothing and its data. This might not be an issue within the group chosen for this research, but future generations, born and raised to live in close cooperation with machines.

> *"A drawback might be loss of own thinking. It might result to not being able to interpret ones own bodily signals. For example, it is known that a dieter does not recognize whether they are full or hungry, because they only follow a clock and a scale."*
> *- Female, 25*

Intuitively, price and availability were among respondents' worries. Many believe it will take a long period of time before a piece of smart cloth is part of the everyday for the many. There is no arguing with these responses. However, technical advances are happening and will happen in the future too. This research acknowledges the fact that the chosen smart object/services are futuristic today, but are well into development and within a reasonable timeframe will emerge into everyday customer products.

4.2 Customer perceptions on smart homes

The second part of the questionnaire was of a smart home. Respondents were asked to tell how they would use a smart home and what benefits and drawbacks they see in it. Each question is opened up in the latter chapters.

In short, a smart home utilizes IoT applications such as smart objects embedded in structures to monitor the houses' functions. A smart home can optimize energy consumption, monitor possible errors in its functions and ease the everyday by automatizing tasks such as temperature control, food consumption and even coffee making.

Below are the respondents' answers themed by the frequency of answers. Price was again mentioned as a hindering point, but not described in more detail.

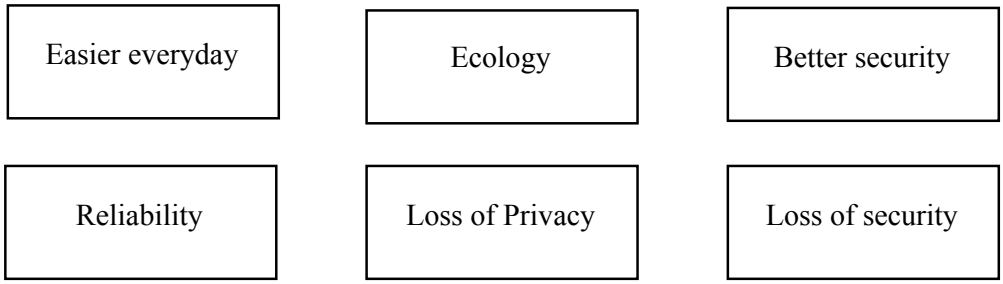


Figure 6. Themed results from questionnaire – smart home.

4.2.1 Ecological advances and convenience

In general, respondents' felt monitoring of energy consumption is a major benefit and that more knowledge of a houses' functionality will benefit the issue tremendously. Also, a houses' security would increase, when outside threats and for example fire hazard would be better monitored.

Interestingly, the ability to remodel spaces came up in a couple of answers. This topic is very interesting in the context of small space living in cities and it seems this development will

continue in the future as well. Altogether, respondents seemed to easily think of ways to use such a smart object.

In the benefits part, respondents clearly related to three major themes they already presented in the general "how would you utilize" –question. Ecology, security and easier everyday were clearly very easy to relate to and gave most respondents ideas to present. Ecology was mentioned and described in each response.

> *"The house would automatically identify in which room I am in and which lighting and temperature would be best for me. To save energy this way is excellent."*
> *-Female, 25*

> *"A smart home could switch lights on and off automatically depending on the usage of a room. It would control temperature/heating and electricity usage of domestic appliances, especially the passive usage."*
> *-Female, 22*

Ecology was closely connected to easier everyday. Respondents clearly feel monitoring and worrying about energy usage is a hindering task and some felt they do not know enough about technology and maintenance in order to make a difference themselves. If a smart home would optimize their energy usage for them, everyday would also be easier.

A smart home would also be connected to a city operating system. Information flow would benefit both individual homes and the whole system. For example, traffic information, daily events and energy availability would be included in the information flow within a smart city.

4.2.3 Reliability and security issues

Respondents felt that technical errors were the most worrying thing in a smart home. Interestingly, if we look at the results in smart clothing, technical errors were not such a big problem. It seems that home is where you need to feel a hundred percent safe and rely on its

functionality. Furthermore, the smart clothing would have a direct connection to your bodily functions, and therefore your health. Could it be that respondents see their family and next of kin even more important than their own security in this context.

> *"Like in every 'smart' system-object, reliability and energy dependence for example in a blackout is essential"*
> *-Female, 25*

> *"Can a smart home interpret information related to safety wrong somehow and cause dangerous situations?"*
> *-Male, 26*

> *"Technical errors could jam the whole home and deny access inside, even if you had a biometric key with you. Also, extreme climate in Finland could cause serious challenges for some functionalities"*
> *-Female, 22*

The technical errors were easy to anticipate, but in actuality no one could describe the malfunctions in more detail. This feels intuitively right, when we look around and think of; for example, the history of microwave ovens. Peoples anticipations towards new technology is in principle 'negative' in a sense they fear the unknown.

Price, security and privacy were also mentioned one way or another in many of the respondents' answers. New technologies tend to be expensive and as housing is very expensive in general, participant raised the issue quite strongly. Security and privacy were mentioned in many of the answers. They are closely related to one another and also to technical errors. In some of the answers a continuum was apparent. Technical errors can result in less security and poor security can result in loss of privacy.

> *"Another problem is privacy and information security. We have already given up a lot of our privacy in the age of the Internet, so it is not new. However, when sensors and smart devices penetrate our homes, it raises questions. How can we be confirmed that private*

persons or a nations behavioral data is safe? It is practically impossible a device would only gather data for its owner. -- Who owns the information?"
-Female, 25

"Data privacy risk, one could hack the home and at worst someone could remotely access its technology. Passwords etc. would be easy to fish. Also, your privacy would suffer when your partner, parents would be able to monitor what is going on in the house."
-Male, 26

4.3 Customer perceptions on automated traffic

The third part of the questionnaire was of automated traffic. Participants were asked to tell how they would use automated traffic and what benefits and drawbacks they see in it. Each question is opened up in latter chapters.

In short, automated traffic is organized through technology within the vehicles in traffic. The vehicles would have the previously described IoT abilities to sense their surroundings, communicate valuable information and of course the chassis for various transport needs. In automated traffic each vehicle is autonomous and does not need a human touch beneath starting the system and letting it know the destination. Today, cars have automated features such as parking assistants, automated braking in unforeseen situations and driving lane assistant. However, for example; car manufacturer Tesla has brought an autopilot system that can be partly used in traffic already.

The Society of Automotive Engineers (SAE) further explains the levels of autonomy, being rated from one to six. Level one equals to the vehicle being able to assist in for example; steering and speed, where the human driver still does all the dynamic driving. Level six has full autonomy and all the dynamic driving is done by the system. (SAE, 2015)

Below are the respondents' answers themed by the frequency of answers.

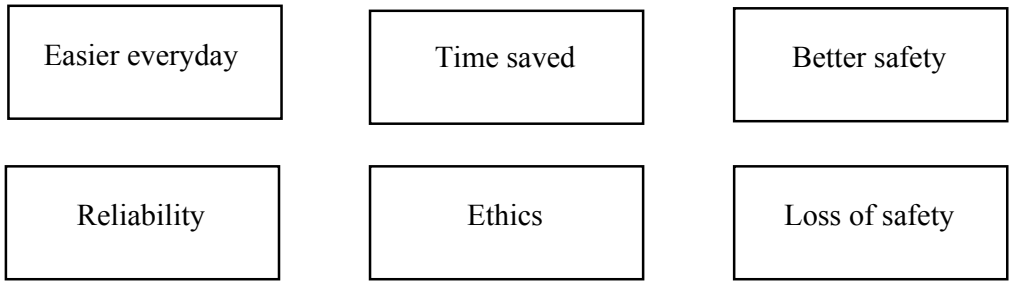


Figure 7. Themed results from questionnaire – automated traffic.

4.3.1 Time saved and increased safety

Respondents general answers on how they would use automated traffic, gathered around time consumption one way or another. For some, commuting and transport are time consuming, therefore the spare time would be appreciated. This is a combination of freeing yourself from driving, but also from optimizing routes and traffic flow. Also, public transport was seen needless and traffic as a common utility where owning a vehicle would be useless. The ownership was presented by one of the respondents:

> *"Yet again, automated traffic is not something you consume, but 'live'. -- In the future I think you do not have to own a vehicle, but traffic will be 'taxi-like'. -- A good scenario would be a 'Überland' of robot vehicles, where private motoring would be nearly vanished and common vehicles would transport people in the best and most efficient way possible."*
> *-Female, 25*

The same theme as was with smart clothing and smart home, respondents again felt the struggle between whether the good would outdo the bad. With clothing, the battle was between getting more information mixed with fear of losing privacy. Furthermore, a smart home was seen possibly bringing more security but the trust towards its reliability was put to question. In the case of automated traffic, the struggle was between safety benefits through having less accidents and lack of safety through distrust towards reliability.

Respondents were almost unanimous that having a system organize traffic would benefit safety aspects. Human errors cause traffic accidents and generally harm the traffic flow. According to Finnish Liikenneturva (https://www.liikenneturva.fi/fi/tutkittua/tilastot/ajankohtaiset-tilastot) over 200 people got killed in the Finnish traffic during 2016, out of which on average (3 years) 52 under influence. The statistics are a crude read and this was acknowledged by respondents as well. Safety was therefore a highly appreciated benefit.

> *"Safety in some situations would be better, for example; tiredness and loss of concentration risks would decline"*
> *-Female, 22*

> *"Automated traffics observation, anticipation and reacting would definitely be better that with humans"*
> *-Male, 26*

> *"It would be excellent, less accidents. Today I think 90% of accidents are caused by human errors, so in this regard the safety benefit in traffic accidents would be huge"*
> *-Female, 25*

Even tough the respondents were almost unanimous regarding safety aspects, there is a distrust towards technology within the answers. This can be seen through the wording of answers, where respondents find it hard to trust that accidents actually would decline, given that majority of accidents are caused by a human error. This distrust was made clear in the drawbacks part.

Another aspect where respondents were almost unanimous was the benefit of saving time. Whether the time saved comes through being freed from the dynamic driving activities, ability to travel faster or better traffic flow, it seems traffic should be more efficient. Furthermore, respondents felt there will be monetary savings as well. You would not have to own a car and traffic could be a common utility. Cars would have higher operating percentage and more people on board rather than multiple cars with empty seats. This would then result in smaller ecological impact as well.

"Traffic would be more efficient, which would save not only time but energy and the nature. Automated traffic combined with new forms of energy production and cars running on something else than gas – we are all good!"
-Female, 25

"Faster transport. Speed limits could be non existing/higher, if the car scanned a bigger area to avoid threats"
-Female, 22

"Less driver responsibility and time available for other tasks during driving. Commute could be used to read emails"
-Female, 26

4.3.3 Reliability and safety issues

Automated traffic brought worry among respondents. Whereas safety was seen as a major improvement in relations to today's traffic, it also was seen as the biggest drawback. Almost every one of the respondents who felt safety as a benefit also said it to be a drawback as well. It has come apparent that there is a distrust or lack of knowledge towards new 'futuristic' technology. This is further discussed in the conclusions chapter.

The safety drawbacks ranged from distrust towards reliability to more complex ethical and comprehensive problems. Reliability seems to be of concern with all three parts of the questionnaire. There is a distrust towards the ability to design truly *smart* objects or services. Also, three respondents were worried about unemployment, which today is a highly political topic in regard of IoT, robotization and technical advances looking to put human out of work.

"The weakness of automated traffic is its reliability, how to maintain the system and electrical processes operational in all circumstances."
-Female, 25

"Major accidents because of malfunctions."
-Male, 26

"Safety cannot be guaranteed in every situation. It depends on how big of a scan the vehicle can make of its surroundings, threats from different directions and other accountable things. - - Children's surprising movements or another vehicles error can be too hard to program to a car."
-Female, 22

In the answers, the distrust or disbelief is quite penetrating and straightforward. Honestly, this is surprising. The respondents in this research represent the so called Millenials or Generation Y, who are widely regarded to be digitally native and somewhat prone to technology.

The more interesting and pondering answers were dealing with liability issues and problems in programming human characters into vehicles. These issues will most likely be the hindering traits when a more comprehensive introduction becomes reality. In relation to the prototype of a Millenial and the respondent's profiles, these topics were something that were anticipated to be more in the center of answers.

"If the vehicle pursues full flawlessness and maximizing the safety of passengers on board, the vehicle most likely cannot make a judgment where damages are minimized. Such situation would be for example; if a kid runs in front of a vehicle and the only way for the vehicle to avoid a crash is to drive into a ditch, would it do it? Most likely no."
-Female, 22

"Moral choices, does the vehicle drive over a child or cause a crash to another car. Who does the vehicle protect more, the driver or the other party?"
-Male, 26

The question of ethical choices is very intriguing and is something that already is being discussed. The topic is highly political in a way that who could be the deciding party whether the vehicle crashes into a ditch or a cyclist? In reality, this will most likely be the biggest single topic postponing automated traffic introduction for the masses for years. Furthermore, respondents were worried about liability questions.

> *"Does an insurance company compensate? Insurance companies' business is based on that there are a lot of insured customers. The one selling this technology would probably have to become the insurance company."*
> *-Female, 25*

4.4 Review of the research questions and theoretical synthesis

The aim of this research was to study customer perceptions towards smart object/services made possible by IoT. In this research, the following research questions were set based on previous research, the fuss around IoT and the researcher's personal interest:

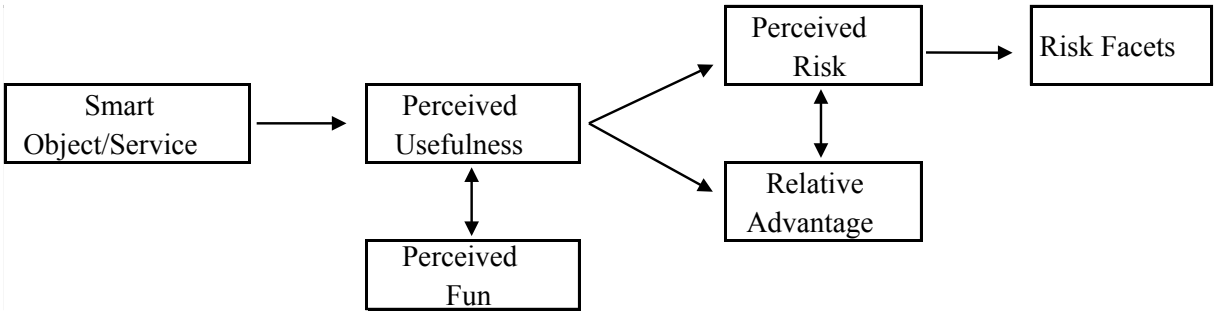
How do young adults perceive themselves using a smart object/service?

What benefits young adults perceive in using a smart object/service?

What drawbacks young adults perceive in using a smart object/service?

The research questions are answered in the following chapters, where first in 4.6 general using perceptions are presented in relation to the theoretical synthesis' "perceived usefulness". Then in chapter 4.7 benefits are presented in relation to the theoretical synthesis' "relative advantage" and in 4.8 drawbacks are presented in relation to the theoretical synthesis' "perceived risks".

In order to scope and understand the received answers, the following theoretical synthesis was created based on previous research:



The theoretical synthesis gives a research sort of spectacles to look into the data, focused on the set research purpose and questions. In this research the synthesis was created based on previous research done on customer acceptance and adoption of new technology.

Based on the empirical data gathered through a questionnaire, the following three major themes stood out as the major advantage in perceived usefulness, the relative advantage compared to a current similar solution and the biggest perceived risks:

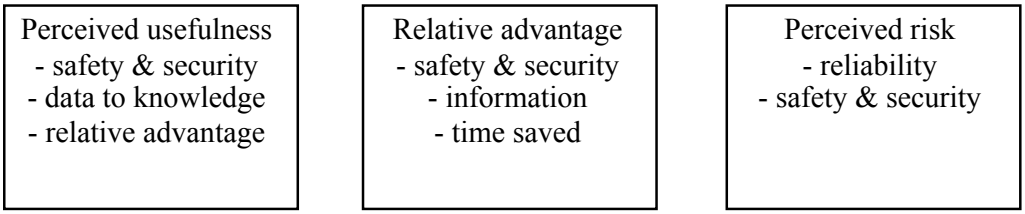


Figure 8. Themes in relation to theoretical synthesis.

The in depth results of each chosen smart object/service are presented in the previous chapter and the aim now is to draw conclusions and revisit the theoretical synthesis in the light of results. As presented before, the theoretical synthesis was created from previous literature, using TAM and its extensions. Next, the three major themes from empirical data are concluded and an updated version of the theoretical synthesis presented.

4.5 Perceived usefulness

Based on the empirical data gathered in this research, young adults find it rather easy to see themselves using the chosen smart object/services. This question was intentionally helped by selecting a set of products or services which among respondents are consumed daily or are otherwise very well known in their current form. Therefore, relative notes of future usage were received.

The respondents' answers depicted both perceived usefulness and relative advantage corresponding well to the theoretical synthesis. Perceived usefulness was especially seen through getting more knowledge through data and relative advantage through comparing current solutions to future solutions. However, answers regarding perceived using and perceived usefulness gave strong indications towards perceived usefulness being affected by relative advantage. Usefulness was often seen as being created from the advantages gained relative to current ones.

Respondents strongly indicated that their everyday would get easier and they saw themselves using the chosen smart object/services as part of their lives. Easier everyday was gathered around information and time consumption. In each part, information was given a meaning where it would benefit the respondents individually but also as parts of larger groups. There is an interesting aspect to this, the network externalities concept, where value or benefit gained from a product or service is related to the user mass (Katz & Srapiro, 1985). Now more than ever, in the case of IoT this is relative. One of IoT's basic ideas is to benefit the system through multiple data sources. Therefore, mass adoption would not only benefit single users, but the whole community and the producer as well. Time consumption was often related to getting rid of small tasks we nowadays need to perform daily. For example, a smart home would be used to automate tasks such as coffee making and heat adjusting.

Using and benefits were always close to each other. Therefore, a strong correlation between relative advantage and usefulness can be drawn. Often, respondents continued their answers from general using to benefits. Also, the general using was often presented as benefits to their lives. This could be seen as a soft correlation and indicate that future adoption would overcome

the resistance or doubt presented in the third part of the questionnaire. However, drawing stronger conclusions will need further research and this can only be used as a discussion starter.

4.6 Relative advantage

There were three topics that pierced all three smart object/services: safety & security, better knowledge through data and relative advantage. Respondents saw the benefits quite clearly and saw themselves using the chosen smart object/services in everyday situations. There was a lot of anticipation in perceptions towards making life easier and more convenient.

First, safety and security. Safety can be described as a sense or knowledge within, whereas security is something more external, provided for example through a service. In the respondents answers both aspects were clearly visible. The emphasis given to safety and security is interesting. Respondents clearly are interested in discovering their health (smart clothing), feeling more safe at home (smart home) and enjoying traffic without fear of accidents (automated traffic). The answers represent young adults' expectations and should be evaluated as such. In the future, when IoT applications are consumer products the respondents will most likely be the first adopters. This implicates these aspects can be used by producers to better support adoption. Even more so, when the biggest drawback was given to be loss of privacy, safety and security. Expectations are high, but convincing needs to be done. Basically, this was the main topic amongst answers, but it created most controversy as well.

Safety & Security was presented in the theoretical synthesis as a continuum from perceiving a smart object/service useful and later on as a correlation between relative advantage and perceived risk. This seems to stand correct based on the empirical data. However, the strong polarization between whether it is a benefit or a drawback was unexpected. In some answers perceived risk was so strong it surpassed the perceived usefulness in a way that a respondent would not adopt the object/service. The risk facets supported in the empirical data are presented in the next chapter.

Second, data and therefore better knowledge in different forms. As said in the first paragraph, there is a definitive correlation between the three top topics given by respondents. In the case of IoT, data is sort of the key to unlocking new possibilities. Of course, the hardware has to be

reliable and be able to be smart of its surroundings, but the value comes through gained data. Respondents answers depict better knowledge of for example bodily functions, when smart clothing can help them realize behavioral affects to their bodies. Data also makes it possible to better monitor and develop your home's security and energy consumption.

Regarding future, it seems that young adults are expecting their lives getting easier and technology giving them valuable information whilst doing it. Producers need to acknowledge these expectations and therefore focus on the end-user experience, where data is used and presented in an easy and comprehendible manner. Otherwise, rejection towards the better knowledge benefit might outweigh the good.

Third, benefit in relation to the current form of using similar products or services. The relative advantage was a clear starting point in the respondents' answers. Continuing from better safety, security and knowledge, young adults feel their everyday will get easier through smart object/services. This advantage feels very intuitive, whenever something new is coming up people expect benefits compared to their current form of using similar products. In relation to IoT the expectations are high, which makes it important to further study consumer expectations through more comprehensive studies.

4.7 Perceived risks

There were two topics that pierced all three smart object/services and are worthy of putting forward as findings. For research purposes, the drawbacks offered the most interesting answers, even more so, when they in almost every part of the questionnaire were polar opposites of the benefits. There seems to be a lot of disbelief and distrust towards such big changes in technology.

In the theoretical synthesis perceived risk consists of risk facets incorporated from Featherman and Pavlou (2003). They are as follows; performance, financial, time, psychological, social, privacy and overall risk. In the answers especially performance (reliability), privacy (data and information) and overall risk (combined reliability and safety & security outcomes) were mentioned. Other risk facets were merely mentioned or implied, for example; financial (price) and psychological (fear).

The risk facets were identified through each part of the questionnaire. In the smart clothing part, respondents felt their privacy is at stake and showed reluctance towards adopting before being convinced of data privacy and protection. Smart homes rejection was put out regarding reliability, security, privacy and price. Yet again, it seems respondents as consumers would need a lot of convincing before adopting. Furthermore, the current media attention towards hacking and data privacy problems might affect respondents' answers. News of data theft cases are quite common and more than often political players are involved. It is therefore understandable respondents are worried of their privacy. Autonomous traffic part had little indication of data privacy issues, but safety was of concern. Respondents were close to unanimous there would be issues in form of accidents. On top of fear of accidents, ethical issues were raised among respondents.

First theme that was present in each of the questionnaire's parts was reliability. Whether it was security of a smart home or safety of autonomous traffic, young adults were straightforward negative towards their reliability. This finding is important to note. It is almost paradoxical to notice that the young adults in this research were so straightforward with their distrust. Interesting, when considering they have grown up with technology and for example a smart phone occupies their lives on a daily basis. By contrast, this reflects some of the themes from mobile phones' first appearance, where radiation among other issues was talked about a lot. Furthermore, do they feel and experience the same distrust towards the reliability of their current high-tech appliances such as a mobile phone? A mobile phone has all the smart object features from sensing surroundings and communicating with other devices to providing information.

To further put this distrust towards reliability and its affect towards adoption in to a different context, there were a lot of studies conducted of home computing adoption a couple of decades ago (See for example; Dickerson & Gentry 1983, Lin 1998). In these studies, it was found that the first adopters are well educated adults with good income and previous experience of adopting innovative technology. Furthermore, they are already familiar with technology and usually have an interest towards technology. The respondents in this research do fit the profile, but there is convincing to do regarding the aforementioned issues.

The second theme from respondents' answers was safety and security. As mentioned, the benefits and drawbacks were often polar opposites, where young adults felt their safety would get better with smart clothing, but at the same time cause safety issues due to poor privacy. The same opposites were present in the smart home and autonomous traffic parts as well. Compared to the first presented drawback of reliability, safety and security issues were more awaited when putting together and distributing the questionnaire. There is a reasons for this, since there is a lot of public discussion of data privacy. The issues are at a level, where governments are seemingly involved and it is hard for a single citizen to comprehend the magnitude of the issue. Furthermore, the most famous whistleblowers of the 21st century have come from positions where government level phishing is put out in the open; Edward Snowden and Julian Assange in particular. It is therefore intuitively justified to have suspicion towards one's data privacy.

Consumers negative reactions towards innovations and new technology have been studied for decades. The phenomenon is often referred to as consumer resistance, innovation resistance, technophobia, technostress or in more specific cases computer anxiety. There are multiple traits in personalities, difference between sexes, age and environmental factors. (See for example; Kleijnen, Lee & Wetzels 2009, Laukkanen 2016, Korukonda 2005) In relation to this research, innovation resistance seems to apply even with more native technology users. This is also intuitive because of the fact that the chosen object/services are at the level of innovating, not in consumer use as of yet. In a research setting trust has been studied for example in Yan, Zhang and Vasilakos (2014) where the brand image of recognized companies was found to support trust.

To further look into this fear or distrust towards new technological advances, for example; Szmigin & Foxall (1998) present three forms of innovation resistance: rejection, postponement and opposition. First, rejection usually relates to the consumers' belief that no real advantage can be gained through the innovation. Companies can then alter the product or its message to gain further adoption. Second, consumers can postpone their adoption to a later time. They might already accept the advantages, but for example; environmental factors may delay their action. Monetary reasons will most likely postpone comprehensive smart home adoption for a period of time. Third, opposition is a form of rejection. Consumer may try and adopt a certain innovative product, but return to rejecting it for various reasons.

In this research, it became apparent that there is reluctance or rejection amongst young adults, born in the era of Internet. This was not expected in such a broad manner, in each part. Hsu & Lin (2016) in their research came into a conclusion that IoT related service users are concerned of privacy issues, but the benefits, however outweigh the negative thoughts. In their research, the focus was less futuristic, where IoT services or products were not specified, but respondents were asked directly whether they like using IoT or not.

4.8 Revision of theoretical synthesis

Based on the findings in this research, the theoretical synthesis can be presented in a more focused setting. However, given the futuristic nature of this research and its limited amount of participants, the contribution should be taken as a conversation starter. Future research of customer perceptions needs to be conducted.

First, in this research perceived usefulness and relative advantage are interconnected. This is supported by the respondents' answers, but also intuitive because of lack of trialability and trust towards a specific supplier. Respondents could not and could not have tried the chosen object/services before or during the data gathering. Because of this, it is very intuitive also that when imagining the future, current forms of similar objects and services are the starting point for imagination.

Second, in this research perceived risks were seen equal to perceived usefulness and relative advantage. The respondents clearly indicated distrust towards the chosen object/services to the extent that it would hinder or stop adopting the object/service. The distrust was pointed to reliability and safety & security.

Third, in this research perceived fun was not supported by the data. Respondents were quite logical and based their answers to everyday situations rather than the extraordinary or special events. Again, perceived fun aspects are more likely to be supported when respondents have the ability to try and feel the object/service.

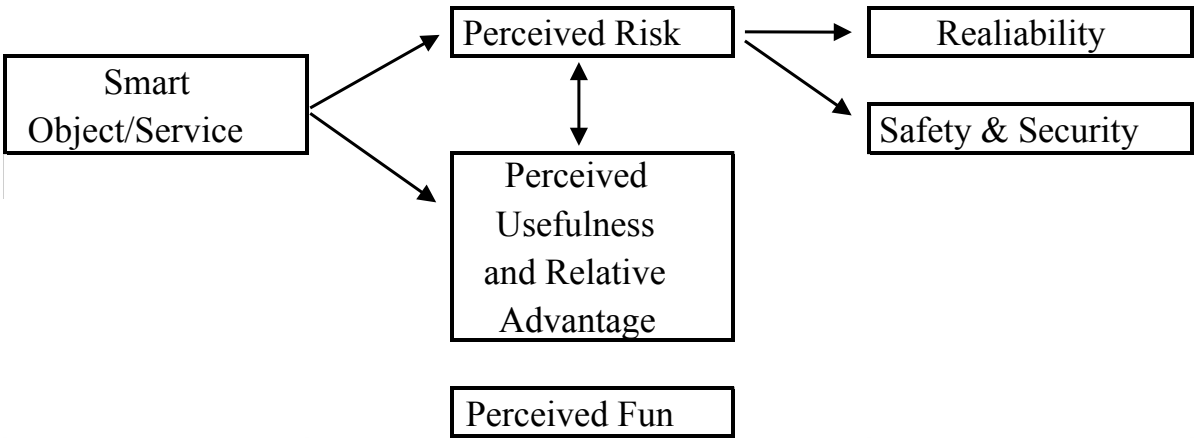


Figure 9. Revision of theoretical synthesis.

In reflection towards the initial theoretical synthesis, it became apparent in this setting that perceived usefulness and relative advantage were interconnected and did not appear as separate entities as they have been presented in the previous literature. Davis (1989) originally argues that perceived usefulness and perceived ease of use are the cornerstones of predicting acceptance. However, in the light of the results from this research, usefulness and relative advantage determine majority of the positive acceptance, but in a futuristic setting the perceived risks are the other cornerstone. Therefore, perceived usefulness and relative advantage are located in the same frame. Perceived risks were moved closer side by side as the other cornerstone and further described as consisting of reliability and safety & security.

Ruyter, Wetzels & Kleijnen's (2000) research on relative advantage and perceived risk had similar results as in this research. They argued that relative advantage explains the acceptance a lot. In relation to the results in this research, this applies. Even more so in a setting where no concrete trial or experience can be produced. Their perceived risk idea was based on trust towards a supplier, which again could not be experienced or presented in this research, when the chosen smart object/services were futuristic.

Perceived risk ended up being the other cornerstone of perceptions and acceptance. In this research Featherman & Pavlou's (2003) risk facets were incorporated into the theoretical synthesis. Out of their 7 facets, two were strongly presented in the respondents' answers. However, all of the facets were mentioned at least once and could be of more importance in a

more comprehensive study. In the light of this research, reliability and safety & security seem to determine the majority of fist perceptions.

Also, the results suggest that perceived fun was not affecting acceptance or perceptions towards smart object/services. The perceived fun was adopted from Bruner & Kumar (2005), who argue in their consumer focused TAM, that perceived fun is even more substantial in determining acceptance than perceived usefulness. In the light of the results in this research, especially in a setting where trialability and actual experience cannot be organized, logic takes over emotional perception. Therefore, perceived fun has no correlation drawn in the revised synthesis.

5 CONCLUSIONS

5.1 Summary and main results

The purpose of this research was to get first insights on young adults' perceptions towards smart/object services. To fulfill this purpose, a questionnaire was formed and methodology set on qualitative, interpretive standpoint. Data was analyzed very practically, by counting frequencies for respondents' answers and building larger themes through analyzing the meanings behind their answers.

The idea and background for this study was built both on extensive discussion in media related to IoT and the researcher's personal interest towards the matter. The idea and background was also supported by both experience gathered at work and the university. Being part of an organization in retail business, new concepts are often discussed and their affect towards the business evaluated. Furthermore, university and the connections built during studies have supported this research. Especially gathering data was easy, when eager and interested participants were easy to gather.

In the theoretical part of the research, the Internet of Things was presented through past, present and future points of view. IoT is the enabling force behind this research's theory and will in the future have dramatic affect on the way our everyday life works. This dramatic affect will come through first of all the dramatic change in the way things come to life. Things we today see as fulfilling a certain narrow and boring task, for example; a chair, will in the future be able to fulfill other purposes, way out of the traditional concept. Such new purposes can be for example analyzing your body temperature and in connection with other applications in your smart home, either turn its own heating on or adjust the home's thermostats.

The key concept in this research is smart object/service. However, smart or intelligent services are still new to academia as well. The common nominator in defining smart object/service meaning in this research was put on three characteristics: a smart object/service has the ability to sense its surrounding, a way to communicate the data and the body in which it is built. As a

remark, once more research on these new types of things appears, it seemed natural to use the term smart object/service. Even if it is not in wide use in academia, it felt natural and its prerequisites were carefully though of. As examples go, the previous chair example is one way to put it. At its core, a smart object/service truly is a mixture of an object and a service. Think of your mobile phone, is it merely a thing or an object? For some yes, but in reality, it has all the characteristics of a smart object. It has almost every human sense and can interpret and share the data it gathers through those senses.

Finalizing the theoretical part, based on former research on perceptions, a theoretical synthesis was created. The synthesis took its form based on the Technology Acceptance Model (TAM), which roots are in the late 1980s, when Fred D. Davis extended the Theory of Reasoned Action. TAM has since been used in many research settings, and extended into TAM2 and for example; c-TAM, both of which gave their input into the theoretical synthesis. TAM2 by Davis & Venkatesh added social and cognitive parameters into the model. These externalities were excluded from the synthesis based on the aim of this research. However, externalities could be of use in more in depth research in the future. In another extension of TAM, the c-TAM, Bruner & Kumar added perceived fun as a parameter and focused on the customer point of view. This was added to the synthesis to see if the chosen smart object/services spark joy in the respondents. Finally, to add a very important aspect to the synthesis, perceived risk facets were taken Featherman & Pavlou's research on service acceptance. This addition was strongly supported when reading and getting to know the context of IoT and smart object/service. Technophobia has affected all the latest innovations from microwave oven to mobile phones. Altogether, the theoretical synthesis was a collection of previous perception and acceptance research. Based on its support through the results, it seems to have worked as intended.

In chapter three, methodology was explained. As said earlier, this research based its roots on qualitative, interpretive ground. In short, a phenomenon called the Internet of Things will shape the future, changing our surroundings dramatically. From this phenomenon, first insights from the consumer point of view were gathered. The chosen group of participants was from a similar age group and background to focus the research. Data gathering was done with a questionnaire, with open ended questions. Total of nine responses were received, resulting in a 100% response rate. Data analysis was constructed around practical and almost quantitative methods. The respondents' answers were put on a matrix based on their frequencies, themed and further looked into to find deeper meanings. These choices were supported by the futuristic and

somewhat projective nature of this research. None of the chosen smart object/services are in consumer use as of now. Therefore, respondents were asked to imagine and project their thoughts on the future.

Results were first presented in depth per smart object/service. The chosen object/services were smart clothing, smart home and automated traffic. Each part had a summary of themes based on data analysis. Respondents' answers were also cited in order for the reader to challenge the presented themes and the conclusion drawn from them.

The first part was of smart clothing. In short, smart clothes have technology embedded in them to, for example; monitor bodily functions. Respondents' answers were centered around getting more information resulting in, for example; health benefits and making their everyday easier. However, they also showed strong risk perceptions towards losing their privacy and at worst losing self-awareness. From the first part of the questionnaire on, it became apparent that respondents would battle between whether the good perceptions would outdo the bad. Win some, lose some, whether its health versus privacy.

The second part was of a smart home. In short, it is a home embedded with technology to monitor, for example; energy consumption and living conditions such as temperature. Similar to the other smart object/services respondents showed controversy between the benefits to drawbacks. They saw advantages especially in ecology, where resources would be better managed in different situations and needs. They also emphasized easier everyday in the form of automated solutions. On the negative side, perceived risks were centered around technical failures and poor reliability.

The third part was of automated traffic. In short, traffic would be automated to the extent that no dynamic driving activities would be needed. Cars would have the abilities to sense and communicate with their surroundings, resulting in, for example; better traffic flow. Respondents emphasized yet again the easier everyday aspect, which would bring them advantages compared to current time consuming commute and other travelling activities. Interestingly, compared to the other object/services, traffic raised the question of ethics. When a vehicle would be in charge of making such decisions as how to avoid an accident in an extreme situation. Also, perceived risks included reliability and safety issues, very much like in the other parts of the questionnaire.

Results chapter was finalized by revisiting the theoretical synthesis and updating it based on the results. Also, results were analyzed from a bigger picture, to see what perceptions in general young adults have towards these future smart object/services. First of all, in the revised theoretical synthesis, relative advantage and perceived usefulness were interconnected. This is because of the respondents connected answers. From the data, it became apparent that young adults compared the future solutions to the current ones and saw the advantages clearly. Perceived usefulness, based on the data, was specifically constructed around relative advantage. Therefore, they were put on the same frame on the revised synthesis.

The themes based on the bigger picture analysis were better safety & security, easier everyday and the knowledge gained through having more data. Safety & security is unlikely to be a problem in the Finnish society or the respondents' lives, but interestingly this came out of the results in a comprehensive way. Both personal safety in the form of knowledge and security in housing were mentioned most frequently. Based on this research, there is a growing interest towards personal safety and utilizing technology and especially data to advance such pursuits. The most important finding based on the results was the polar opposite of better safety & security. In fact, the loss of safety & security with added distrust towards reliability was mentioned in each of the smart object/service parts. Because of reliability issues, respondents felt that their privacy would be in danger.

What makes these high risk perceptions towards safety & security more interesting is the fact that the respondents were chosen within an age group and background, which intuitively would support less fear of technology or *technophobia*. Generally, the perception is that 20th century born, now young adults, are technology oriented and grown into the world of ubiquity. Furthermore, if we look at the case of mobile phones and the current way of sharing personal information over the Internet, it is highly unlikely similar risk perceptions would rise if the research was conducted on mobile phones. Extending the comparison to mobile phones, the results in this research show that mobile phones would be seen as making the everyday easier and producing viable information whether its machine made or personally searched. Also, based on the results in this research, mobile phone users would fear their privacy and therefore safety being worse than before because of mobile phones. In this sense it seems that the perceived risks are also based on, in the light of these results, the lack of trialability and brand knowledge. In this research trialability and brand knowledge were almost impossible to have, other than from doing some reading before answering the questionnaire. It is likely that some

did gather pre-understanding before answering. However, for further implications on safety & security and its deeper meanings, more research is needed to grasp what the reason is for this. For future research purposes in the context of IoT and smart object/services this needs to be focused on.

5.2 Managerial implications

Based on the findings in this research, producers need to take into account the risk perceptions of future adopters. There was a clear indication that even within the group of young adults, distrust towards technological innovations exists. In more detail, the perceived risks consist of trust issues towards the reliability of the smart object/services, loss of privacy and ultimately worse safety & security.

For a producer, in the light of the results, trust building will be in the center of finding early adopters. In this research, the distrust was found to be related to distrust towards reliability and the fear of losing privacy. To support early adoption and market penetration with smart object/services, data privacy needs to be focused on. The results in this research show, that even within the technology oriented group of young adults, perceived risks are on such a high level, it would in some cases result in total denial. This was especially emphasized in the automated traffic part, which caused one respondent to fully deny its ability to work.

Reliability issues as such are likely to be solved in a natural way. Extensive testing of new innovations is strict and public institutions support the process. However, given the current discussion around data privacy and issues related to it, future adopters have high distrust towards their data privacy. Producers have a great deal of convincing to do, in order to strengthen positive perceptions. Data privacy issues as of now, are somewhat hard to grasp and they often do not get solved. Whereas purely technical, mechanic issues get fixed one way or another, for data privacy and information leakage it seems that fixes are harder to find. Transparency in developing these innovations will be of great importance. Also, research and development in getting rid of hacking and data privacy issues must be visible for the future consumer of smart object/services.

It is important to remember, that in each part of the questionnaire, respondents saw clearly the relative advantage and themselves using the smart object/services. There is definitely demand and based on the results of this research it is a bit unclear whether the perceived risks could outdo the relative advantage and perceived usefulness. For example, the easier everyday aspect was such a clear indication towards positive adoption behavior, that producers can support this easily. What it comes down to, is the using experience. The results in this research showed that perceptions were straightforward positive and respondents could describe themselves using a specific smart object/service.

For producers it is important to gather more information on how, in practice, the adopters would use an object/service. In more detail, what exact nuisances they see in their current forms of using products. For example, it was made clear especially in the smart clothing part, that the relative advantage in relation to the current solutions in sports come from less things to carry with you and getting rid of the nuisance. Relative advantages come from getting rid of things in current solutions, making using and experiencing easier. In short, future users expect high reliability, easy access and easy user experience. This must be noted by producers.

5.3 Limitations and future research

In research, reliability and validity need to be analyzed in order to maintain objectivity. In general, reliability refers to the extent to which the results of a research can be replicated over time. For example, in this research the results show that young adults have high perceived risks towards the reliability and safety & security of smart object/services. If the same results occur constantly in research, the reliability would get higher and higher over time. However, the reliability evaluation in qualitative research is somewhat divided into two schools. On one hand, reliability in qualitative research is given almost no importance. This is because of the amount of various sets of methodological choices, difficulty of replicating research settings and subjectivity. One the other hand, others argue that no matter how diverse the methodology, reliability can not be disregarded. Different methods such as questionnaire or interview, should yield similar results over time. (Lewis-Beck, Bryman & Liao, 2004)

In this research, reliability is viewed through dependability. It means in this research the extent to which the results can be seen to give insight on perceptions. Subjectivity in reading and

interpreting the results will determine dependability. This terminology is supported by the philosophic nature of this research and qualitative research in general. The aim of this research was to study a phenomenon and give insight. In qualitative research, one of the underlying ideas is to view the reality as constructed. In this research this means that subjectivity creates different meanings and will affect the results now and over time.

Evaluating validity in qualitative research is even more divided concept than reliability. In general, to call a research valid, is to call it well done and representing the reality accurately. What makes this interesting, is the extent to which a researcher him or herself can objectively call one's own research valid or others for that matter. Because of this divided field, this research sets it ground on realism as much as possible. Realism and its variations focus on staying true to the fact that reality is constructed and realizes the limits to accessing its core objectively. Therefore, in this research validity is seen as the extent to which the results are plausible and dependable. (Lewis-Beck, Bryman & Liao, 2004)

In light of the above and the results, the reliability and validity of this research is affected by subjectivity, but presented in honesty and before further research fulfill the humble aim of getting first insights, that was set in the beginning of the process. Theoretical contributions however can be excluded and further conclusion regarding customer perceptions in general need more thorough, in depth, research.

5.3.1 Limitations

In support of reliability and validity, it is important to ponder on limitations. Limitations mean evaluating the aspects, which affect the reliability and validity of a research. In this research there are a few things to openly reflect upon.

First, the research setting and aim was futuristic in nature. Therefore, the bar for the end result was set low in the sense that getting first insight was emphasized throughout the research. This seems to have worked as intended. First insights suggest further research is needed and previous literature was supported in a way it supports the reliability to an extent. From the researcher's point of view, no far drawn conclusion are presented and humbleness remain the red thread throughout the pages.

Second, the gathering of empirical data via a questionnaire could have been extended with a second round of interviews, where respondents would have had a chance to elaborate on their answers in more detail. The questionnaire itself was constructed ambitiously on very open and generalized questions. The expectations towards respondents answers and ability to imagine themselves using the chosen smart object/services was very high. Altogether, the answers were good and had insight, but in hindsight interviews would have supported the results even more. Also, the low amount of participants puts added pressure on drawing conclusions. Therefore, the conclusions are presented as such, trying to remain neutral and emphasizing the fact that further research is needed.

Third, previous research utilizing TAM and its extensions is mainly produced using quantitative methods. This also puts added pressure on the results. Quantitative research has a clear set of reliability and validity scales to compare results over time. This research was set on qualitative ground and therefore it is harder to compare the results in the same set of reliability and validity scales. However, similar indications to previous literature was received, even if in another form. The theoretical synthesis itself is presented subjectively based on the results gotten in this research and it is not be presented as a theoretical contribution.

5.3.2 Future research

This research was built on a humble purpose of getting more insight into perceptions towards smart object/services made possible by IoT. During the process it was evident that whereas perceptions have been studied for an extensive period, there seems to be lack of urgency in academia towards IoT. This was also discussed in the introduction chapter of this research and is somewhat worrying given the results in this research.

For future research purposes, customer perceptions towards IoT needs to be further researched in the perceived risk areas. The findings in this research give early suggestions of high distrust towards the chosen technological advances. In other words, deeper insight of perceived risks towards smart object/service within future adopters needs to be studied. Especially, two out of the seven risk facets, reliability and safety & security came out so forcefully, they need further research. As is said throughout the pages of this research, distrust was unexpectedly high and

at worst a state of denial. These risk facets should be studied in a larger group of young adults as the first future adopters. Both qualitative and quantitative methods should be used to support more extensive reliability and validity. Also, multidisciplinary research ranging from behavioral to business studies is called for.

Based on the results and with added interest because of the intuitive hypothesis, the adoption behavior and traits of 21st century diginatives needs to be studied. In this research a hypothesis was that the chosen group of respondents would represent a technology oriented generation, thus focusing on other issues rather than technical reliability and data privacy. However, the results show that the main perceived risks were exactly the aforementioned aspects. In light of this, behavioral and social research needs to be conducted. One of the interesting questions based on this research include the differences between generations and if, in fact, there still are no major differences between the perceptions towards technological advances between them.

On a more positive note, it seems based on the results, that young adults wait for the smart object/services to make their everyday easier. Getting rid of tasks considered as nuisance or otherwise hard for the participants is possible through smart object/services. As said in the managerial implications, producers need to study the way young adults use their technological solutions today and assess the relative advantage and perceived usefulness traits that make them wanted and easy to use. In the first theoretical synthesis, perceived fun was included in the frame. The lack of trialability and ability to relate to a certain brand might have caused the lack of support. Therefore, a suggestion for future research is to continue with concrete trialability research and insight on perceived fun aspects.

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APPENDICES

APPENDIX 1: Questionnaire

Kysely	Teollisen Internetin kuluttajaodotukset	2016

Vastaaja:
Sukupuoli:
Ikä:
Päivämäärä:
Ammatti ja opintosuunta:

Tämän kyselyn tarkoituksena on tutkia teollisen Internetin mahdollistamien uusien palvelumuotojen ja innovaatioiden **kuluttajaodotuksia**. Teollinen Internet mahdollistaa niin sanotut älykkäät esineet, jotka sisältävät prosessointitehoa, sensoreita tulkitsemaan esineen omaa ja ympäröivää toimintaa sekä kommunikaatiovalmiuden muiden laitteiden ja hallitsevan päätteen kesken.

Vastaa alla oleviin kysymyksiin vapaamuotoisesti omasta näkökulmastasi. Tarkoituksesi ei ole kehittää uusia palveluita tai keksiä innovatiivisia ratkaisuja, vaan **kuvitella itsesi valittujen tuotteiden tai palveluiden käyttäjänä.** Kyselyyn ei ole olemassa oikeita vastauksia, eikä sinulta odoteta aiempaa tietoa aiheeseen liittyen. Mieti, millaisia mahdollisuuksia ja tilanteita tuotteet aiheuttaisivat sinun arjessasi, työssäsi tai vapaa-ajalla.

Kyselyyn valitut tuotteet tai palvelut ovat: älyvaate, älykäs koti ja automatisoitu liikenne.

Älyvaate on teknologiaa sisältävä vaate, joka kykenee tulkitsemaan ruumiintoimintojasi sekä ympäristöäsi. Älyvaate kykenee raportoimaan keräämänsä tiedon halutussa muodossa sekä muodostamaan ehdotuksia tulevaa toimintaa tai käyttöä varten. Älyvaate on ulkoisesti, käytännöllisyydeltään ja mukavuudeltaan täysin nykyisiä vaatteitasi vastaava.

Erilaiset sovellukset voivat olla yleishyödyllisiä (terveys, turvallisuus) tai puhtaasti vapaa-ajantoimintaa tukevia, kuten urheilusuoritusta arvioiva ja ohjaava vaate.

Kuvittele omasta näkökulmastasi:

Kuinka käyttäisit älyvaatetta?

Mitä hyötyjä näet älyvaatteissa?

Mitä haittoja näet älyvaatteissa?

Älykäs koti hyödyntää rakenteisiin sekä kodin laitteisiin upotettuja sensoreita ja prosessoreita tulkitakseen asunnon toimintoja, säädelläkseen niitä automaattisesti ja raportoidakseen niistä tiedon käyttäjälle.

Älykäs koti mahdollistaa esimerkiksi automaattisen, tehokkaan energiankäytön ja asunnon turvallisuuden parantumisen.

Kuvittele omasta näkökulmastasi:

Kuinka käyttäisit älykästä kotia?

Mitä hyötyjä näet älykkäässä kodissa?

Mitä haittoja näet älykkäässä kodissa?

Automatisoitu liikenne järjestyy itsenäisesti eivätkä ajoneuvot tarvitse kuljettajaa. Ne valitsevat optimaaliset reitit ja kykenevät kommunikoimaan keskenään kolareiden ja ruuhkien välttämiseksi.

Kuvittele omasta näkökulmastasi:

Kuinka käyttäisit automatisoitua liikennettä?

Mitä hyötyjä näet automatisoidussa liikenteessä?

Mitä haittoja näet automatisoidussa liikenteessä?