The technology adoption process and barriers of assistive technology for people above sixty years and propositions to manage barriers in maintaining of welfare

A Master Thesis written at MSc Business administration and information systems on Copenhagen Business School

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[1] 214.607 / 2.275 = 94,33

Executive Summary

1.5 million people are above sixty years of age in Denmark, this amount is increasing, and their welfare is under pressure. There is much assistive technology on the market e.g. the Sigfox ecosystem has over 700 different units. These devices are currently not commonly used, even though they have great potential towards assisting people and maintaining the welfare for people above sixty years. Therefore, this study has been addressing the issue on what hinders or enables full adoption of assistive technology for people above sixty years through interviews and surveys of relevant parties. It was important in this study to include the relevant users because they often are excluded in the body of knowledge. This thesis did not use the case study method, like the majority in the body of knowledge but rather the interpretive paradigm was used as a tool to understand people above sixty and their world views. Conclusively, this turned out positively as the understanding and involvement of users provided interesting findings. I.e. Target group being extremely needs driven and will vary from their psychographic group, if they hear about a specific product positioned in another psychographic group and covers a need they have. The ethical barriers provided an interesting finding on the level of fear versus level of knowledge. Fear increases as the level of knowledge on data storage, gathering, owners and usage decreases and the overall level of knowledge decreases the further into the technology life cycle. With fear comes the concerns that primarily are the potential violation of factors like privacy and dignity. To overcome this obstacle the transparency should be increased by awareness, addressing of ethical concerns and knowledge sharing so that the common knowledge will increase as well. This thesis proposes that by enabling organizations to establish their own separate nudging strategy with the purpose of altering the behaviour in a predictable way and thereby, work around the barriers as a unit. Consequently, the users gain more of a common knowledge and start making requirements to organizations regarding transparency. The second barrier being the municipalities. They found that efficiency is needed in an organisation on a wide level which slows down implementations and communication which thereby create barriers e.g. employees afraid of losing their job to assistive technology. The significant with this thesis is the interpretative of the target group as users. Which contribute with findings the organizations can use to manage their assistive technologies through the full adoption life cycle and the associated barriers. This enables the organizations to overcome the hindering factors e.g. falling into the cracks or the chasm. The goal is for the organizations to increase sales and the goal for the users is to have an increased welfare. Furthermore, making them able to live in their private homes longer, rather than going to a nursing home by using passive technologies earlier in the trajectory. Because of this the government gain an economic benefit by an increased tendency to living at home longer and the 97 % of the participants will get their wish of never have to live in a nursing home.

Acknowledgement

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Without you two, this thesis would not have been possible.

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Chapter 1. Introduction

In first quarter of 2020 there was 1.500.362 persons in Denmark who was above 60 years, out of the 5.822.763 people in Denmark (Statistikbanken, 2020).

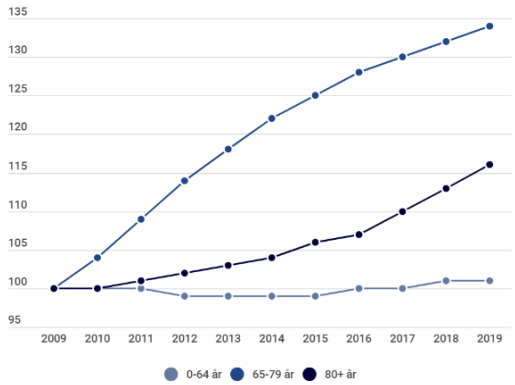
Age	Amount
60 - 70	725.451
71 - 80	537.817
81 - 90	201.783
90+	35.311
Total	**1.500.362**

Table 1 – Population in Denmark 1st quarter 2020 (Statistikbanken, 2020).

Region	Amount
Zealand (Sjælland)	642.495
Jutland (Jylland)	703.615
Funen (Fyn)	139.292
Bornholm	14.960
Total	**1.500.362**

Table 2 – Population in Denmark by region 1st quarter 2020 (Statistikbanken, 2020).

As the tables above show, there are currently living 642.495 people in Zealand being 60 years and above. The place with the largest amount is in Jutland with 703.615 people above 60 years. Out the total number of 1.500.362, 1.1 million is above 65 and the picture below shows a tendency in which the number of people in the 65 to 79 and 80+ categories is increasing. It is a dilemma for the Danish welfare society that there has been an increase of around 30 % through the last 10 years (Antal ældre i Danmark , 2019).



Picture 1 – The development of people (index) (Antal ældre i Danmark , 2019).

Out of the 1.1 million people who are above 65 years old in Denmark, around 120.000 receive homecare and around 40.000 live in a care home. The organization DaneAge association (Ældresagen) have five target group that differentiates by age 50, 60, 65 and 80 (Tal og Fakta om ældre, 2020). There are many different offers of help these people, because people are different and have different needs, these offers include e.g. cleaning, food delivery, activities or personal care (kommune, 2019).

These offers and services are not cheap, in 2017 the total expense for municipalities per person above 65 was 65.078 DKK (Indenrigsministeriet, 2017). When the number of people above 60 years increase further, especially the elder care will have a hard time follow that growth. 'Arbejderbevægelsens Erhvervsråd' state that there could become 40 percent more seniors per employee in the elderly area in 2025 (erhvervsråd, 2017).

The point of view in this thesis is to extend the knowledge on people above 60 years with their usage and concerns regarding assistive technology. Therefore, we will identify the social structures regarding people above 60 years and their use of assistive technologies to maintain high welfare and independency. We want to identify why assistive technology is not used more by the seniors themselves, their relatives or caretakers. The goal is to identify how these social structures can be used to gain more successful implementations of assistive technology to people above 60 years.

The targeted group of readers for this thesis is new master students or researchers who can make further research on the topic. This thesis is a knowledge transforming paper which is purpose oriented through research and analysing of a problem that will be reader oriented (Jørgensen, 2018, s. 44). Furthermore, the thesis is targeted to contribute the organizations providing or managing data with a better understanding of the users above 60 behaviour. By giving the organizations and other relevant participants these data, they will better be able to meet the need of people above 60, so that assistive technology can be implemented to a higher degree and consequently maintain the welfare of these people.

The problem is caused by every person growing old and therefore have interest in the subject of making their welfare better in the long run (statistik, 2018). It especially constitutes a problem because the welfare for people above 60 years are in danger of exposure to decreasing welfare (Andersen, 2003). The number of seniors is increasing and the amount of money the state can provide will remain the same (Hansen J. H., 2009). Therefore, it is worthwhile studying, also because some people fear to grow old and less independent (Matthiessen, 2017).

We personally chose the topic because everyone grows old or experience challenges due to health issues. Everyone experiences family members growing old and will someday grow old themselves. With our knowledge in information technology, we found it interesting to use that knowledge to research a topic of

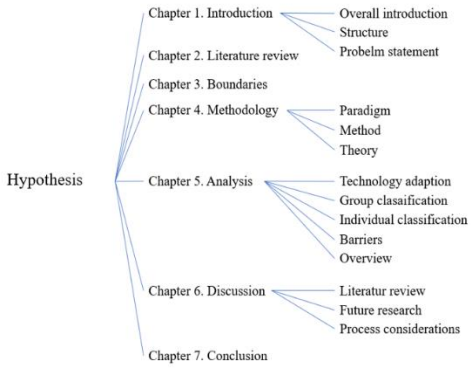
implementation the assistive technology and why the technologies is not implemented at a larger scale by now and thereby prevent e.g. welfare reduction and some of the pain a relative experience when a family member grows less independent.

This thesis makes use of several tools for the analysis. By using the technology life cycle, the six criteria for relation spreading and the additional theory crossing the chasm, the technologies and their mapping will take place for an illustrated overview of the gathered data. Thereafter, the core needs will be used to illustrate the psychographic groups mapping of needs. Lastly, the ethical theory will be used to analyse barriers and the nudging theory will be used to provide proposes towards a nudge strategy used to a overcome barriers.

Structure of the report

At this point the visualization contribute with a structure of sections, that shows how the thesis is build and help the reader orientate through the reading experience (Jørgensen, 2018, s. 32).

First will the current situation be stated with the problem statement, thereafter the previous literature and method on which the analysis has taken place will be described. Then the analysis will take its place followed by the discussion and conclusion that leads to the references list and appendix – See picture below for an overview of the structure.



Picture 2 – Visualisation of thesis structure

Problem statement

The research question provides answers to the gap in the body of knowledge, and the research question for this thesis is the following (Jørgensen, 2018, s. 109).

"What hinders or enables full adoption of assistive technology for seniors?"

Chapter 2. Literature review

This chapter will provide the reader with an overview on what others have researched on the field and subject. The purpose is to find a gap in the literature that is not researched. This gap will give this study its potential and make it relevant to the field of research (Watson, 2002).

To evaluate the identified literature three parameters has been used to measure the importance and relevance to this thesis. These parameters have been used to include only the most relevant articles (Watson, 2002).

- Year: Technology moves fast and articles from 10 years ago use outdated technology. This will not benefit this study, where articles that do not use outdated technology are used.

- Country: This study concerns the Danish population. Literature have been reviewed on how close to the Danish market the content in the articles are. Countries that differs from the Danish market can be included if the results are highly innovative and prove useful to the readers overall understanding of the literature.

- The literature needs to relate to the research topic. The literature does not need to be about the IS field but must bring some understanding towards the gap.

This literature review is divided into 3 main concepts being assistive technology, ethics and user involvement. Those are this thesis concepts, and by understanding the included studies own concepts, the body of knowledge will provide an overall picture on the current state of this subject. Which make up an important direction leading the review, starting with the technical literature, further down the ethical perspectives and so on. The table below shows an overview of the concepts of interest and which literatures they are in.

	Assistive technology	Ethics	User Involvement
Bratteteig, 2018	X		
Ertner, Different generalizations of the elderly in design of welfare technology, 2016	X		X
Ertner, Hvem bestemmer hvad en gangstav skal bruges til?, 2016	X		X
Tjis Vandemeulebroucke, 2017	X		(X)
Hansen, Bak and Andersen, 2010	X		
Nielsen, Andersen and Sigh, 2016	X		
Ertner, 2019	X		X
Skubic, Popescu and Rantz, 2009	X		
Zulas, Crandall, Schmitter-Edgecombe and Cook, 2012	X		
Lofti, Langensiepen, Mahmoud and Akhlaghinia, 2010	X		
Zwijsen, Neimeijer and Hertogh, 2010		X	X
Gelling, 1999		X	
Hofmann, 2013		X	
Meagher and Szhebehely, 2013			X

Table 3 – Overview of literature concepts

The elderly population is growing and challenges the current organization of elderly care services in Norway. It calls for new ways of delivering care work in a more cost-efficient manner. Over the two last decades, housing-oriented care such as assistive housing has become an international trend but in Norway, the use of assistive technology has been relative limited (Bratteteig, 2018).

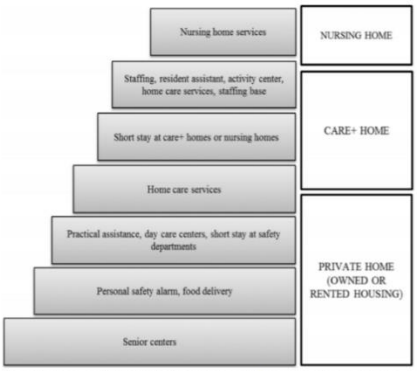


Figure 2. The care staircase illustrating municipal elderly care services (formal care).

Picture 3 – The care staircase

Figure 2 shows the staircase of different elderly care services depending on the elder's location in the system. In 2014, 68% of elderly people above 80 years old, died in nursing homes. The initial case study focused on assistive technology practice in a care housing. The second case study concerned user assessments of assistive technologies in nursing homes (Bratteteig, 2018).

Other literature was included that conducted a research project into assisted living on the use of a tablet for access to home-based services targeting elderly people. What some researchers argued for was that the technology should merge with the changing functional abilities of elder people. Furthermore, much of the current literature on assistive technology pays attention to technology-supported follow-up services after hospitalization (Bratteteig, 2018).

The main concept deduced in this study was an overview on the service staircase including the technology supported elderly care trajectory. The green color indicates the number of technologies included in each box (Bratteteig, 2018)

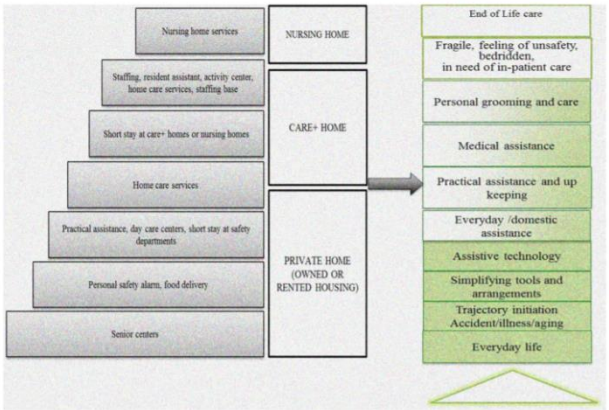


Figure 4. An illustration of the care staircase compared to our technology-supported elderly care trajectory. The green color in the trajectory illustrates the amount of technology use.

Picture 4 – The care staircase compared to the care trajectory

Furthermore, formal care vs. informal care are included in the next figure. Formal care are the services from the elderly care staircase, the informal care is e.g. the support the municipality gives over the phone. The way through the trajectory provides less active use of technology and more passive use e.g. sensors (Bratteteig, 2018).

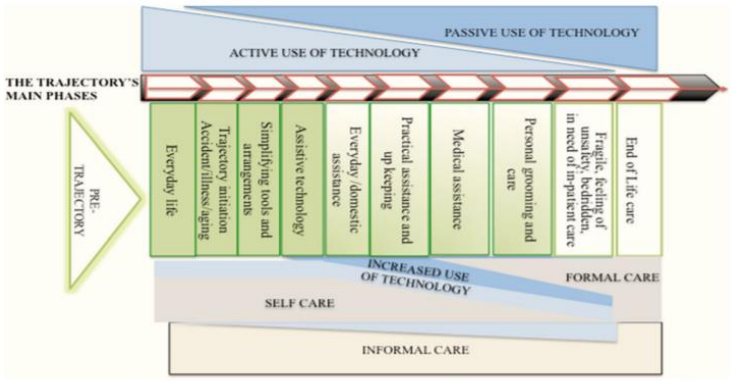


Figure 6. The figure shows how technology provides layers of increased support in the care services including self-care, informal care and formal care, prolonging elderly persons' time within a phase of the trajectory.

Picture 5 – Technology layers

The concept highlight design proposal to better support elderly people with technology-supported services. These are design that include levels of automation, that include simple interaction mechanisms, and critical services on dedicated technologies aiming for robust solutions working 24/7 (Bratteteig, 2018).

Another concept is the extremely difficult situation that happens by trying to satisfy both the designer's and user's point of view. The future elderly of the ageing society is profoundly different than elderly in the past and that they have specific needs and life demands (Ertner, Different generalizations of the elderly in design of welfare technology, 2016).

The initial concern had been to identify potentially stigmatizing stereotypes of the elderly within the project and thus wanted to find and propose a way for the designers to better align the human user with the users they were inscribing into the welfare technologies being developed. The conclusion was that the responsible designers of welfare technology should ask themselves, how the elderly become generalized, by whom, and with what effects (Ertner, Different generalizations of the elderly in design of welfare technology, 2016). The conclusion is that the seniors are not easily generalised and demand a rethinking of designs that hopefully can give rise to more humble and user-friendly approaches in the development of welfare technology for the elderly people (Ertner, Hvem bestemmer, hvad en gangstav skal bruges til? Et etnografisk studie af velfærdsteknologier og deres brugere, 2016).

Looking to get a better understanding of how older adults experience, perceive, think, and feel about the use of socially assistive robots (SARs) in aged care settings. This had a higher focus on the technology and its following effect rather than the older adults. In recent years, a tremendous amount of knowledge has accumulated on what robots are and how they could be used in aged care, but the robots are not widely used yet (Tijs Vandemeulebroucke, 2017).

The result is that older adults have clear positive and negative opinions about different aspects of SARs in aged care. Some opinions can be ambiguous and need more attention if SARs are to be considered for use in aged care (Tijs Vandemeulebroucke, 2017).

Understanding older adults' lived experiences with SARs creates the possibility of using an approach that embeds technological innovation into the care practice itself. Conclusively, there should be considered further research on the complexity of using SARs in aged care (Tijs Vandemeulebroucke, 2017).

Elderly have drawn a great deal of attention as it is a controversial topic being pushed forward by the fact that there will be a dramatic increase of elderly in most western countries. Many researchers have been researching on robots interacting with elderly and several commercial products have been introduced to the market (Hansen, Bak, & Andersen, 2010).

A lot of other researchers are very practical oriented, and basically evaluate whether a specific product is usable in elder care or not. Consequently, most evaluating reports are positive but vague about concluding clear benefits from using robot technology (Hansen, Bak, & Andersen, 2010). The general attitude towards introducing robot technology in nursing homes is positive. The nursing staff have high requirements and products which are considered unstable or complicated to use are not as tolerated (Hansen, Bak, & Andersen, 2010).

It is a case study that investigates the implementation and use of robot vacuum cleaners in Danish eldercare, demonstrating how robot vacuums have proven to have considerable interpretive flexibility with variation in the perceived nature of technology, technology strategy, and technology use between key stakeholders in eldercare. Billund Municipality are introduced as a first mover to introducing robot vacuum cleaners as a substitute for traditional vacuum cleaners in eldercare (Nielsen, Andersen, & Sigh, 2016).

This study provided a concept that proposes an extension to the original Orlikowsky and Gash model by adding a client perspective in order to study the use of the technology in close physical proximity to the clients and the impact on service delivery (Nielsen, Andersen, & Sigh, 2016). The Danish Social Services

Act obligates local governments (municipalities) to facilitate the help and support needed by the elderly. Within the legislative umbrella, two forms of eldercare exist (Nielsen, Andersen, & Sigh, 2016).

1. Care in municipally owned and operated assisted living facilities.
2. Municipality funded home care delivered to senior citizens in their private homes.

In both settings, personal services (e.g., bathing) and practical services (e.g., cleaning) constitute the core of the delivered services. Denmark is considered a frontrunner in the area of public-financed eldercare in terms of extensive service provision to the elderly and high per capita spending. Therefore, in Denmark, 118,000 persons receive public-funded practical services such as cleaning, amounting to a total of 87,000 hours each week (Nielsen, Andersen, & Sigh, 2016).

Robot vacuum cleaners have been severely criticized by the Danish Association of the Elderly and others who fear that robots undermine personalized services and represent a masked privatization of welfare services. Scepticism seemed to wane over time but the debate on robots continues (Nielsen, Andersen, & Sigh, 2016).

Top managers have a clear vision of the benefits that robots could provide, and the economic constraints provided a key motivation for adopting the robots. Resistance to change is common when new technologies are introduced, and assisted living technologies, such as robots, may be an especially sensitive point for frontline staff, since this type of technology can eventually make them redundant (Nielsen, Andersen, & Sigh, 2016). This study as started a debate on robots in eldercare and engage researchers to further explore the role of robots in public service (Nielsen, Andersen, & Sigh, 2016).

In Denmark, great effort has been invested in developing national strategies to speed up the uptake of welfare technology in Danish municipalities but many municipalities experience barriers when projects move from test phase to implementation phase (Ertner, 2019).

The technologies that were introduced ranged from shopping services, e-books, self-wash toilets, and iPads and implementation strategies as the ‘plug-n-play’ approach was considered harmless and less invasive to the users’ homes. A group of around 15 homecare workers were recruited from different homecare units by project managers to take on the tasks of implementing new technologies. They had group meetings every third month and received training in technology implementation (Ertner, 2019).

The empirical material was gathered by e.g. ethnographic observations, informal interviews with the older citizen and the care workers and project managers. There are barriers for the older people e.g. most online vendors have a minimum price at 400 or 500 DKK per delivery, which for most elder people is too much (Ertner, 2019). The implementation is a difficult analytical and empirical concept and require myths,

beliefs, and emotions to make the homecare workers motivated and dedicated implementation agents (Ertner, 2019).

This study introduced the concept of installation of passive sensor networks in 17 eldercare facility apartments. The network includes simple motion sensors, video sensors, and a bed sensor that captures sleep restlessness, pulse and respiration levels. The data collection has been ongoing for two years (Skubic, Popescu, & Rantz, 2009).

The strategy was to identify the problems while they were still small. So, the goal was to capture patterns representing physical and cognitive health conditions. In doing so, the researchers strived to provide early detection of potential problems which could lead to health issues. The ethical issues have been shortly evaluated before the deployment of the sensors (Skubic, Popescu, & Rantz, 2009).

The adjustment stages were important and by the end of the first month, the elders already report that they do not consciously think about the sensors. There were considerations towards technical challenges because maintenance was required. Furthermore, challenges arose with finding relevant usage for the data and ended up with an internal database, that included the data on sentinel health events such as hospitalizations and falls (Skubic, Popescu, & Rantz, 2009).

This concept provides a first step toward investigating the predictive capabilities of the sensor data. In addition, open for the possibility to move the sensor networks into other settings, including public housing and private homes (Skubic, Popescu, & Rantz, 2009).

Smart home technology, dives into the concept of assistive technology, and may be part of the answer in helping to keep elders independent and at home longer while reducing the workload on nursing care practitioners since the number of elders are increasing. The testing in this study was made to the aging adults. The researched visualization tool were CASAS that were showed to nine nurses (Zulas, Crandall, Schmitter-Edgecombe, & Cook, 2012).

It is unknown how to best deliver information to the caregivers e.g. Nursing staff, physicians, children of the clients, and spouses. The important factors the visualisation program showed was nutrition, sleep, hygiene, socialization, routine, activity, emotional wellbeing, and quality of ADL's (activities of daily living). The delivery of data was done by an overall understanding e.g. present the data in a way that makes sense to the target group. Furthermore, the visualisation was quick, the nurses did not trust the data, it was difficult to provide the correct amount of information on a specific subject and alerts was a possibility (Zulas, Crandall, Schmitter-Edgecombe, & Cook, 2012).

The interviews were completed with a successful response. The nurses liked the visualization and wanted to use it for every client (Zulas, Crandall, Schmitter-Edgecombe, & Cook, 2012).

Extensive research has been reported on smart homes with a variety of applications including monitoring systems for elderly independent living. Accident and fall detection as the most commons. The aim is to design an unobtrusive ‘‘activities of daily living’’ (ADL) monitoring system to allow identification and by using different recurrent neural network technique to predict the future activities. Furthermore, the caretakers are included by allowing them to observe any changes to the patterns (Lofti, Langensiepen, Mahmoud, & Akhlaghinia, 2010).

The challenge is to understand human behaviour from low level sensory data and no evident communication with elders. The understanding could be achieved using common-sense knowledge or using computational intelligence integrated with sensory data (Lofti, Langensiepen, Mahmoud, & Akhlaghinia, 2010).

Based on the results, homes equipped with some low-level sensors can provide important information about the status of the occupant. Furthermore, it is not effective for younger, more active occupants or if the elderly has a pet (Lofti, Langensiepen, Mahmoud, & Akhlaghinia, 2010).

“The possibilities seem to be endless, more and more technology is being developed and implemented in the homes of elderly people, while the ethical implications of the use of such devices remain underexposed” (Zwijsen, Neimeijer, & Hertogh, 2010). This statement contributes to the concept of parameters that have a high ethical influence on the healthcare employees and elder's usage of assistive technology. Privacy plays a factor towards identifying possible privacy concerns. From previous study, results are that most elders state that the need for devices overrule privacy concerns (Zwijsen, Neimeijer, & Hertogh, 2010).

The concept autonomy is often seen as the right to self-determination. Earlier study declare that elderly people feel that they do not want anybody to automatically know when they fall, because they would like to cope with it themselves. Furthermore, when using a tracking device, both patients and caregivers feel more confident when people with dementia go outside for themselves. They achieve more freedom and do not experience the fear of getting lost (Zwijsen, Neimeijer, & Hertogh, 2010).

Previous results state that caretakers and elders state that wearing or using a device is a symbol for frailty and dependence and can therefore be stigmatising. There are shared results in this matter. Other researchers have experienced arguments that if every single apartment in the building was equipped with

smart technology, no single person would have to feel that they were the only one who had such equipment (Zwijsen, Neimeijer, & Hertogh, 2010).

The analysis provided insight towards the concerns regarding the focus of assisting technology and giving elderly people more independence. However, the loss of human contact might be at risk. Some researcher points out that assisted technology can improve the possibilities for social contacts e.g. videoconferencing (Zwijsen, Neimeijer, & Hertogh, 2010). The health professionals clearly feel that good care is linked to genuine relationships and social interaction. Another concern is the individual approach, in some articles, it is advocated that the desirability of assisting technology should be weighted for each individual and people should not be monitored just because the technology can do it. Installing assisting technology devices in homes just because technology is available could lead to the loss of skills because a person becomes over reliant on the system (Zwijsen, Neimeijer, & Hertogh, 2010).

It is important to consider the aspect of affordability, e.g. will the health care insurance pay or do the individual person have to pay? it is questionable whether the benefits will become available to those on low income. Furthermore, the safety is mentioned by researchers regarding the elders feeling safer when they are monitored (Zwijsen, Neimeijer, & Hertogh, 2010).

Obtrusiveness is named as one of the negative characteristics of assistive technology e.g. when the use of a robot is obtrusive in a person's daily routine. This concept is used to capture all negative objections towards assisted technology (Zwijsen, Neimeijer, & Hertogh, 2010).

All in all, the elders are approached more directly, and some researchers mentioned in the study, that they have used the elder's opinions (Zwijsen, Neimeijer, & Hertogh, 2010).

There are concepts of important principles used when dealing with ethics in a health care context. One concept to deal with this is with these principles designed for caretakers or nurses:

- Beneficence is the requirement to benefit the patient (Gelling, 1999).
- Non-maleficence is that no harm should overcome the patient (Gelling, 1999).
- Fidelity is the building of trust between patient and researcher (Gelling, 1999).
- Justice is the requirement to be fair to participants (Gelling, 1999).
- Veracity is the obligation to tell the truth to the participants (Gelling, 1999).
- Confidentiality is to not disclose information considered to be secret (Gelling, 1999).
- Respect for autonomy are the respect towards several concepts e.g. privacy, voluntariness or free choice (Gelling, 1999).

Within the ethics concept have five general models been identified that are used in Scandinavian health care (Hofmann, 2013):

1. The moral principle and values based. This principle has dominated in Denmark since around 1996. The principle made in Denmark are equality, solidarity, security, and autonomy. The principles are achieved by e.g. transparency and accountability (Hofmann, 2013).
2. Moral principles an economic assessment. This principle has focus on cost and efficiency. This has generally been used in Norway and Sweden (Hofmann, 2013).
3. Procedural approach. This principle concerns accountability for reasonableness and have been used in Norway and Sweden (Hofmann, 2013).
4. Expert based practice. This principle regards prioritize boards who are dominated by experts. This have been used in Norway and Sweden (Hofmann, 2013).
5. Participatory practice. This principle concerns prioritizing boards where representatives from health care professionals, health trusts, and patients are equal participants. This has been used in Norway and Sweden and are concluded to be the principle with pest potential.
   The elder's opinions are not included, but they are somewhat included in principle five, where they have equal to the other board participants (Hofmann, 2013).

The marketisation principles in Denmark were originally intended to be a steering and control instrument in the pursuit of horizontal and vertical efficiency within the public sector. In Denmark, the local authorities are responsible for the assessment of the need for eldercare and the main care services consist of home care and nursing home care (Meagher & Szebehely, 2013).

Overall, home care has a considerable number of adults aged 65 and over in 2012, 13.7% of this group received home care. Marketisation in Danish eldercare has mainly been fostered by the Free Choice in home care legislation. It was introduced in order to improve efficiency, quality in care and user autonomy, and was expected to lead to more user-led services and to result in a more cost-effective and quality-conscious eldercare sector (Meagher & Szebehely, 2013).

Earlier study has often been based on non-representative municipal case studies. In a Danish study of the factors that are important for service users – trust, transparency and the opportunity to file a complaint – eldercare services were ranked the lowest compared to the other social service areas for which free choice is available. Furthermore, the users did not feel that free choice of home care provider ensured a more satisfactory service (Meagher & Szebehely, 2013).

Although studies show high levels of satisfaction, many users are still unaware of the possibility of choosing between public and private for-profit providers. Approximately one third of home care users are unaware of the free choice scheme (Meagher & Szebehely, 2013).

Conclusively to Literature Review

The literature review has contributed with interesting learnings, e.g. many of the studies and their concepts emanates from case studies. Researchers have earlier found results that it is beneficial to start earlier with a technology implementation. If it is desired that people above 65 should use technology in that age, it could be beneficial to start implementing the technology when they are in their fifties (Tijs Vandemeulebroucke, 2017). Common for many researchers, was that there were a lot of positive feedback on many technologies or functions, some elders forgot that they had passive technology installed in their homes (Skubic, Popescu, & Rantz, 2009).

A highly relevant model was introduced, the care staircase (Bratteteig, 2018). This staircase illustrates the elder's road through stages of needing more help and the technology included in each stage. The staircase starts at the private home, moves to the elderly living at home that receives care and lastly a nursing home. For each place there is different relevant technology usage e.g. assistive technology to private homes or medical assistive technologies to the elderly at home who receives care.

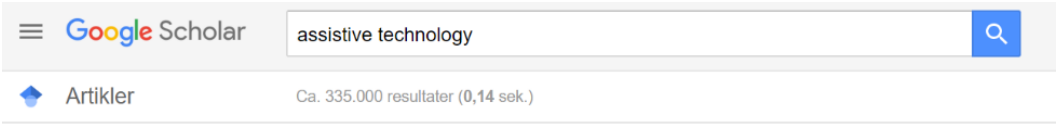
Knowledge has accumulated on what these different technologies like robots or assistive technologies are and how they could be used in aged care, but the robots are not widely used yet (Tijs Vandemeulebroucke, 2017). For the most part the current literature on assistive technology mostly pays attention to technology-supported follow-up services after hospitalization (Bratteteig, 2018), studies on specific products (Hansen, Bak, & Andersen, 2010) and not assistive technologies in general at private home. Which is interesting because the staircase states that there are most technology used when the elderly lives at their own home (Bratteteig, 2018).

In general nursing staff are positive towards introducing robot technology in nursing homes. The nursing staff have high requirements and unstable or complicated products are not as tolerated. Researchers found resistance due to the common fear of being replaced by the technology (Nielsen, Andersen, & Sigh, 2016) or stigmatization (Zwijsen, Neimeijer, & Hertogh, 2010).

Furthermore, there are important ethical principles to consider in this topic like respect for autonomy (Gelling, 1999), veracity (Gelling, 1999), obtrusiveness (Zwijsen, Neimeijer, & Hertogh, 2010) or the moral principles (Hofmann, 2013). These principles have all in common that they should be considered so the participant does not feel violated by the new technology. These ethical principles are not commonly used, and a researcher calls the subject underexposed (Zwijsen, Neimeijer, & Hertogh, 2010).

The literature provides a body of knowledge for this thesis and it contributes with several interesting gaps. Smart homes and assistive technology are a researched topic, many researchers have touched the last fifteen years. The patterns are clear that smart homes make good potential for private homes (Skubic, Popescu, & Rantz, 2009) and not just nursing homes and that the elderly are overall positive towards the technology in nursing homes – they even forgot that the passive sensors were there (Skubic, Popescu, & Rantz, 2009). This positive feedback and the fact that the care staircase states that most technology are used by seniors living at their own home (Bratteteig, 2018). This opens for the potential to investigate into implementing assistive technology (including robots) to people that lives in their own home and start with old adults paralleled with the seniors.

The care staircase also states the number of technologies is decreasing through the trajectory, so the least technology is used in nursing homes (Bratteteig, 2018). This is conflicting with the amount of research done on assistive living in nursing homes – there is potential for more passive technology in nursing homes. The conflicts between these articles provide a gap in the form of where the technology precisely is placed and why more technology isn't implemented when so much research have been done – See the picture below for the number of search results on assistive technology.



Picture 6 – Search result for assistive technology

Most of the researchers included the nurses or care takers and provided beneficial results to these. There was a general pattern that the seniors were not involved as much as the care takers or nurses. It was clear that the researchers that have included some seniors only included them to a minimum by referring to an opinion of theirs. A researcher investigated the potential for a concept that is an extension of the original Orlikowsky and Gash model by adding a client perspective in order to study the use of the technology in

close physical proximity to the clients and the impact on service delivery (Nielsen, Andersen, & Sigh, 2016). This opens an interesting gap because the study did only include the care takers for this research, so is the seniors not considered a client when care takers wants to implement assistive technology to help them with their welfare. Have the seniors no saying in what help they will get and is it ethical correct to not try to include the end client and just push technology into their everyday life without them having a saying.

Furthermore, the overall ethics are a forgotten topic in the implementation of assistive technology to improve the welfare of care takers and seniors (Zwijsen, Neimeijer, & Hertogh, 2010). There was a pattern in the literature, that ethics were little included in the technical studies, in fact only one researcher mentioned that the study considered ethics but not what and how. A researcher state in an ethical study that more and more technology is being developed and implemented in the homes of elderly people, while the ethical implications of the use of such devices remain underexposed (Zwijsen, Neimeijer, & Hertogh, 2010).

This concludes that there are gaps in the body of knowledge around assistive technologies to seniors in every stage of the care staircase. There is a gap with the user adoption because one of the users, the elderly is not included in many studies about them and the ethical perspective also lack the involvement of the elderly user.

Chapter 3. Boundaries

This thesis focuses on the group of people above 60 years old. It is necessary to have a target group that are narrower than the entire Danish population. The target group will have an increase in numbers and possibly could suffer a reduced welfare level in the future. Therefore, this target group is the most interesting, it is these people that should see the opportunities of assistive technology and request it. This target group will through this study be addressed as the "target group" or "people above 60 years", to maintain a neutral view through not offending the participants.

The threshold of 60 years is chosen through the DaneAge association (Ældresagen) commonly used groups. Furthermore, the body of knowledge provided info about the involvement of "old adults" to spread positive awareness before the need to buy or receive help risen. Furthermore, the data should be gathered through a widespread because of the geographical influence of human behaviour.

The primarily focus are the innovator, early adopter and early majority due to them being a large and according to the theory, openminded and somewhat technology understanding group that will want to participate in such a study like this on assistive technology. Where the late majority and laggards will take time in convincing them to participate.

For this thesis it is assumed that municipalities are trying to implement assistive technologies, and they act as a middleman in the relationship to what technology the target group use, however, the process takes time. Furthermore, it is assumed that there are other options than going through the middleman. Hence, the focus of this thesis is primarily on the end users. These people have power over the implementation, whatever it is from the municipality or private – they can accept, deny, speed the process or slow the process of implementing assistive technology (Appendix Six, page 3 line 11-17).

Due to the municipalities having a long response time or none, it is assumed that all requested interviews will not be achieved. The most important factor is to get an overall understanding from their leaders that maintain an overview. Furthermore, the DaneAge association, a relevant group of people that has a lot of information on the target group will be included to the highest possible extent because of their level of knowledge on the target group. But they have a reputation for being very critical, therefore it is important to try to contact these organizations. It is important to note that they are not so important that they are, allowed to control or slow down the process and results.

Chapter 4. Methodology

Paradigm

Throughout this thesis the interpretivist paradigm will affect this study. Generally, the interpretivist "*assume that people create and associate their own subjective and intersubjective meanings as they interact with the world around them*" (Orlikowski & Baroudi, 1991). With the aim to understand how social groups and their members enact realities and thus make them meaningful to the group (Orlikowski & Baroudi, 1991).

Burrel and Morgan (2016) sociological paradigms combine objectivism-subjectivism with radical-regulation change continuum into a 2 by 2 matrix defining four paradigms. With an assumption that organisations have rational problems that can be solved with rational solutions, how these rational problems are defined, depends on the paradigm (Saunders, Lewis, & Thornhill, 2019). The interpretive paradigm is in the lower left half, putting it in the subjective realm and towards the regulation, which affects the world view of the interpretive researcher and will be elaborated in three layers, ontology, epistemology and human nature (Orlikowski & Baroudi, 1991).

Ontology

The ontology for this study mainly on information systems within the interpretive paradigm is subjective, hence the reality is nominal and decided by convention. Enabling multiple realities as one reality exists if it is perceived a certain way (Saunders, Lewis, & Thornhill, 2019).

Epistemology

The epistemology determines how and what becomes valid-, acceptable-, legitimate knowledge. For the interpretive researcher to get valid results, the results will have to be accepted as the truth by the studied subjects thus the informants. Requiring the researchers to adopt assumptions in the studied environment (Saunders, Lewis, & Thornhill, 2019). Michael Myers define the interpretive study to assume knowledge of reality is gained on in social constructions like shared meanings, artefacts and shared language (Michael Myers, 1999), (Saunders, Lewis, & Thornhill, 2019).

Building on German sociologist Max Weber and his term "*verstehen*", interpretivism uses a method of hermeneutics to get acceptance of the informants. Michael Myers explains hermeneutic circle as his first principle for an interpretive field research as, "*The idea of the hermeneutic circle suggests that we come to understand a complex whole from preconceptions about the meanings of its parts and their interrelationships"* (Michael Myers, 1999). That iterates from a part to the whole, and from the whole to a part, to understand the meaning in the social construction studied, and through (Michael Myers, 1999).

Method

The study of this thesis will be a cross-sectional study, over a short time period as opposed to doing a longitudinal study. This section will cover research strategy and the data gathering methods. The method section will provide the readers with the documentation of research strategy and data gathering including the conditions and circumstances of the thesis and its environment. The method motivates the research question by the choice of methodology used to address this question by including structure on how to gather data.

Research strategy

The use of the interpretive paradigm provides the opportunity to use the research strategy of qualitative research which provides good answers to questions about 'why' - but not 'what' and 'how much'. So even though qualitative data is crucial to understand the target group, quantitative data should be the other half of the truth as a secondary tool. Furthermore, the thesis will be using multiple methods including case study and survey and expert informants to provide the needed data as well as tables, visualizations, word cloud, co-occurrence, or mind mapping to present the data in a manageable manner. The overall goal is to include the target group and gather data that gives insight into their values and with openness by no hidden agendas that can affect the outcome.

In general, this study is following the seven principles of an interpretive study by Myers, first principle already explained in epistemology as the hermeneutic circle. Second principle, contextualization, requires researchers to reflect and understand the social and historical background in the research setting. In our study we have used contextualisation from our understanding of what technology can today as well have a prerequisite about seniors' abilities with technology. Third principle requires interaction between researcher and the subject, which will be done through semi structured interview. Fourth principle of abstraction and generalization says to use theories as a sensitizing device and interpreting data gathered abstraction and generalization builds on the first two principles to describe the social and human understanding. Fifth principle of dialogical reasoning states to be aware of contradiction between theoretical stand points to the actual findings of the data, and revise with subsequent iterations. Sixth principle of multiple interpretations, gives itself away and is founded in the possibility of different interpretations among the participant, telling the same narrative. Requiring the researchers to be aware of this might happen and be able to understand the full narratives explained by the participants. Seventh principle of suspicion, states that narratives are potentially told with biases and researchers will have to look out for these to dissolve and look through them (Michael Myers, 1999).

Data gathering

Data are gathered through different methods; this section will go through these different methods. The methods are survey and interview. Furthermore, the authors of this thesis have studied similar topics in previous assignments, data will be used from these assignments as evidence. Survey to get a wider variety of data from the target group and interviews to get data on expert sayings, the target groups deeper opinions and other relevant data.

Survey

To reach an overview by a sample gathered from seniors, a survey has been made a distributed - see the survey on appendix one. A survey is made by questions in a predetermined order and the data should be manageable to reproduce by other researchers (Brinkmann, 2009).

The target group of this survey is people over 60 years old, this are people who is old adult and seniors. (Brinkmann, 2009). The survey data and the interview data are both primary data because the data have been gathered our self for this specific purpose. This contributes to the gathering of quantitative data being the main research strategy method and to the secondary and supporting method of quantitative data. It is important to maintain reliable data, that is why calculations have been made to ensure the level of reliability and considerations towards surveys (Determining Sample Size, 2020).

With a 95 % confidence level, 5% margin of error and a population of 1.5 million being above 60 years in Denmark. The sample size should be around 385 people for the sample to be very reliable. It is also a possibility to have a 90 % confidence level, 10 % margin of error and a population of 1.5 million being above 60 years of age in Denmark. For this scenario, the ideal sample size should be around 69 persons (Calculate your sample size, 2020). As the margin of error level grows or the significance level drop the required sample size will decrease – See the table below for an overview.

	Confidence level			
Margin of Error	**95%**	**90%**	**85%**	**80%**
5%	385	273	208	164
6%	267	190	144	114
7%	196	139	106	84
8%	151	107	81	64
9%	119	85	64	51
10%	97	69	52	41
11%	80	57	43	34
12%	67	48	36	29
13%	57	41	31	25
14%	49	35	27	21
15%	43	31	24	19

Table 4 – Calculated overview of sample sizes (Calculate your sample size, 2020).

To maintain the margin of error level the survey was printed and spread by hand in several communities, to gain a better overall understanding of the target group, there was people from the city and outside the

city answering the survey. The survey is printed and spread by hand so that there will come responses from all the relevant groups e.g. laggards and innovators. No sample is perfect, and, in this study, the preferred margin of error is a maximum of 13 % because there is allowed some errors. An example hereof, is that the surveys are distributed by hand so that every group can be represented in the answers, but this means that the survey is assumed to not gather any data from Jutland who currently have around 700.000 people above 60 years. Furthermore, the confidence level is how confident the data should be, this thesis should have a confidence level of 80 % and preferably above by gathering as high a sample of data as possible.

When the data are gathered it is organized through an excel sheet, so it is easier to get an overview and use the sheet to analyse the data. Furthermore, some of the participants will be analysed deeper so it is possible to put words on and explain some of the answers deeper. Interviews will be used to analyse the data on a deeper level. The data will be colour coded and analysed by using the theoretical structure in this thesis.

Interviews

Qualitative interviews are often unstructured and not standardised, the interviews used to gather data in this study are semi structured. This is because we want to push the interview in the correct direction – thus operationalized relevant theory to direct the interviews - but still have open questions that will make the interviewed person talk more freely. The interview will follow the open-minded rule of an unstructured interview and the natural path the interview takes. That also builds on the 3rd principle of interpretive field studies, interaction between the subjects and the researcher (Michael Myers, 1999).

By using a semi structured interview, we want to understand themes from the daily life of in the interviewed persons own perspectives. The interview should feel like an everyday conversation but have purpose by using approaches and techniques. Before each interview there was made an interview guide that acts as a guide through the interview with focus on specific topics and suggestions to questions.

The interviews are recorded and transcribed. The transcribed data are colour coded by using different colours to illustrate the relevant quotes that can be used in specific topics - See Table 5.

The interviewed persons mainly speak Danish so to make them feel more relaxed through the interview, it will be in their main language. The power relations should be as neutral and equal as possible. This is established by us coming to them and ask the questions and we answer their questions so that we have a conversation. This is mainly to ensure the quality of the interviews (Brinkmann, 2009, s. 190).

Furthermore, the quality of the interview is considered through sensitivity of the questions asked, specificity of different situations and actions the goal for the interviews is that every person should have a positive experience by gaining insights into a new life situation.

The relevant quotes will be colored a given color that will specify in which theory or topic the data belongs. When the relevant quotes are colored, they will be inserted into an excel sheet, sorted and if relevant, translated to English – See appendix two.

Color	Theory or Topic
Blue	Ethics
Green	Chasm
Yellow	Relevant for more than one topic or theory

Table 5 – example of color codes

Before the interviews roles was mode so the interviews will provide the most effective amount of data. One of the interviewers had the role of asking questions and the other take notes, observe and ask frequently follow-up questions. There are different types of questions, each interview started with an introduction question (Brinkmann, 2009, s. 155- 156). See the figure below for examples of the types of questions used.

Question type	Question example Danish	Question example English
Preliminary question	Introducer kort jer selv.	Shortly introduce yourself.
Follow-up question	Hvis ja: Hvilke produkter og hvorfor?	If yes: What products and why?
Direct question	Har I prøvet at en implementering af assisterende teknologi er fejlet?	Have you tried the implementation of assistive technology failed?

Table 6 - Examples of different question types.

There are different interviews, some are used for data gathering but others are also used as an expert interview to weight the data with the general knowledge from an expert in the field. As for the confidentially of the interviewed persons, we do not want to display anybody, so we do not use names of the person we have interviewed only their titles (Brinkmann, 2009, s. 209) – See the figure below for an overview of the interviewed people.

Title	Data gathering method	Topics
IoT Denmark CEO	Expert interview and discussions of ideas.	Expert interview around IoT and eldercare (Appendix Seven).
Chief Consultant in Danish municipality.	Interview	Expert interview on screening and the earlier usage of assistive technology in a Danish municipality (Appendix Five).
Welfare Technology coordinator at a Danish municipality	Interview	(Appendix Four)
The leader of eldercare at a Danish municipality	Interview	(Appendix Four)
IT supporter at a Danish municipality	Interview	(Appendix Four)
Professor in Digitalization, Data and Design with IT University of Copenhagen	Expert interview	(Appendix Six)
Person in the innovator psychographic group	Expert interview and target group interview.	With the surveys in consideration the interview will be about core needs and identification of the ethical line (Appendix Eight).
Person in the early majority psychographic group	Target group interview.	With the surveys in consideration the interview will be about core needs and identification of the ethical line (Appendix Nine).
Person in the late majority psychographic group	Target group interview.	With the surveys in consideration the interview will be about core needs and identification of the ethical line (Appendix Nine).
Person in the late majority psychographic group	Testing	Testing of assistive technology.
Person in the late majority psychographic group	Testing	Testing of assistive technology.

Table 7 - Scheme of interviewed persons

Operationalization of questions

As a precaution to reaching questions with better and more relevant answers, the theories are operationalized and used in the questions to guide the interview in the correct direction. See the figure below for examples.

Subject	Question	Theory/ search direction
Survey to people over 60 years of age. The purpose is to gain a general understanding from a sample of the target group.	Would you feel more secure in your everyday life if you had functioning products set up in your home that measure different parameters such as your indoor climate, smoke or how often you open your refrigerator?	The core need, security (Anderson, 2010).
Questions to the leader of eldercare and the welfare technology employee.	What is your view on ethics and the use of assistive technology in eldercare? Where does the line go?	Ethics.
Questions to the leader of eldercare and the welfare technology employee.	How was the relationship with the seniors during implementation, met with resistance or positive feedback?	Crossing the chasm (Moore, Crossing the Chasm, 2001), (Moore, Crossing the Chasm, 2014).

Table 8 – Operationalization

Theory

This section describes the glasses that have been put on and looked out of when the research question needed to be analysed. This description of theory choices is a motivation for the reader to understand how the analysis are structured and the theories combining each other. In order to investigate the world and analyse the data with the different theories chosen as tools. See the figure below for an overview of the chosen theories.

Theory
Technology life cycle adoption
The Six Criteria of Relation Spreading
Crossing the Chasm
Nudging
Core Needs
Ethics
Assistive technology

Table 9 – Overview of theories

The theories will be used in conjunction with each other by using the technology life cycle adoption and assistive technology theory as the basic understanding of the thesis analytical framework. In relation to the life cycle will the six criteria and theory from crossing the chasm be used to analyse assistive technologies. For further identify what world view these assistive technologies acts in the core needs combined with theory from crossing the chasm will be used to identify the target groups behavioural basis. By understanding the target group, the barriers between them and assistive technology will be identified, and ethical theories will be used to analyse the barriers. Lastly the nudging theory will be included by a way of making realistic nudge design.

Technology life cycle adoption

The technology life cycle adoption builds on Everett Rogers's book Diffusion of Innovation, at handles how mass adoption occurs, which has been described as happening in five groups (Everett, 1983).

Rogers, in book Diffusion of Innovation have six criteria, used to understand, and manage the relation spreading of innovations. The first relevant criteria for this thesis are the relative advantage which states that the bigger the expected advantage are the quicker the relations will spread. The second criteria – observability, is used in this thesis to state the relation spreading is quicker when the advantages are easier

to see. It is assumed through the analysis that the relations will spread quicker when trialability is easily accessible for the customer, as well does compatibility affect the relation of spreading when innovations match the previous innovations the customer have experienced. Thus, disruptive innovation makes it more difficult to be compatible with todays need and reversed for continuous innovations. Relation spreading is considered faster when easier compatible with current customer need. The complexity sums up that the innovations need to be less complex for the relation spreading to happen quicker. Lastly the risk is an important criterion for this thesis. It needs to be perceived as small as possible for the effect of relations to spread quicker (Everett, 1983).

Attribute	Score
Relative advantage	High
Compatibility	High
Complexity	Low complexity
Trialability	High
Observability	High
Risk	Low risk

Table 10 – Attributes of innovation (Everett, 1983, s. 210)

The six criteria are used to analyse and identify the assistive technologies relevant for the interviewed participants. Through scores the relation spreading level can be established as to understand how fast or slow the relation spreading is. The table above show an example of the best possible scores that can be established by organizations to assistive technology products.

Technology life cycle adoption are used to categorizes people into five characteristic groups adopting technology. Innovators, early adopters, early majority, late majority, and last laggards. It is assumed in this thesis that each group has certain characteristics that determine when and how they will adopt a new innovation (Everett, 1983).

Innovators are characterized by aggressively seeking technology for their own interest even before the product has been marketized. Examples include investors on kickstarter.com, buys product that are not build yet and only a prototype exists, they want the product regardless of the functionality. *Early adopters* require more reasoning before buying into a new product, technology, or innovation. They are characterized by being able to imagine the benefit and appreciate it, they gain by owning/using the

innovation, so the intuitive benefit of the innovation drives the early adopters (Moore, Crossing the Chasm, 2001, s. 9).

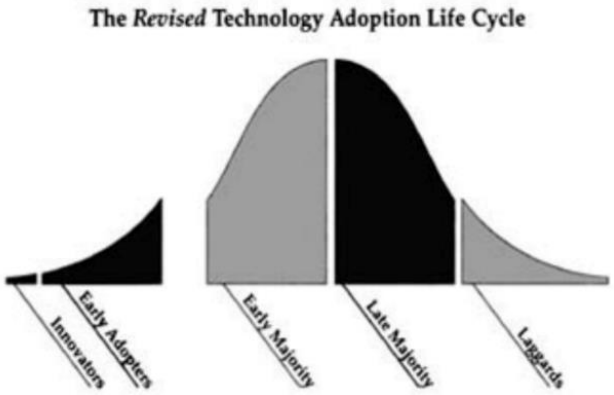
Moving into the next group the *early majority*, who share some characteristics of the early adopters, by being able to relate to the technological benefit, however, are more practical oriented and relies much more on reference prior to investing in the innovation (Moore, Crossing the Chasm, 2001, s. 9).

The latter groups *late majority* and *laggards* both more reluctant to use technology, as opposed to early majority, late majority is not comfortable using technology products and in general do not believe in their technological abilities. Therefore, late majority tend to wait to adopt until it becomes the standard and even then, seeks support before buying a product. The la*ggards* have a different attitude towards technology, they generally do not want anything to do with new technologies. Many reasons being either personnel or economic, laggards only buy a technology when it is buried deep within another product (Moore, Crossing the Chasm, 2001, s. 9).

"This process can be thought of as a continuum with definable stages, each associated with a definable group, and each group making up a predictable portion of the whole." (Moore, Crossing the Chasm, 2001, s. 10). As the quote states this theory will be used to create a groundwork through the definable groups, for the assistive technologies the participants have provided data on. This groundwork will provide a basic understanding on the state of these assistive technologies and thereby help addressing the hindering and enabling factors in a full adoption.

Crossing the Chasm

Moore's expansion of the technological life cycle adoption states that in between the characterized groups are *cracks*. Cracks that is between the psychographic groups, it is necessary to target the specific psychographic group through separate strategies, for them to start using the product (Moore, Crossing the Chasm, 2001, s. 10). It is assumed that the technology adoption life cycle is thought to have a smooth transition and that innovators are critical to have adopted before the early adopter buys into the product. Thus, innovators creating a bandwagon effect which moves slowly from innovators towards laggards, and thereby will we be assuming a bandwagon effect is in play in between psychographic groups (Moore, Crossing the Chasm, 2001, s. 10).



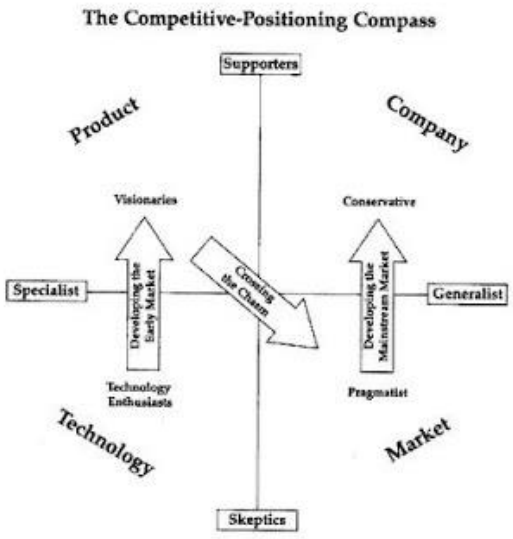
Picture 7 – The Revised Technology Adoption Life Cycle

The first relevant crack is the gap between innovators and early adopters. To move into early adopters, the technology needs to translate into a new benefit that is so major, that early adopters can imagine the benefit. The key to the first crack is to show that the technology creates an intrinsic value, and enables a strategic leap not possible without it, as well appeal to the non-technologist (Moore, Crossing the Chasm, 2001, s. 13).
Another relevant crack for this thesis, is between the early majority and the late majority, it has equal magnitude as the first one, however at this point the technology has proven its benefit. Leaping the crack into late majority requires making the product easier to adopt, as the major difference from early to late majority is their abilities and willingness to become competent or familiar with the product (Moore, Crossing the Chasm, 2001, s. 14).

The latter crack between late majority and laggards, is characterized by aiming a product at people likely unwilling to change attitude towards technology products and it can be relevant for an assistive technology to hide their technology within another product (Moore, Crossing the Chasm, 2001, s. 14).

The biggest and most relevant crack for this project is the chasm. It is between the early adopters and early majority. The transition tends to go unrecognized because early adopters buy into the product with an expectation to get a competitive advantage and seeks radical discontinuity for their investment making early adopters prepared to master this discontinuity. On the other side of the chasm is early majority, who seeks productivity improvement to existing market rather than radical change in current ways of operating. Early majority is looking for evolution rather than revolution, and there by wants to change as little of the current situation and still get some gain from new technology (Moore, Crossing the Chasm, 2001, s. 14).

For this thesis the chasm is assumed to be between the two groups of radical seeking early adopter versus the evolution seeking and productivity increasing early majority (Moore, Crossing the Chasm, 2001, s. 14). These incompatibilities among early adopters and early majority makes them no good reference for the early majority. In search for reliable references to avoid having to disrupt their current operation to enhance, these reliable references are assumed to be a key concept for early majority (Moore, Crossing the Chasm, 2001, s. 14).



Picture 8 – The competitive positioning compass

The competitive positioning compass is a tool used in this thesis to understand the tendencies of the target groups and the individual's psychographic groups. The model is another way of visualizing the way for a product through the technology life cycle. The first step in the model is the technology enthusiast who is the skeptic specialists thereafter are the supportive specialists called the visionaries. Then the chasm is the next step which takes the product from the early market placed in the left side of the model to the mainstream market at the right side of the model. When this step is taken a product starts acting on the mainstream market and in the first group the pragmatists who are the skeptic generalists and further through to the next market segment the conservatives who is the supportive generalists.

A product will follow the arrows through the model as it goes through the technology life cycle, and thereby gain more and more of the market. In this thesis this model is used to further understand the psychographic groups and the behaviour that drives them.

The four gears have been included in the thesis so that the four fundamental gears can identified and understood and thereby the driving of organizations to larger scales (Moore, Crossing the Chasm, 2014, s. 249). The gears are acquiring traffic, engaging users, monetize their engagement and enlisting the faithful through engagement and thereafter acquisition (Moore, Crossing the Chasm, 2014, s. 249).

The theories from crossing the chasm and technology adoption life cycle will be used to map where different technologies are positioned within the target groups perception. Furthermore, the theory form crossing the chasm will be used to map the target group and assistive technologies in different categories and therefore be able to include a layer of complexity by which the user's personalities will be included. In that way, the thesis will not become rigorous and there will not be made to many assumptions regarding the mapping of technologies and users.

Crossing the chasm assists in understanding how many have and likely will adopt assistive technologies, as defined by the psychographic groups. Which thereby, is used to analyse the hindering and enabling factors in the problem statement.

Nudging

"A nudge is any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives." (Thaler & Sunstein, 2008). A nudge strategy is small changes to the environment that are inexpensive and easy to implement. This theory will be used to understand the behavior, and how architecture can push the audience in the intended direction. Also, contributes to the understanding of the target group and thereby identify insights to why assistive technology is not more commonly implemented with the target group.

It is assumed for this thesis that humans have two families of cognitive operations available in the brain when a decision must be made (Thaler & Sunstein, 2008):

• System 1: Fast, automatic, uncontrolled, unconscious, intuitive.

• System 2: Slow, reflected, controlled, conscious.

The analysis of barriers in this thesis is about gaining a deep knowledge of the structures, motives and incentives that drive behavior. The barrier analysis is crucial when a nudge is designed that should change the environment to overcome the barriers. The barrier is analyzed by using relevant principles as norms, expecting errors and context through environment and incentives. Through analyzing these relevant barriers, the diagnoses and solutions can be identified and there are several in making it possible to overcome barriers e.g. by making a nudge easy, remarkable, educate employees or make choices simple.

The barrier analysis will be used to propose one or several nudge strategies that can be implemented and change the environment towards more usage of assistive technology and thereafter a better welfare (Thaler & Sunstein, 2008).

This theory is used in this thesis to address the enabling factors towards a full adoption of assistive technologies for seniors, by analyzing the barriers and thereby make small environmental changes that affect the human behavior towards a full adoption.

Core needs

The core needs derive from the book by Linda Ackerman Anderson & Dean Anderson called Beyond Change Management - How to Achieve Breakthrough Results Through Conscious Change Leadership. The core needs represent the "warning signs", our most sensitive areas as human beings. These core needs we need to have covered especially in changing times and will therefore be used to uncover the needs of seniors when adapting new technology. The importance on each category varies from person to person, but ever human individual has these needs when a new technology or change are implemented into a group. To some degree these needs must be fulfilled for else the individuals will resist the implementations (Anderson, 2010, s. 167).

The first relevant core need in this thesis is security, that is the need to feel safe physically and emotionally. Affiliation is the need to be invited and be a part of the group where power is the need to have a direct influence on the results and the process of change. The fourth core need are order and control that are the need to know what is going to happen and keep the order by structure and planning. Competence is the need to feel competent, efficient and capable and lastly justice is the need to feel a sense of fairness and justice in things (Anderson, 2010, s. 167).

The method of core needs is in this thesis assumed, that there should be opened dialog from both ways and that no opinion in incorrect or correct. Furthermore, that there is a transition from resistance to neutrality with every change and every people (Anderson, 2010, s. 167). This theory is used in the thesis because it can provide an analytical relevant tool for this project, that is necessary when dealing with implementations that have not been implemented successfully. This theory can help give an insight into the target groups needs and therefore provide info on why assistive technology have not been fully adopted by this group.

This theory addresses the problem statement through understanding of the target group. By having an understanding for the target group and their needs, it is possible to analyse their concerns and opinions and thereby gaining a more comprehensive barrier analysis.

Ethics

The ethical tools seen in the table below, are from a toolbox at VIRT-EU. VIRT-EU are a project that includes a group of researchers, designers, and policy professionals. The goal with this theory through its involvement and usage in this thesis, is to use a practical tool that help technology developers think and talk about ethics. As it is said on their web page, the goal is not to provide yet another check list, but rather toolkits that offers a way to understand necessary language, structure and authority to convene and engage in conversations about ethics (About us – Why we care, 2020).

Privacy	Safeguarding intimacy, identity, and physical integrity.
Data Protection	Providing users access to their collected data, giving them explanations about how personal information is used. Issues concerning the distinction between anonymous and personal data that could allow companies to avoid data protection but still have impacts on groups and individuals. Ensuring the rights to access, rectification, erasure (right to be forgotten) and to object with regard to personal data processed by means of IoT devices and facilitating data portability.
Dignity	Avoiding any forms of surveillance or invasive control over individuals using IoT devices. IoT devices shall not be used to collect unauthorised private information or to publicly disclose private facts.
Well-being	Increase individuals' well-being and fostering "IoT for good".
Non-discrimination	Preventing any forms of discrimination.
Autonomy	Safeguarding individual self-determination and freedom of expression.
Transparency	Providing access to information concerning personal data processing. Encouraging transparency about data operations, device usage and firmware and software upgrades.
Participation	Effectively engaging data subjects in data processing design. Promoting debate and dialogue (e.g. manifestos).

Accountability	Effectively addressing security and safety issues, adopting adequate risk prevention strategies and measures.
Interoperability	Promoting interoperability as one of the key values to create a trusted IoT ecosystem. Facilitating data portability, both for taking data out and in.
Safety & Security	Protecting users against any harm due to IoT devices (hardware and software security). Updatability of devices for security.
Responsibility	Strengthening algorithmic accountability/liability.
Openness & Shareability	Promoting open hardware and software with open source code.
Sustainability	Issues concerning the potential impact on social and environmental justice.
Inclusion and equality	Considering diversity and inclusion both in IoT development and regarding users' experience.

Table 11 – Ethical tools (Toolkit, 2020)

Technology users fear unethical behaviour from technologies. These fears are left unaddressed for the sake of economic growth driven by technology. That is why these ethical tools are included in this thesis, so the ethical view can be addressed with functioning tools, that makes it possible to understand future data gathered. This theory is used to address the hindering factor, that stand between assistive technology and a full adoption for seniors.

Assistive Technology

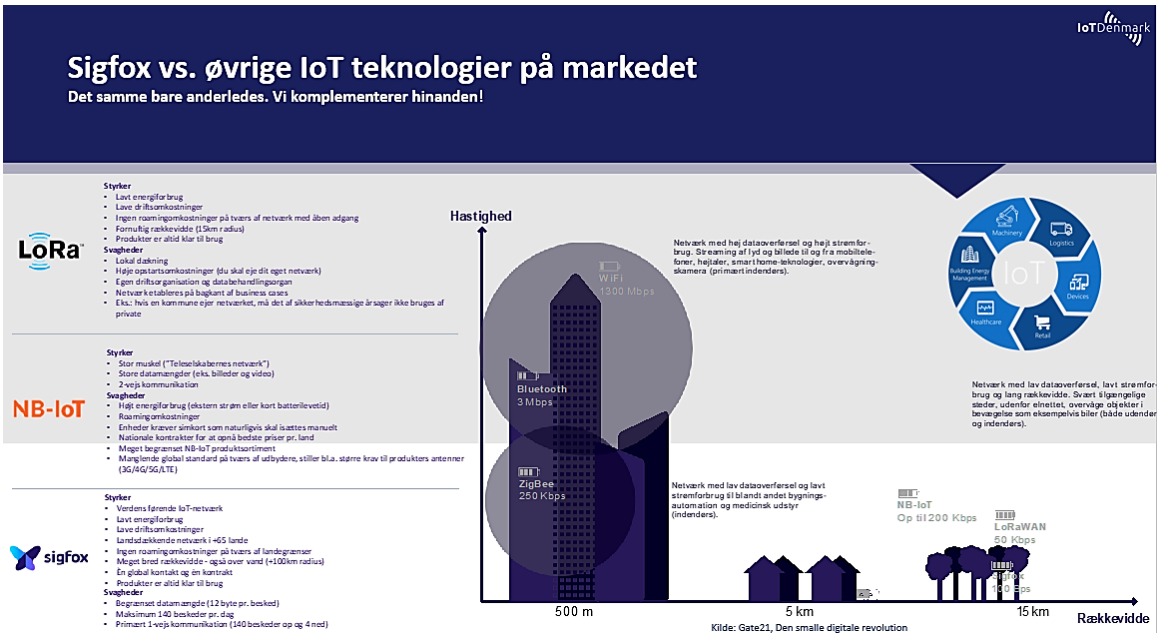
The definitions vary regarding assistive technology, the first quote is a definition from a municipality in Denmark: *"Assistive technology is technology that can help people to become self-reliant in their everyday and support caretakers in their daily assignments"* (Appendix Four). This next quote is from the study by Bratteteig on assistive technology in eldercare that states the definition on assistive technology as "*The notion of assistive technology, which in Norway is termed welfare technology, is an umbrella term for user-oriented technologies aiming to provide or assist users with public or private welfare services"* (Bratteteig, 2018). This is just two definitions out of many but what these have in common is that people should be assisted by an assistive technology either to become self-reliant and function in the society. This thesis makes use of both these definitions. Consequently, for this thesis the term assistive technology will be considered a term used for technologies that will assist a user, so they can become more self-reliant in their everyday.

There are different technologies that can be used as an assistive technology in this thesis context. This section will be the description of the necessary theory, needed to layout the playground for this thesis.

These technological theories are necessary to understand so the reader can follow the products that are discussed and the principles of technology that are used to understand the world. The introduced technologies in this section have all in common that they mainly are soft technologies, that needs to be managed by a human e.g. change batteries in the IoT device or start a robot vacuum cleaner (Hard and Soft Technologies, 2016).

Internet of things in this thesis, is the concept of connecting any device to a non-virtual object with an on and off switch to the Internet (Morgan, 2014). The purpose is to gather data that can give an understanding of a wide variety of subjects e.g. has the container moved, have the fridge been opened or are there registered water in the bed. In Denmark there are different IoT distributers e.g. Sigfox or the Lora Alliance.

These IoT providers have different ways of implementing IoT through how the device communicated and sends the data to a database. Sigfox have their own separate network of base stations that provides with connectivity to Sigfox based devices (Iot Denmark, 2019). Another IoT provider, the Lora Alliance makes use of a local Wi-Fi to create connectivity to their devices (Lora Alliance , 2019). Each connectivity option has their pros and cons, Wi-Fi have a shorter range than the Sigfox network but the Sigfox network are not very stable indoor. See the picture below for an overview.



Picture 9 – Sigfox vs. other IoT networks (CEO IoT Denmark, 2019)

In this thesis it is assumed that there are different types of robots, they differentiate through their purpose and the four types will be explained. The industrial robot is used for production, the definition is *"a*

programmable, mechanical device used in place of a person to perform dangerous or repetitive tasks with a high degree of accuracy" (Defining The Industrial Robot Industry and All It Entails, 2019).

The service robot has the purpose of do services for humans. The definition for a service robot is *"that performs useful tasks for humans or equipment excluding industrial automation applications"* (Service Robots , 2019). Through the next couple of years, the robot technology will keep increasing in the service industry and take over some of the work from employees (Willcocks, 2016). The benefits of these service robots are that they free up the employees time and opens for novel ways to complete a task and creative potential for the employees (Collier, 1983).

Social robots interact with humans their definition is" Social robots are robots that interact with humans and each other in a socially acceptable fashion" (Daily, 2017). The social robots gain success by the personalization and the meaningful interactions. They can help with many tasks such as rehabilitation, therapy, or assisted logistics (Boulos, 2013).

Software robots is an AI (Artificial Intelligence) system that can include machine learning and RPA. It runs on a host device rather than existing as a standalone machine (Rouse, 2019). These software's can function on desktops (RDA) or in the cloud (RPA) (What Is The Difference Between RDA and RPA, 2018).

To identify how and when people use technology a distinction between active and passive technology will be used through this thesis. Active technology is assumed to be technology the user directly interacts with. "*Customers touch it, figuratively or literally. They engage with active technology*" (King, 2020). With the likes of your phone, you interact with the screen and read the site you are on. Where opposed is passive technology, users do not interact with or is even aware of its use, assuming it is working. An example is power. Users do not interact with it but use it to power their phones, laptops and lamps. If it is working users don't interact or is even aware of its functions running in the background, supporting the user (King, 2020).

These technological theories are all part of the assistive technology. Therefor these theories have been used to give a deeper insight into assistive technology and its different competences and tools that can be helpful for the target group. Assistive technology is important because it covers many technologies and can provide a better welfare to the target group. The theories of assistive technologies are used in this thesis to gain an understanding on the definition of what assistive technologies in this project is defined as. Assistive technologies will mostly be focused around service robots in enabling completing tasks. Thereby, the assistive technologies theories are used as the foundation of this thesis and the problem statement.

Chapter 5. Analysis

The first section of the analysis will provide an introduction, to the technologies that have been discussed and are relevant to the interviewed participants world view. There are many possibilities in assistive technologies, but only the technologies that are relevant in the analysed markets will be included.
The analysis will build pillars from the presented theories and used to build bridges across theories to map how these relate. Pillar one, first will products/technologies met through data gathering be mapped in their psychographic group. The second pillar will map the psychographic groups with core needs. Third pillar will look at barriers related to the target group.

The Dose-can is introduced as a device designed to help users by reminding them to take their medicine at the correct time. This is an active technology because the user interacts with the device when they should take their pills and they also interact with the device when it is filled with pills. "*We also have a lot of focus on the medicine box - dose-can, which is a medicine box, which means that when the citizen has taken their medicine, the homecare is notified*" (Appendix Four, page 2 line 4-6). Thus, the device is an IoT product that is used in the Danish municipality, referenced as Alpha in this thesis, to rehabilitate people by helping them to remember their pills. Furthermore, the municipality also introduced another technology "*Then there is the electronic diaper which is an assessment diaper*" (Appendix Four, page 2 line 11), which is an active technology that will give a signal when a diaper is used and should be changed. The municipality also mentioned the robot vacuum cleaner, which is an active technology and a service robot that can contribute to the cleaning of a home (Appendix Four, page 2 line 22-23). Lastly, the second municipality, referenced as Beta in this thesis, mentions IoT products like the Apple watch's and use of its fall sensor, which is rated as the best on the market (Appendix Five, page 5 line 38-40). Lastly the data also gave an insight into the automatic light switch, which are more considered towards people with dementia (Appendix Five, page 4 line 29-31).

A professor from the IT-University in Denmark provided information about the robot vacuum cleaner and considered it a failure at the municipalities the professor has visited (Appendix Six, page 5 line 19). The professor has followed the implementation of different technologies in multiple Danish municipalities and currently they are working on implementing iPads (Appendix Six, page 3 line 40-41). They have also implemented some wash-dry toilets to seniors that have had difficulties using the toilet by themselves (Appendix Six, page 4 line 23-24). Furthermore, the professor mentioned Telenoid (Telenoid, 2020)OBJOBJ. The Telenoid is a social robot from 2007, developed in Japan that is designed to look like a human and developed to provide social interaction with a person (Appendix Six, page 8 line 30-32).

The CEO of IoT Denmark mentioned smoke alarms as a passive way to use IoT technology to detect smoke and alerting the target group through a high-pitched sound and notifications to associated phones (Appendix Seven, page 5 line 4-7). Furthermore, the CEO also mentioned tracking devices and showed other devices from the 700+ certified IoT devices that uses Sigfox (Sigfox Partner Network, 2020).

Every contributor to the assistive technology has opinions on the financial gains and if it is worth it. There are many new costs associated with implementing assistive technologies, at the municipalities. This includes implementation costs, training costs and costs towards hiring employees that can manage data and support. For the target group in general the main cost is buying the products and future maintenance cost. The costs vary according to the technology, some technologies are cheaper than others e.g. an IoT sensor can vary in costs from 300 DKK and up to above 1000 DKK (CEO IoT Denmark, 2019). The interviewed municipality Beta stated that in their municipality the assistive technology would provide a financial gain (Appendix Five, page 9 line 29). Where municipality Alpha was more hesitant towards the financial gain because of the major costs towards the structure and therefore the unclear path to success (Appendix Four).

Technology adoption

A technology's life cycle starts with the innovators that will buy the products when it is young, and the process will stretch over the different life cycles until it ends with the laggards. At this point the technology is either implemented as a standard or died out in an earlier phase and therefore, not adopted by all the life cycle adoption groups.

The technologies which have enough data, makes it possible to identify and map its position in the technology life cycle. It is important to note, that these technologies are positioned according to the given data, from the participants and not the general population.

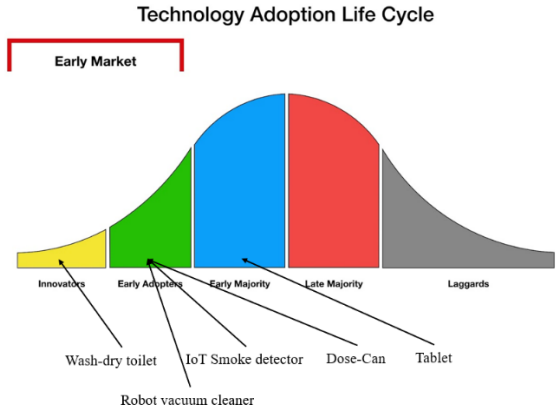
The chasm will be used in this section to understand the rights and wrongs regarding the identified technologies from the previous section. The chasm is built upon the technology life cycle which introduces cracks and a chasm on which innovation can be trapped and resulting in their growth stopping (Moore, Crossing the Chasm, 2014, s. 4). For this thesis, the theory of crossing the chasm has been used to understand the tendencies a product goes through and therefore understand the users that imposes these tendencies.

It is possible to cross the chasm if the innovators have the means to cross the different cracks and chasm. The most important rule is company unity, which is essential during the crossing period (Moore, Crossing

the Chasm, 2014, s. 8) and understanding each group and their unique psychographic profile (Moore, Crossing the Chasm, 2014, s. 8).

The key to success is to focus on the dominant adoption type in the current phase of the market, learn to leverage that segment's psychographic profiles and adjust the marketing strategy and tactics accordingly (Moore, Crossing the Chasm, 2014, s. 34). Thus, organizations must understand the groups psychographic, achieve company unity and strive for a mainstream market through a marketing strategy that successfully respond to all the stages (Moore, Crossing the Chasm, 2014, s. 34).

The picture below presents the visualization of the mapped technologies in the technology life cycle.



Picture 10 - Technology life cycle with examples

The Wash-Dry Toilet

The wash-dry toilet was given to people who had a hard time using a toilet. It is a problem because of the consequence of severe bacteria that could lead to illnesses (Appendix Six, page 4 line 23-24). This technology is placed in the technology life cycle model as the innovator. The reason for this is that the technology is only provided to few people through municipalities. It is still new on the market and the people who have received it acted as early evaluators (Moore, Crossing the Chasm, 2014, s. 39). Typically, a product in the innovator phase poses fewer requirements (Moore, Crossing the Chasm, 2014, s. 39) towards the products functionalities and the relevant consumers are well known enthusiast that makes great critics (Moore, Crossing the Chasm, 2014, s. 38).

For this product the situation is atypical, because the people who received this product had a strong need for it and received it through a middleman (municipality), they were so grateful to have received this product, that they did not provide useful criticism until very late in the process (Appendix Six, page 4 line

36- 48). Furthermore, this product belongs to the innovator phase because the products is new and only a few received it and these few spend hours trying to learn the products, tinker with it and was very hard to make unsatisfied (Moore, Crossing the Chasm, 2014, s. 38). One of the people that received this product, had problems with the toilet seat being too small which caused complications when she used the toilet paper. Therefore, she spent hours modifying a rod that could hold the toilet paper so she could use it correctly (Appendix Six, page 4 line 36-48).

The wash-dry toilet is mapped in the innovator psychographic group and the following table illustrate the scores related to the relation spreading, the better the score is the faster it is the spreading (Everett, 1983, s. 210). The relative advantage, compatibility, trialability and observability needs to be high for being a good score furthermore the complexity and risk needs to be low for them to be seen as a good score with the target group.

Attribute	Score
Relative advantage	Medium
Compatibility	High
Complexity	Medium
Trialability	Low
Observability	High
Risk	Medium

Table 12 – Attributes of innovation (Everett, 1983, s. 210)

"*Then there are the wash-drying toilets, where they were visiting some who had difficulty getting to the toilet, or some who had a lot of cystitis.*" (Appendix Six, page 4 line 23-24). The quote state that the relative advantage by acquiring such a toilet is perceived to medium, as it allows the target group with difficulties using a normal toilet by themselves, to be able to use it without any assistance, as well as maintaining a good hygiene.

Observability is high because the advantages are easy to identify for common users. The users live with their difficulties very day and easily acknowledge the advantage associated with a product that helps them manage their difficulties.

The product has high compatibility compared to the regular toilets, because of its almost similar usage. However, complexity is medium because there are more functionalities in the wash-dry toilet e.g. buttons that control toilet functions, thus driving up complexity of use.

The trialability is low because there no easy way of trying the product before the implementation. The users have a high need for the product; therefore, they accept the risks and override their emotional security. The risk is medium because the implementation is comprehensive, and it is difficult to remove the product in favour of the normal toilet after the full implementation.

Consequently, when the toilet is installed there is a risk associated with the product e.g. if the user does not find the product helpful. The risk could be scored as low if the organization had a whole product market strategy (Moore, Crossing the Chasm, 2014, s. 119). This strategy is lacking because there is no place to buy accessories to the product e.g. a new toilet seat that fit better (Appendix Six, page 4 line 36 - 48). Summed up the wash-dry toilet has not made the crack into early adopters yet, because trialability is the largest impact on relation spreading preventing further adoption with a, as stated, medium relative advantage and high observability. Furthermore, the organization behind the product have not fully managed to implement the important market strategies associated with further development through the products life cycle phases.

The Robot Vacuum Cleaner

Robot vacuum cleaner in an eldercare context provide mixed feelings. The first municipality Alpha stated that they have tried robot vacuum cleaners but there was no financial gain. Therefore, in that municipality people must buy this device themselves (Appendix Four, page 2 line 22-23). The second interviewed municipality Beta stated that there was a financial gain (Appendix Five, page 9 line 29) but in their municipality the citizens were not ready for the implementation and their attempted implementations failed (Appendix Five, page 1 line 27-28).

Furthermore, one municipality have implemented robot vacuum cleaners in 2013 (Jarl, 2013), around 2018 the robot vacuum cleaner is still used, and the person receiving eldercare can choose if they want manual vacuuming or robot vacuuming (Bjerre, 2018). The professor from ITU used the robot vacuum cleaner as a classic example on a failed assistive technology because municipalities had too high expectations to the technology (Appendix Six, page 5 line 19). This product is placed in the early adopter's phase because of its failed implementation attempts. The first municipality Alpha advises people to buy this product themselves, so it is assumed that a part of the people in the target group have bought this device privately.

The robot vacuum cleaner is mapped in the early adopter's psychographic group and the following table illustrate the scores related to the relation spreading, the better the score is the faster it is the spreading (Everett, 1983, s. 210). The relative advantage, compatibility, trialability and observability needs to be high for being a good score furthermore the complexity and risk needs to be low for them to be seen as a good score with the target group.

Attribute	Score
Relative advantage	Medium
Compatibility	Low
Complexity	Complex
Trialability	Medium
Observability	High
Risk	Medium

Table 13 – Attributes of innovation (Everett, 1983, s. 210)

Relative advantage is perceived to help vacuum cleaning; however, it does not provide the same level of cleaning as with manual vacuum cleaning. Compatibility is low as the way you interact with this product is no way near the same as when people do manual vacuum cleaning, and this product gives a new way of interacting which increases complexity. Thus, higher complexity gives a low score because it makes the spreading slower.

Trialability is medium as the product has a medium acquisition cost and the device cost from 1.400 DKK and up to 10.000 DKK. A regular vacuum cleaner cost around the same as the robot vacuum cleaner, but the difference is that it can also be bought much cheaper (Robot Vacuum Cleaner prices, 2020). Observability is high as the service provided by the product is easily observed and needed in every home. The perceived risk of robot vacuum cleaning is that you end with a product that cannot fulfil the service needed, thus spending lots of money on a half solution to their cleaning needs.

Summed up the robot vacuum cleaner have not overcome the crack into early majority yet, because the compatibility is low and it being complex. The user needs a new understanding of the product, and has a harder time associating the robot vacuum cleaner with the normal vacuum cleaner. Therefore, the early adopters have not yet spread the knowledge and opinions for this product to the next psychographic group for them to buy into it.

The IoT Smoke Detector

IoT Smoke detector shares the great potential of what many IoT devices can do in elder care and there are a variety of IoT smoke detector who is acting on the market e.g. Smockeo (Smockeo, 2020) or Siterwell smoke detector (Siterwell, 2020). These are all Sigfox devices that collects data on the user's environment so that it can detect smoke in case of a fire. In appendix seven the CEO from IoT Denmark states that everybody is using a smoke detector and therefore the technology can provide a continues innovation and pave the way for a multitude of IoT devices not commonly used today (Appendix Seven, page 5 line 4-7). The smoke detector is placed as an early adopter product, due to it bringing more value than a regular smoke detector and the value is likely only perceived by those who understands the technology (Moore, Crossing the Chasm, 2001, s. 9)

IoT Smoke Alarm is mapped in the early adopter's psychographic group and the following table illustrate the scores related to the relation spreading, the better the score is the faster the spreading (Everett, 1983, s. 210). The relative advantage, compatibility, trialability and observability needs to be high for being a good score furthermore the complexity and risk needs to be low for them to be seen as a good score with the target group.

Attribute	Score
Relative advantage	Medium
Compatibility	Medium
Complexity	Medium
Trialability	High
Observability	High
Risk	Low risk

Table 14 – Attributes of innovation (Everett, 1983, s. 210)

Relative advantage is perceived as medium but close to low, small new functionality such as data visualisation and a more secure feeling to the user through its standby messages. More security also makes the perceived risk lower as you get notifications about the product and its status.

Compatible is medium due to new features but the core product provides the same service. Thus, complexity arise with new features, however the functions have more of read-only purpose and does not provide options to give the smoke detector commands. The IoT smoke alarm has a high trialability due to

it being easy to test and because it can be bought in different online stores and to less than 1.000 DKK. Combined with a high observability the advantages are easy to understand and communicate for the target group.

The biggest differentiation between the IoT smoke detector and the normal smoke detector is the price, the IoT smoke detector have a different pricing strategy with the medium compatibility makes for a higher price than the normal smoke detector (Smoke Detector prices, 2020). Summed up the IoT smoke detector have not overcome the crack into early majority yet, because the compatibility and their market strategy consequently increase the price to much more than the regular smoke detector. Most of the users do not experience a fire and therefore do not feel the need for a fancy smoke detector, which only provides a little security but do not in reality get used.

The Dose-Can

Dose-Can is a device that remind the user that they need to take their medication (Dose Systems, 2020). This device is also used in the first municipality Alpha, where the caretaker gets a notification when the person has not taken their pills (Appendix Four, page 2 line 4-6). This device is used by the municipality as a rehabilitation device to make people self-reliant when taking their medication and help the users with the refilling of medicine at the correct time (Appendix Four, page 3 line 4-5). The Dose-can are placed in the early adopter's phase because the current users see the opportunities this product provide (Moore, Crossing the Chasm, 2014, s. 42) and there is a possibility that this product could generate a burst of revenue and visibility through this life cycle (Moore, Crossing the Chasm, 2014, s. 47). According to the first municipality Alpha the potential is there, and therefore they have a great focus on this device and its development (Appendix Four, page 2 line 4-6).

IoT Dose-Can is mapped in the early adopter's psychographic group and the following table illustrate the scores related to the relation spreading, the better the score is the faster it is the spreading (Everett, 1983, s. 210). The relative advantage, compatibility, trialability and observability needs to be high for being a good score furthermore the complexity and risk needs to be low for them to be seen as a good score with the target group.

Attribute	Score
Relative advantage	High
Compatibility	Medium
Complexity	Medium
Trialability	Medium
Observability	High
Risk	Medium

Table 15 – Attributes of innovation (Everett, 1983, s. 210)

Relative advantage is high because the dose potentially can replace the daily pill canister. The users must occasionally remember to pack their medication in the dose can when it is empty. So, the user's health increases when they remember their pills every day and at the correct time. The compatibility for such a product is perceived to be medium, as new feature change the way you take your daily pills and affect the complexity to be equally or a less complex process. The trialability is medium due to the common way of receiving the product through the municipality. The municipalities are not known for their fast approach in the screening process and therefore there can go up to some months for a user in the target group to get this product. It is easy for the target group to understand the advantages it brings as well as the risk being medium since it has a low price but require habitual changes.

Summed up the IoT Dose can have not crossed the chasm yet but the attribute scores that contribute to the relation spreading, indicate that this product is on the track to possibly cross the chasm in the future. The organization needs to keep on track and make necessary strategy regulations to be able to evolve further into the technology life cycle.

Tablet

Tablets is a complex technology as it allows for a multitude of use cases, and thereby some use cases being less complex. Professor at ITU states how purchasing groceries was a useful task to do online but it is a complex task to understand and handle (Appendix Six, page 4 line 14-17).The first municipality Alpha makes use of the tablet for their caretakers for documentation purposes, but the target group is not introduced to the products (Appendix Four, page 2 line 30-35).

The second municipality Beta have implemented tablet to some degree (Appendix Six, page 3 line 40-41) and make the target group able to borrow a tablet at the library and get help from a caretaker (Appendix Six, page 4 line 8-14). This is to aid them with grocery shopping, but that attempt failed due to the target

group not being able to buy the required amount the online grocery shopping website required (Appendix Six, page 4 line 8-14). This product is placed in the early majority phase because it is a widely spread, implemented and used product in other groups than the target group. Therefore, many from the target group have this product privately and can easily borrow or buy one.

Tablet is mapped in the early majority psychographic group and the following table illustrate the scores related to the relation spreading, the better the score is the faster it is the spreading (Everett, 1983, s. 210). The relative advantage, compatibility, trialability and observability needs to be high for being a good score furthermore the complexity and risk needs to be low for them to be seen as a good score with the target group.

Attribute	Score
Relative advantage	High
Compatibility	Medium
Complexity	Medium
Trialability	High
Observability	High
Risk	Low risk

Table 16 – Attributes of innovation (Everett, 1983, s. 210)

Complexity is lower than a PC, as a tablet has more closed functionalities locked into apps, like a smartphone. Likewise, with the compatibility the tablet is smaller than the pc and larger than the smartphone but provide similar functionalities. The trialability is high due to it being easy to acquire or test one in store, it does not cost much and are sold in many places. The use case of tablets is easy to perceive today, as there are so many apps providing different services playing to the tablets perceived advantage, as well the risks are low as it provides convenience rather than critical features. Summed up tablets are solidly placed on the early majority and are enjoying the attention at the time being. The technology has potential to move forward to the late majority, but not at the time being.

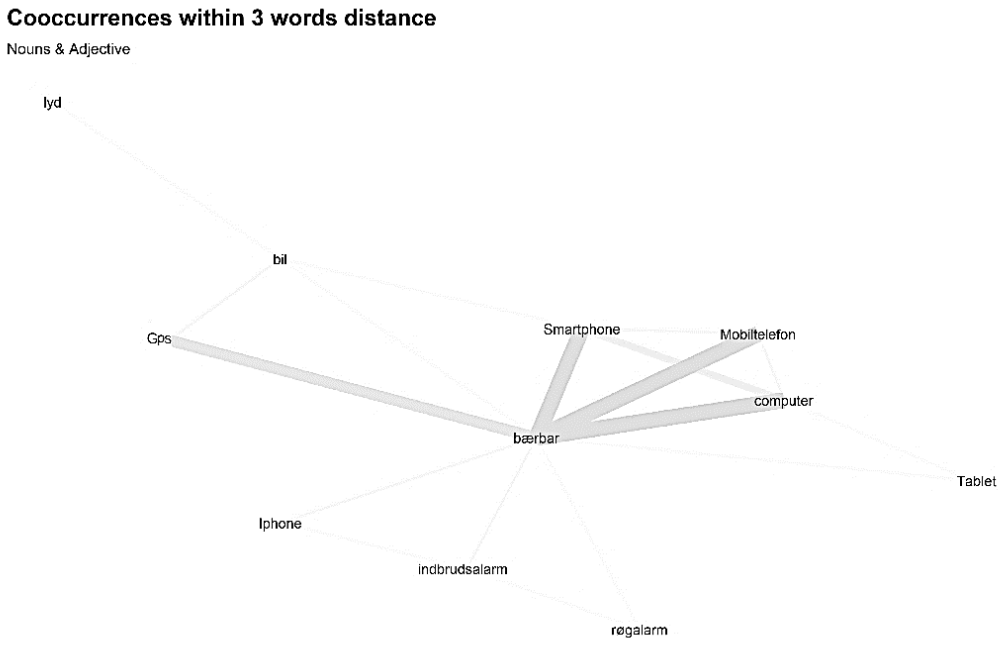
The last step in the adoption life cycle are the laggards that needs to be won over by implementing a product or component as a standard in everybody's daily day. Examples for this for the target group are the fridge or phone which is something almost everybody owns even though they do not necessarily like it, but they need it. The technologies all have in common, that they relate to the different individuals that

functions in the psychographic groups. These groups each have their core needs mapped in different ways regarding what they find important and not. Therefore, it is important to understand these groups and their needs and concerns so that there can be identified why assistive technologies have not been implemented to a higher degree.

The Overall Group Classification

The groups classification stretches over the overall target group of this thesis with their experiences and feedback regarding assistive technologies. The gathered survey data provide a random sample from this group and this analysis will lean on these data.

The data provided information such as 77 % of the participants showed an interest in getting help from assistive technologies when they need the help. Therefore, to get further knowledge on what technologies that are used by the target group now; the picture below is presented to introduce the co-occurrences of technologies mentioned.



Picture 11 – Co-occurrence on survey question one "Which technologies are you using today?"

88% of the participants feel that technology helps them in their every day and the picture above show their commonly used technologies. All the technologies mentioned more than two times by the target

group, the most frequent being Smartphone, mobile phone (mobiltelefon), computer and laptop (bærbar). This gives an overview of which technologies the target group is aware of they are using and have in their everyday life, this includes theft detection (indbrudsalarm), smoke detector (røgalarm) and GPS systems. Picture 11 it tells which technologies is being used together, and there is a strong correlation between smartphones and laptops as well as mobile phone and laptops. From the survey it was found that 65% receive help with their technology products, mainly from neighbors, friends, or family (Appendix Three).

Many participants have a laptop and a smartphone or mobile phone. Most who do not have a laptop have a computer, these people have a higher tendency to also have a smartphone than a mobile phone. Insinuating different needs as people with smartphones and laptops has their need covered in a different way than the target group who own mobile phones and laptops, where mobile phone has limited functionality, restricted to texting and phone calls. Where smartphone and laptops provide a broader opportunity and functionalities with the products, the relative advantage from the functionality along with trialability as well as the complexity to operate the products affect how well received the advantage of the smartphone is (Everett, 1983).

These products are spread through advantages and other criteria's being maintained. Design is an important relative advantage that increase the compatibility of a product (Appendix Eight, page 8 line 1-3). "*Form, function and logic, and a sensible user-friendliness*" (Appendix Eight, page 8 line 21). The quote is from an expert on the important relative advantages a product needs, he states that the form of design should be presentable, and the complexity needs to be small through user friendliness. These factors decrease the risk associated with a product and will make the product more adoptable to the life cycle. Furthermore, the price needs to decrease in development with the psychographic group to maintain adoption of the technology (Appendix Eight, page 8 line 31-17).

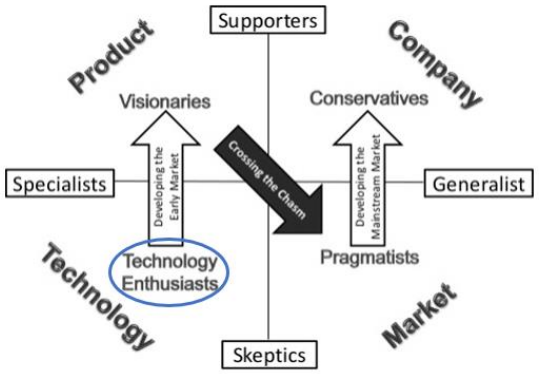
In combination with the relation spreading criteria being maintained for a better chance of crossing the cracks and the chasm, other group tendencies need to be identified for a better understanding of the products way through the life cycle. The four gears are a fundamental contribution to driving the organizations of assistive technologies to larger scales (Moore, Crossing the Chasm, 2014, s. 249). The gears base on acquiring traffic, engaging users, monetize their engagement and enlisting the faithful through engagement and thereafter acquisition (Moore, Crossing the Chasm, 2014, s. 249). The target group will firstly be acquired to the technology by ways of relation spreading. Thereafter the organization will have to engage users and monetize their engagement for understanding their interests, where after the faithful will be enlisted. The goal is to affect the target group as a unit to increase demand and thereafter supply which makes the organization better suited when the chasm and cracks should be crossed.

The individual persons opinion also plays a role for which underlying rationales the target group have and thereby how teach psychographic group justify their behavior trough their needs. Thus, a person classification is introduced below.

Psychographic Group Classification

Below is a classification with visualisations of the core needs for every group in the technology adoption life cycle, be aware that these visualisations are specific to the target group of this thesis, and not the overall population of Denmark. Furthermore, to illustrate the dynamics between the groups evolvement the competitive positioning compass are used to illustrate and describe the psychographic groups.

The innovator is in the early market where decisions are dominated by technology enthusiasts with products as key value - See the picture below for a visualization.

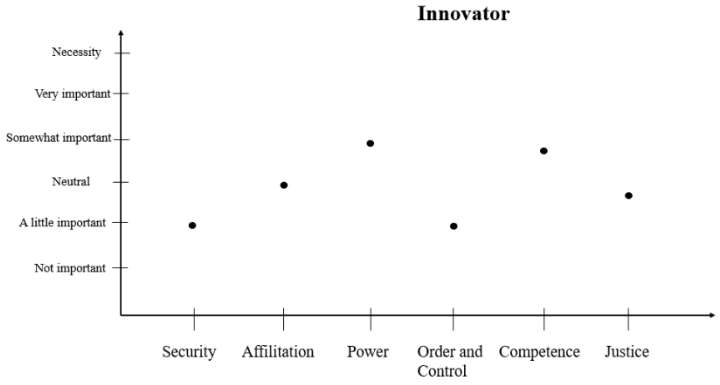


Picture 12 – Innovators placement in the competitive-positioning compass

The innovator is placed in the bottom left corner in the competitive positioning compass. In that placements are the technology enthusiast who acts as skeptic specialists. They find the product interesting rather than the market or company. This group is the first group in the life cycle which is the reason for the skepticism that is the common state in all beginnings. The technological enthusiasts are always on the lookout for new technological breakthroughs. They will not sponsor products but rather get involved in understanding the technology and thereby gain an appreciation for the product itself (Moore, Crossing the Chasm, 2014, s. 168).

To act in this group the organization must demonstrate a strong technology advantage by e.g. architecture, schematics, demos or trials (Moore, Crossing the Chasm, 2014, s. 189).

The picture below shows a visualization of the innovators mapping of core needs.



Picture 13 – Innovator core needs specification

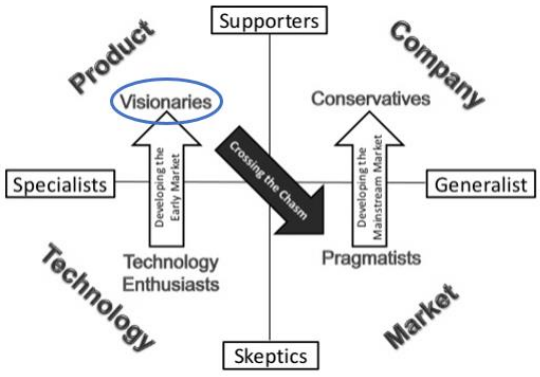
An innovator has been interviewed to understand this psychographic group. The interviewed person has at this moment a keen eye on nanotechnology (Appendix Eight, page 2 line 23-24) and IoT which he believes has huge potential. (Appendix Eight, page 2 line 39). He has as many innovators, tried having an influence on products through testing and being first mover (Appendix Eight, page 5 line 9-10). Therefore, the innovator has little need for security, as they are technology seeking and this makes them more risk seeking.

Where affiliation is classified as of neutral importance, innovators will move on to new technologies regardless of how their acquaintances influence them, thus need to feel part of a group is unnecessary as he states. "*Sometimes I think it makes us less social even if you are on social media. Through dinner my son and my sister's daughter, who did not know each other quite well, sat down most of the time and communicated via their smartphones. So, there were those two extremes there. The grown-ups sat and enjoyed some food and communicated at the table, and they communicated, presumably just as interesting, but in a different way.*" (Appendix Eight, page 6 line 20-26). The neutrality shows in the quote that the innovator found himself thinking that sometimes technology makes people less social, but he had no objection to the way his son and sister's daughter communicated.

Innovators finds it somewhat important to have influence on the result of the technology, and as innovators often create their own adjustments with technology, their adjustment shows some need for power. The innovator maintains power through buying technologies they feel is needed or useful (Appendix Eight, page 9 line 23), this psychographic group maintain power by controlling owned technologies, their functions and their life by deciding for themselves. "*If I couldn't move, I would imagine that I needed assistive technologies, but I would be able to decide for myself*" (Appendix Eight, page 9 line 34-35).

However, they need little control over everything often adopts new technologies and make the best of them, through optimistic view. "*I was super optimistic having bought a number of technological wonders, which today are packed away in a box. "*(Appendix Eight, page 7 line 16-19). Furthermore, the order and control level are easy recognizable through the innovator buying habits of research and impulse buying (Appendix Eight, age 7 line 36-38). Competence is important for the innovator because of their technology filled life (Appendix Eight, page 7 line 4-5). Justice has neutral importance as they often go with the flow and don't feel stepped on their toes (Moore, Crossing the Chasm, 2014), the interviewed innovator stated that he has experienced being treated unfair many times, but do not think twice about it (Appendix Eight, page 7 line 14).

The next group in the early market are the early adopters. The picture below shows a visualization of the competitive positioning compass.



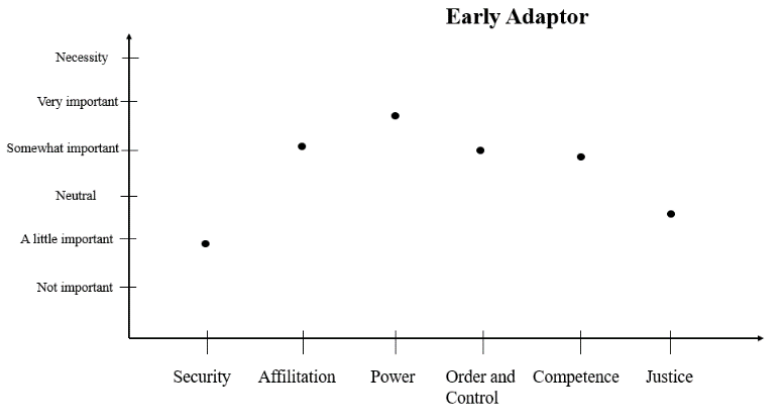
Picture 14 – Early adopters' placement in the competitive-positioning compass

This group is based on people who are specialists and supportive. They have moved vertically one step up in the model and are placed in the top left corner. This group is supportive rather than skeptic which

means that they support the value proposition and will take interest in the products and the organization (Moore, Crossing the Chasm, 2014, s. 168).

From the innovator to this group, the organization needs to convert the strong technological advantage to product credibility by e.g. benchmarks, product reviews, design wins or sales volume (Moore, Crossing the Chasm, 2014, s. 189).

The picture below shows a visualization of the early adopters mapping of core needs.



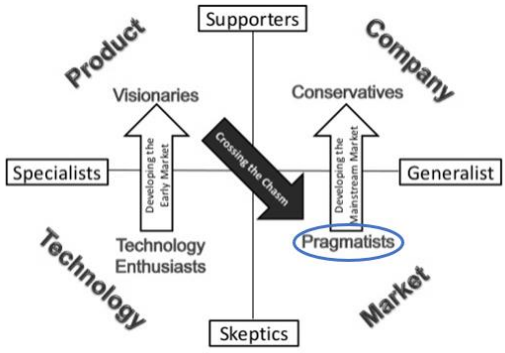
Picture 15 – Early Adopter core needs specification

Early adopters need little security when they seek new innovations as a result of the group seeing the perceived benefit. However, the early adopter needs communities to spread the perceived benefits, therefore it is somewhat important for them to have a network or community through the affiliation core need. Power is an important need as the benefit of the technology is their main purpose, thus being empowered by the technology becomes very important. Along with the need for order and control, early adopters, need to somewhat have control of what the technology can do for them, as well as feeling competent enough to utilize the technology. Competence comes somewhat natural due to early adopters' natural curiosity towards technology, as well knowing the neutral towards justice as they seek themselves the technology solution that changes their usage (Moore, Crossing the Chasm, 2014).

The interviewed person from the early adopter group stated that he got an Apple watch as a gift and did not know that technology at that time. "*Back then, I didn't know it, but over time, it has many benefits. It is amazing what it can do, there is training, weather, texts and mail also comes.*" (Appendix Nine, page 5 line 12-14) As the quote states, he quickly saw the benefits and learned the functionalities of the watch by

himself. An Apple Watch is for the target group not a mainstream product, therefore it is mostly innovators or some early adopters that own this kind of technology. The interviewed person has in favor of the Apple Watch, left the group matching his mindset. So, in this specific case, he functions as an early adopter. Through affiliation and his family, he forgot the need for security and felt a combination of increasing need for power and competence towards the acceptance and functionalities of this product. This made him learn the products functionalities and use it every day, even though his mindset should not qualify this temporary behavior.

The next group is the early majority, who is the first one to appear after the organization has crossed the chasm and entering the mainstream market. See the picture below for a visualisation of the competitive positioning compass.

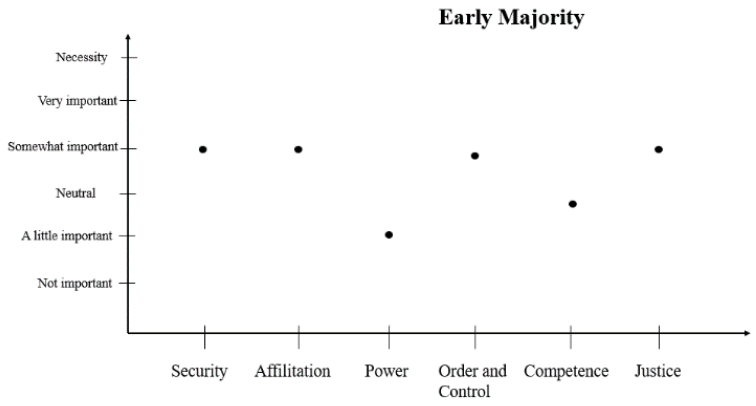


Picture 16 – Early majority's placement in the competitive-positioning compass

From this stage on, the chasm has been crossed and at this point it is the generalists that will be the acting group. This group is skeptic generalists and find market leadership and company stability more important than technology and its attributes. This group is the first after the chasm has been crossed and the mainstream market achieved. Therefore, the group have the common state of skepticism and are placed in the bottom right corner of the model. This group is always interested in new market developments, but the product must cover an unmet market requirement. Thereafter through an appreciation for the market opportunity they will start appreciating the organization (Moore, Crossing the Chasm, 2014, s. 168).

The organization needs to develop a mainstream market by demonstrating a market leadership advantage by e.g. market shares, third part support or standard certification (Moore, Crossing the Chasm, 2014, s. 189).

The picture below shows a visualization of the early majority's mapping of core needs.



Picture 17 – Early Majority core needs specification

The early majority group are adopting technology that have been presented to them by the early adopters. They have a need for the technology output and because of that, they accept the technology when it is presented to them. This group have a somewhat important need for emotional security and affiliation because they need a reference from the earlier adoption groups to feel secure enough to acquire a new technology. The interviewed person from the early majority group said that in a situation where he and his wife needed help from a caretaker with cleaning, the caretaker made the smallest excuses to abandon the job e.g. the vacuum cleaner did not work or that the caretaker did not know how the washer worked. For this group the security is somewhat important because they need to feel secure especially when they receive help, so they do not have to prepare emotionally every time a caretaker or assistive technology is assigned to help (Appendix Nine, page 2 line 28-29). The need to have affiliation is also somewhat important due to the conversations that happens between friends and family. "*What about your kids talking to them about tablets? Well, we do, because they are smarter than us*" (Appendix Nine, page 3 line 29-30). The quote from the interviewed person in this group states that they talk with family about their technologies because their kids are more knowledgeable regarding functionalities (Appendix Nine, page 3 line 29-30).

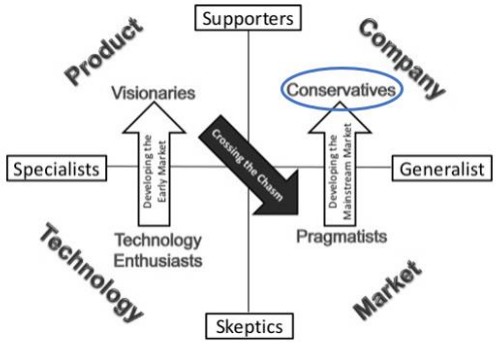
They do not need to have power and a direct influence on the product, but they have a somewhat important need to have order and control through structure and planning when using the product. Specific for this group the order and control plays a role because they do not let the technologies decide for them e.g. an Apple Watch will tell when you need to start moving, but people do not need to listen to an advise

(Appendix Nine, page 5 line 16 – 22). Furthermore, the justice is somewhat important because a large group of people have more influence specifically if the product do not provide justice.

"*Should things go wrong, I hope I fall over before going to a nursing home*" (Appendix Nine, page 3 line 2-3). The quote from the interviewed person in this group pointed out that he did prefer to fall over than losing the control associated with going to a nursing home. This is highly influenced by the groups need for control that is somewhat important (Appendix Nine, page 3 line 2-3). He told that he had heard so many awful things about nursing homes and even tried their food at the close by nursing home, but the food was awful. He talked about this like it was wrong to have such bad food due to the justice need being somewhat important to this group (Appendix Nine, page 3 line 5-7).

The feeling of having good competences vary a lot because this is a large group therefore this is at a neutral level. This can easily be seen from the interviewed person in this group because he stated that he had no trouble shopping online (Appendix Nine, page 3 line 2-5) or using Netflix (Appendix Nine, page 3-4 line 31-2) but he had no high desire to learn more than he found necessary or practical and he had no urge to discover further possibilities. This could have a large consequence for the product, because this group are responsible for communicating and influencing the products value to the late majority (Moore, Crossing the Chasm, 2001).

This second last group is the late majority. See the picture below for a visualisation of its placement in the competitive positioning compass.

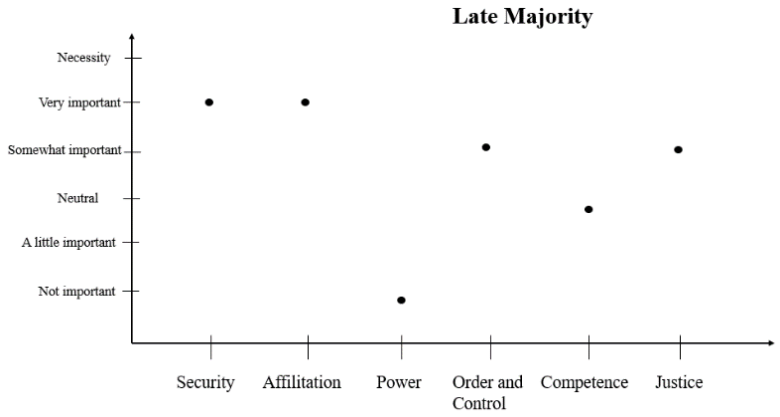


Picture 18 – Late majority's placement in the competitive-positioning compass

This group is the supportive generalists. It has moved a step up vertically in the model, so it is placed in the top right corner. Therefore, they are supportive of the value proposition and will take interest in the products and the organization (Moore, Crossing the Chasm, 2014, s. 168). The organization must convert

the market leadership advantage to company credibility by e.g. revenue, profits, strategic partners (Moore, Crossing the Chasm, 2014, s. 189).

The picture below shows a visualization of the late majority's mapping of core needs.



Picture 19 – Late Majority core needs specification

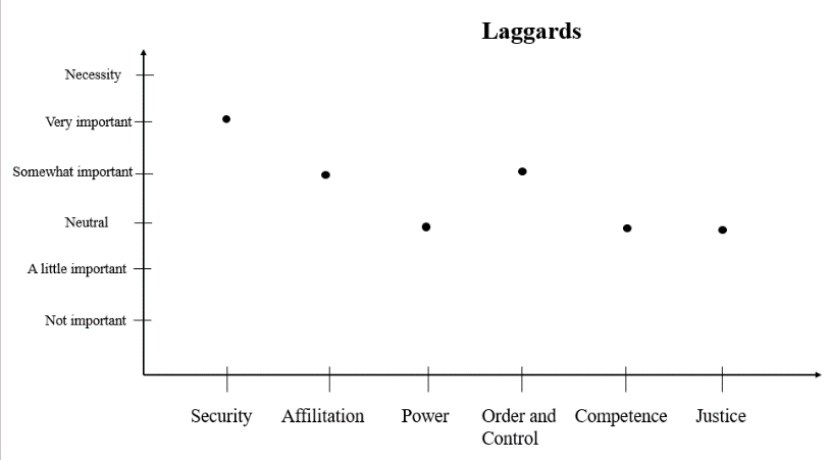
The late majority group adopt technologies when the early majority have shared the technology and influenced the late majority into using the product thus clearly affected by the bandwagon effect. The late majority feel neutral with their competence, it is important for this group that the product is well supported and documented, so they do not need their competences as much as the earlier groups. This factor also plays a role regarding the feeling of physical and emotional security, the group will first take the technology into use when they feel secure about the product, its services and when most of their social group are recommending the product. The late majority group have no need for power and influence on the products results but do find it somewhat important that they have order, control and justice through structure and planning with e.g. the need for product support (Moore, Crossing the Chasm, 2014).

"Well I also have the iPad and so we sit many times and compete with games, but I'm not the one who manages anything (banking, mobile pay, shop online and the like)" (Appendix Nine, page 1 line 20-21). The interviewed person in this group stated that she had the competence to use an iPad but because of this groups neutral competence she did not find her competences and opinions important - this is recognized because she left in the middle of the interview due to distraction. Emphasizing how effective the bandwagon effect is on late majorities. This groups need for power is not important, this is easily recognizable because she lets her husband do all the managing e.g. banking. She trusts her husband with

the important managing and therefore feel more secure which relates to the groups common need for security that is very important. Furthermore, she receives a high level of support from her husband which helps her sustain the need of somewhat importance for order and very important need for affiliation.

The last group is the laggards, the only way an organization can step into this market is to make their product a standard e.g. a component used in all cars. In that way the laggards will likely only buy the product unintentionally or without knowing they bought a certain product, due to it being hidden in another product (Moore, Crossing the Chasm, 2014, s. 168).

The picture below shows a visualization of the laggards mapping of core needs.



Picture 20 – Laggards core needs specification

The group laggards are a small group who have a high need for physical and emotional security, because the laggards keep to themselves and are only using technologies that are perceived as a standard to the overall target group. It is assumed that the laggards keep themselves isolated from these technologies because of a need to feel secure, maintain some form of power, order and control. They feel competent enough in their daily life and the level of affiliation is assumed to be somewhat important for the average person of the target group. Furthermore, the justice and power vary according to the individual but are assumed to be close to neutral for this group because they do not need to affect or be affected by the technology in various ways (Moore, Crossing the Chasm, 2014).

Through these individual mappings and the participants, several barriers have been identified. These barriers will be described and used to understand the target groups concerns regarding assistive technology.

Barriers

There are many small barriers that prevent users from buying products e.g. money or competence. What was learned from the previous section was that the target group have core needs that play a huge role in their behavior e.g. by the early majority that switched for a time to the early adopter.

At other times a product will not cover the acquired need which will make the products life cycle stop in one of the cracks or the chasm. This is worst case scenario for the product which means that the organization have not created their market strategy towards the psychographic group. Because the robot vacuum cleaner did not provide an advantage high enough compared to the regular vacuum cleaner, the target group did not find their need for the assistive technology high enough to consider buying it. Furthermore, there are products which have a working strategy but needs to evolve with the psychographic group to follow the development of their life cycle. Examples hereof are Dose-Can and the tablet, where both needs an evolving strategy according to their current placement in the technology life cycle. They thrive where they are now but can easily fall into one of the cracks or the chasm.

Another example is the IoT Smoke Detector who have the correct relation spreading and strategies, but the product is harmed by its price compared to the normal smoke detector. The need for this product is simply not big enough to cover the higher price. The IoT smoke detector need to either lower its price or make a new strategy that will increase the users' needs by making the advantages more important.

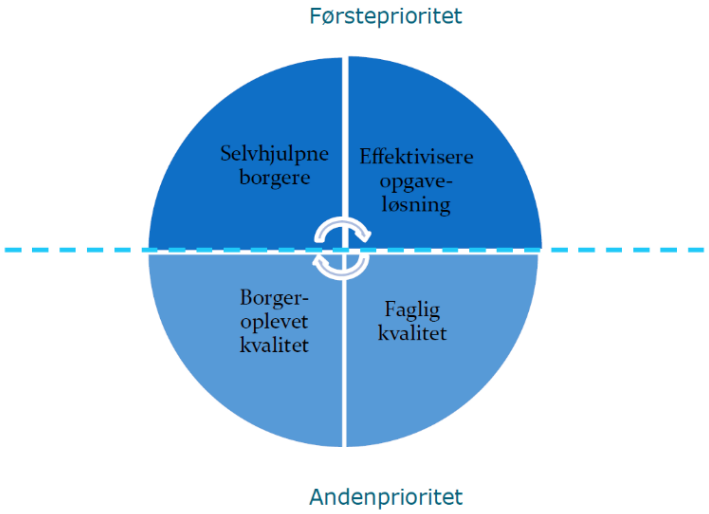
The participants perspectives of concern will be included to apply the individual's psychographic group maps and analyse how these functions with the barriers from the participants.

The Middleman Barrier

A barrier associated with assistive technologies way across the cracks and/or chasm is the municipality barrier. The municipality are in between the technology and the target group. Their job is to have an overview of the assistive technologies on the market and communicate the technology to the people, the municipality have screened and concluded needs help. 18 % of the participants receive home care from a municipality but 46 % feel they need more help. Through interviews observations identified that a huge

factor for the middleman were the high pressure from the political front (Appendix Four). The last resort they offer to their citizens with a high need of help is the nursing home, of which 97 % of participants wishes to stay away from. This is also reflected in the interviewed innovators statement: "*Nursing home. Just the word makes the hairs on my neck rise.*" (Appendix Eight, page 3 line 41-42).

Through interviews, municipalities experience different barriers. The primary focus is efficiency and the secondary are citizen experienced quality, as well as the observation that caretakers fear the assistive technologies will take their jobs. Regarding the efficiency, they have priorities which is followed – see the picture below.



Picture 21 – Municipality Alpha priorities (Appendix Twelve)

The picture shows what their strategy aims for. Their first priority is to make their citizens self-reliant or solve caretaking tasks more efficiently. Their second priority are professional quality and citizen-experienced quality. The arrows illustrate how the means interrelate by the self-reliant citizen who affects the efficient task management and so on. Thereby completing the circle.

The important factors for the municipality are to make citizens self-reliant aided by assistive technology that contributes to the strengthening of the citizens own resources, so that the citizen can better utilize his or her own functional skills in practical everyday life. The technology should help reduce the cost of welfare services or can be kept at existing cost levels. As well is required from the municipality to have capabilities to manage the data becoming available through different sensors.

"*I wanted to write my thesis on welfare technology, because it can save so much money, but it requires a completely different capabilities from the employee.*" (Appendix Four, page 7 line 14-15).

Thereby changes the needed capabilities to run a modern eldercare service. Lastly the professional quality, assistive technology should support the employees' solution to a better professional quality in the work. An example of the need to be efficient through these lines is the wash-dry toilet. "*which can be used so that citizens who would otherwise need help with toilet visits can do it themselves and do not need help. It makes both the citizen more self-reliant and it is efficient. This makes the solution interesting*" (Municipality Alpha). Thereby using technology as an enabler, like the wash-dry toilet, because it can make the user more self-reliant and efficient.

Caretakers are more like friends to many recipients and in extreme cases their only network, "*moreover, it is also found with a citizen that the arrival of a home helper is their only network. So, one has to take care of the loneliness.*" (Appendix Four, page 3 line 37-38). However, often they are a close friend thus also the ones the target group trusts and talks with, and from whom they get most of their information and influence from. Municipality Alpha states how important it is for them to have their employees correctly informed around the impact of new technology (Appendix Four, page 3 line 26-30). As scepticism from employees can seed in the target group, making adoption of the technology less likely. Using caretakers as messengers and representative of technology can be an effective tool to reach the target group. More so for the late majority psychographic group than early adopters, because caretakers can help bridge the need for technical support and lack of knowledge that late majorities has. Covering these needs as reflected in core needs, employees can gap the need for affiliation late majorities has, by making a technology feel safer. As well by being a trusted person help accommodate their justice feeling, avoiding that the technology makes the target group feel unfairly treated.

An important factor is the target groups freedom: "*citizens want freedom. Because the caretaker stops by 4 times a day... they feel it like a station, because there are people walking in and out their homes.*" (Appendix Four, page 3 line 32-35). When devices like the IoT Smoke detector, comes into their home it is still important to feel this freedom. This freedom-term is, among other, combined through factors such as safety, security and autonomy. For which IoT devices sets different scenes than previous technology like smartphones and laptops. Like smartphones, IoT devices monitors - but only a specific measure such as temperature or humidity - and stores data in centralized databases. Much of the data collected today, can be used for various purposes, however for the target group it is only interesting to monitor a given user if they have the need to be monitored for the given setting e.g. the user smokes, forgets about the cigarette and it ignites something in their home the smoke detector can enable a direct message to the

municipality and even neighbors, aiding the user to escape their house. Freedom will therefore come at a small cost of feeling monitored. Hence, the ethical perspectives need to be taking into consideration.

The Ethical Barrier

When technologies are attempted to be implemented by the municipality or through an organization on the B2C market, the ethical barrier is highlighted by the participants. As the analysis have demonstrated up until now is that there are many of these cracks and/or chasms and it is easy to fall into the pitfalls and stop moving forwards. Therefore, this section will investigate what barriers there have been discovered and possible how they can be prevented so that technologies can in the future can get through the cracks or chasm.

One of the biggest barriers when analysing assistive technology have been the ethical discussion. The target group of this thesis are considered the end user of assistive technology in a private setting or they are offered the technology by the municipality. The individual opinions are important to understand, so the line can be drawn, and it is possible to understand what concerns they have and why some technologies do not cross the cracks and/or chasm.

Picture 22 – Word cloud from survey question 13

The ethical barrier is one of the most important topics for the users of assistive technology in the target group. This is illustrated in the picture above, from the survey. In the survey question 13, asked the participants to explain if and why some of the previous questions went over the ethical line for them.

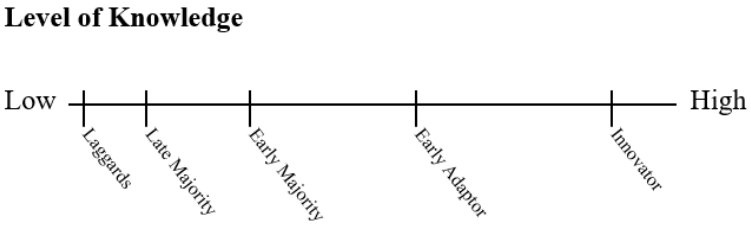
Around 50% have answered the question and the word cloud illustrates what they have overall answered. The words/sentences that are used the most are data, monitoring (overvågning) and “Because it is my home!” (Fordi det er mit hjem!). These show a lot of concern towards the monitoring and the data that are gathered in that target groups private homes. Overall, the general impression shows that there are many concerns towards the complexity, data gathering, monitoring, private life, and misuse of data. A part off the participants had a critical view on technology and mentioned that they were happy with their existing life situation. It’s a typical sign of an innovator or early adopters' mindset to have a progressive attitude and low importance need for security towards technology (Moore, Crossing the Chasm, 2014). These participants have the mindset to act as an innovator or possibly early adopter, but they do not have a physical or mental need for the product, which is important regarding the target groups and their adoption of assistive technology.

Some of the people was open to the technology if they got in a position where they have a need for it and did not have problems with the monitoring or the data. This is people who acts further down the line of the psychographic groups as the safety needs increase (Appendix Four, page 6 line 8-10). These people have a mindset that makes them act according to the need they have, if they have a need for a wash-toilet and are some of the first to be introduced to the product, they act as innovators. The target group are, for some, needs driven which makes it circumstantial if they happen to be in the innovator or early adopters' group but for others they act as innovators by heart and are therefore not needs driven (Moore, Crossing the Chasm, 2014). As it can be seen in the individual mapping, because of the need that drives the target group e.g. they can have a mindset that will put them in the late majority group, but because they have a strong need for a specific new product that will cover the need, they will leap to the innovator group for period but only with this specific product.

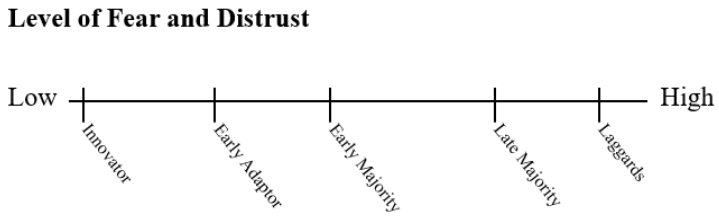
Researchers and developers have a higher need to reflect and understand their products ethical aspects (Ahlbom, 2020), because the users have an increasing critical opinion towards ethics and technology. The evidence for this statement is the surveys the target group answered, 70 % relates critical to assistive technology in their homes (Appendix Three). Having assistive technology in the participants private homes affects the privacy parameter regarding safeguarding intimacy, identity and physical integrity. Privacy is important for all participants and relates heavily to the dignity factor (Toolkit, 2020) which is the factor about avoiding any forms of surveillance or invasive control over individuals. Data should not be used to collect unauthorised private information or to publicly disclose private facts (Toolkit, 2020).

It is clear in that the participants from the surveys are mostly concerned regarding the privacy and dignity being violated by assistive technology. The interviewed person from the innovators psychographic group had knowledge on what data assistive technologies gathers, and how to change the data output if he felt the data violated his privacy or dignity - "*I do not care. I know exactly what can be gained from censor-based monitoring, auditory monitoring, image monitoring, and I still don't care. I also know how to shield against such things - and when I'm not there I don't care*" (Appendix Eight, page 10 line 4-8). The innovator had no fears or concerns regarding data because of his knowledge.

"*It is perfectly acceptable; it is an aid in everyday life. Both for the person himself and those in charge of the people*" (Appendix Nine, page 7 line 10-12). The quote from the interviewed person in the early majority psychographic group found assistive technology acceptable because the technology is meant to help, and he trusts the technology and data owners. This differs from the participants that did not trust the technology, they tended to be critical because they do not know where their data ends and what they are used for. Illustrated below is the level of knowledge regarding data storage, gathering, owners and usage, this enables to determine the level of fear and distrust.



Picture 23 – Level of knowledge per psychographic group



Picture 24 – Level of fear and distrust per psychographic group

The ethical factor of data protection is the factor of providing users access to their data and explanations about how personal information is used (Toolkit, 2020). Furthermore, there is the factor of safety and

security that states the protection of users against harm due to assistive technologies (Toolkit, 2020). These parameters can contribute to making the users less critical, if they more visible and the users understood them. The interviewed innovator has the knowledge of the data protection factor, he is not as critical and show as much fear to being monitored (Appendix Eight, page 10 line 4-8). As the pictures above show, the innovator has a high level of knowledge regarding data gathering, storing, owners and usage (Appendix Eight, page 6 line 16). Because the innovator typical have a high level of knowledge they also typical have a low level of fear and distrust.

The GDPR law from 2018 provides regulations to companies regarding protecting of privacy (Data Protection 101, 2020). This law has taken some of the ethical barriers into consideration and the law provide a way of improving the factor of privacy. By affecting among other, anonymizing collected data to protect privacy and the consent of subjects for data processing. GDPR provides a start regarding ethical rules and guidelines, this law is based on privacy and dignity but has not taken other factors into consideration like autonomy.

"*Does it give you a feeling of being monitored? How much does it affect the feeling of being free and self-determining?*" (Appendix Six, page 7 line 25- 26). The quote is from the ITU professor that wonders about the effects of being monitored and whether the human lose their sense of freedom or self-determination as an ethical consequence. It is more widely known what the short-term consequences are by assistive technology. But it is still unknown what the long-term ethical consequences are for human e.g. mental condition and health (Appendix Six, page 7 line 2-3). The ethical factor well-being states that an individual's well-being should be constant or increased, this factor disclose the purpose of assistive technology. But the question for the long-term of using assistive technology is how the well-being will be affected by the usage of assistive technology in private homes.

Ethics is a set of rules or guideline (Appendix Six, page 7 line 5) that needs to be specified, so users can understand what their data are used for and the possible consequences. Furthermore, developers need to be able to evaluate on ethical approaches to guide their thinking and development (Ustek-Spilda, 2019). Common rules or guidelines could benefit by increasing knowledge and providing a common ground so the developers and users can get their need of e.g. security or justice fulfilled. This could give the overall implementation of assistive technology a more positive view, so the users can more easily adopt the technology by being less resistant. To have these guidelines and rules would benefit and provide info regarding the long run of the user's wellbeing with the ethical perspective taken into consideration and what monitoring does to a human being.

In consideration of the guidelines and rules there needs to be more visible explanation to the ethical factors of data protection and security/safety. The ethical factor of transparency states that the users should have access to information concerning personal data processing and encouraging transparency about data operations, device usage and upgrades (Toolkit, 2020). Furthermore, the autonomy is the perspective of safeguarding an individual's self-determination and freedom of expression (Toolkit, 2020). The levels of transparency that users' need to understand is principles of data protection and safety/security by making them more visible and make them common knowledge. Knowledge could provide users with a better way of securing their autonomy by taking their part of the participation factor. The participation factor is to effectively engage in data processing design through debate and dialog, this should include user and developer/organization and can contribute to a better accountability through effectively addressing security and safety issues (Toolkit, 2020). By participating in these ethical factors, the user and developer/organization get a better relationship which could benefit most of the psychographic group's needs. By creating a better relationship with more transparent communication the users will be less critical and more open to having assistive technologies in their private homes.

"One cannot exist in society without being able to communicate in the same way as everyone else communicates." (Appendix Eight, page 1 line 17-19). An expert state that one should communicate like everyone else to be able to function in a society, this communication form evolves constantly. Consequently, the ethical barrier should be considered important and as it is now, it is of big concern to the users of assistive technology in the target group. There have been made attempts to manage the various factors at play but have only touched the surface of the concerns. Important factors to take into consideration is the need for rules, guidelines and transparency. Transparency should make the way for the rules and guidelines. The rules and guidelines should open discussions regarding ethics and concerns which should remind organizations as the ethical council in Denmark (The Ethical Council, 2020) or GovTech organizations (GovTech, 2020), that they should be front runners in creating awareness.

Testing

Actions often define one's opinions (Thaler & Sunstein, 2008). Therefore, this test is included to provide feedback on the target group opinions through their actions and transparent communication. In this way, it is possible through implementation of a physical device to verify the output of the analyzed barriers. The purpose of this test is to see if a couple in their seventies use their fridge as much as a couple in their fifties. Thereafter, comments were gathered and because there is no current example in Denmark, where seniors have used IoT and is confirmed satisfied with the results (CEO IoT Denmark, 2019).

The device that was used is a Sens'it (CEO IoT Denmark, 2019). This device is a Sigfox test device with a small variety of functionalities e.g. temperature and humidity measuring. Because of it being a test device, it only has a limited sending amount and can send 8 messages an hour. This means that the device will stop counting when the fridge is opened more than 8 times an hour. This does not affect the overall results, because the goal is to identify if the couple have healthy eating habits.

"*The first test stretched from November 8, 2019 to November 13, 2019. The test included two persons in their fifties, where one had high technological experience and the other has a low experience. The comments after the test was "I didn't notice it" and "it just worked.""* (Sørensen, Houmann, & Skov, 2019). This couple were generally satisfied and undisturbed by the product and the gathered data.

Date	Amount	Specification
November 10	43	Door opened and closed
November 11	49	Door opened and closed
November 12	30	Door opened and closed
November 13	43	Door opened and closed

Table 17 – Data from test one (Sørensen, Houmann, & Skov, 2019).

Picture 25 – Data log from test one (Sørensen, Houmann, & Skov, 2019).

Through the second test the two test persons being seniors, had a low technological experience with a behavior similar to a late majority. Late majority finds security and affiliation very important. Order and justice are somewhat important where competence is neutral, and power is unimportant. This couple received help from family to technology and had a neutral view on their competence level. Furthermore, they did not own a tablet which is located in the early majority group, this match up with them being late majority. Through the test it was important to maintain their needs by socializing about the technology and how it can help them to support their affiliation and security. Order and justice is somewhat

important, which was managed by making sure they knew what their data was used for, why they were included and how they can use the device to make them understand the situation on thereby provide security order and justice.

The results from this test and future data from the device could possibly be used to monitoring or surveillance and therefore violate the ethical factors of privacy and dignity that many participants from the target group fear. So, the goals with the communication was to maintain a positive view on the assistive technology and not violate the included persons ethical factors of privacy and dignity. Because the test subjects are in the late majority group, they tend to have a higher level of fear due to less knowledge about data in general.

"*Test two with the seniors, stretched from November 14, 2019 to November 24, 2019. Their comments similar to the participants from the first test "I didn't notice it". Through the test period the fridge was opened one time every other day*." (Sørensen, Houmann, & Skov, 2019). These data indicated that this couple did not open their fridge enough throughout a day and therefore it is assumed that they did not have healthy eating habits trough the test period.

Date	Amount	Specification
November 14	2	Door opened and closed
November 18	2	Door opened and closed
November 21	2	Door opened and closed
November 24	2	Door opened and closed

Table 18 – Data from test two (Sørensen, Houmann, & Skov, 2019).

"The hypotheses for this test was that the target group could have an IoT device, accept it and get a positive experience from it. Furthermore, it was assumed that a couple in their seventies would open their fridge less than a couple in their fifties" (Sørensen, Houmann, & Skov, 2019). The assumption was correct, due to the fridge not being used every day and only opened and closed a couple of times a day when it was in use. By including the couple in the data, they shared the knowledge that the woman had a bad leg so preferred not to cook and were both social through many senior events with dinner (Sørensen, Houmann, & Skov, 2019).

The test concludes that people from the target group can successfully fully adopt an assistive technology in their daily life and by using the data increase their welfare by eating more consistently. What holds them back is that they are in the psychographic group, late majority. This is the second latest group in the technology life cycle and therefore there is more required to take this group into consideration.

There is a line regarding assistive products for the target group, through observations the target group understood that assistive technology is meant for assisting the user (Appendix Nine, page 7 line 10-12). Therefore, 77 % showed interest in getting help from assistive technology. But there are limits to how assistive the technology can be versus the level of monitoring. The Sens'it was accepted as an assistive technology due to its low monitoring level, it measures a specified parameter e.g. temperature or light level. When the level of monitoring increases the criticism increase with it, so when an assistive device has a high level of monitoring e.g. video monitoring, the users tend to draw the line (Appendix Nine, page 6 line 23).

The criteria's related to the maintaining of relation spreading needs to have a high score for these individuals to consider buying a product or for them knowing about products existence. There needs to be a low complexity, high relative advantage and low risk. It is important to have high scores when securing strategies regarding relation spreading e.g. the tablet and IoT smoke detector have a high score via low complexity, low risk and high trialability. Consequently, these products have moved through steps in the life cycle and have potential to someday reach the late majority, but the products need to cover the previous psychographic groups first.

Also, design is an important advantage that increase the compatibility of a product. The form of design should be presentable, and the complexity needs to be small through user friendliness. This provides higher scores that can speed up the relation spreading of a product e.g. the dose-can is the new player and are on the way to a high score via a high relative advantage through acquiring traffic of users that are engaged by the advantages of rehabilitation.

This test was concluded successful due to no ethical factors being violated by having transparent communicate on data and level of fear or concerns. The participants stated they found the data useful and understood the data that were provided, even though they act as late majority and therefore has little interest in these unfamiliar technologies. This test show that assistive technology can to some degree be implemented in the target groups home and by doing it correctly it will not violate they privacy and dignity.

Overview

For this thesis, the main view was on assistive technology and its functionalities helping to increase welfare of the target group. By the semi structured data gathering method branches used by the assistive technology appeared – see the picture below for an overview.

Picture 26 – Overview of findings

The first branch of assistive technology are the organizational strategies of which theories state that organizations needs to have strategies for them to evolve in the technology adoption life cycle and cross the chasm or the cracks.

The technologies the participants strived after was the active Dose Can technology, robot vacuum cleaner, IoT smoke sensor, the wash and dry toilet and the tablet to general aid e.g. grocery shopping. They are all in different stages of their life cycle. There are different ecosystems, a widely known example is the Sigfox network with over 700 different buyable devices - all for different use cases - but with this large number of devices, one wonders why assistive technology is not more prevalent. Even though 77 % of the participants showed an interest in getting help from assistive technologies when they need the help.

These technologies were analysed for better understanding of them and their underlying abilities and placements by using the four gears and the criteria to maintain relations spreading.

Products	Relative advantage	Compatibility	Complexity	Trialability	Observability	Risk
Wash and Dry toilet	Medium	High	Medium	Low	High	Medium
Robot vacuum cleaner	Medium	Low	Complex	Medium	High	Medium
IoT Smoke detector	Medium	Medium	Medium	High	High	Low Risk
Dose Can	High	Medium	Medium	Medium	High	Medium
Tablet	High	Medium	Medium	High	High	Low Risk

Table 19 – Overview of criteria

The table above show the overview of the criteria associated with the products and their findings. Summed up the wash-dry toilet has not made the crack into early adopters yet, where trialability with the largest negative impact on relation spreading, prevents further adoption, with a medium relative advantage and high observability. Furthermore, the organization behind the product have not fully managed to implement the important market strategies associated with further development through the product life cycle phases. The robot vacuum cleaner has not overcome the crack into early majority yet, due to low compatibility and complexity. The user needs a new understanding of the product and has a harder time associating the robot vacuum cleaner with the normal vacuum cleaner. Therefore, the early adopters have not yet spread the knowledge and opinions for this product to the next psychographic group for them to buy into it.

The IoT smoke detector have not overcome the crack into early majority yet, because the compatibility and their market strategy make for expensive products. Most of the users do not experience a house fire and do not feel the need for a fancy smoke detector, which only provides a little security but do not in reality get used. Furthermore, the IoT smoke detector is an IoT device which have monitoring attributes and therefore the product has not developed as far in its life cycle as e.g. the Tablet. Because the users are afraid of getting their privacy and dignity ethical factors violated.

The IoT Dose Can have not crossed the chasm yet but the attributes scores contribute to the relation spreading indicate that this product is on the track to possibly cross the chasm in the future.

Lastly the tablet, is solidly placed on the early majority and are enjoying the attention at the time being. This product is further in its life cycle than the IoT Smoke detector because of the more commonly understood and accepted monitoring because of its relative advantage being high. The technology has potential to move forward to the late majority, but not at the time being.

Furthermore, the psychographic groups branch out from the organizational strategies. The psychographic groups are the innovator, early adopter, early majority, late majority, and the laggards who have all been introduced and mapped with their core needs to understand each group underlying tendencies regarding what drives their behaviour.

The Innovators map of core needs is that they find power and competences most important. Justice and affiliation are neutral where security and order are less important. The early adopter finds power most important where competence, order and affiliation are somewhat important. Justice is neutral and security is less important. Early majority finds security, affiliation, order, and justice important where competence is neutral, and power is of little importance. Late majority finds security and affiliation very important. Order and justice are somewhat important where competence is neutral, and power is unimportant. The last groups are the laggards, that finds security very important, affiliation and order somewhat important. Power, competence, and justice are neutral.

These groups act upon a unique profile but the target group in general also acts as a unique group. The target group act heavily upon their needs, therefore, they can have a mindset that will put them in the late majority group. But because they have a strong need for a specific new product that will cover the need, they will leap to the innovator group for a period but only for this specific product. 88% of the participants in this thesis, feel that technology helps them in their every day and the most frequent technologies that are being used are Smartphones, mobile phones, computers, and laptops. 77 % are interested in getting help from assistive technology which makes the potential for assistive technology increasing the welfare of the target group. 70 % of the participants are critical to assistive technology due to ethical concerns.

The second branch that stretches from assistive technology is the middleman or also called the municipality. Municipalities act as middlemen between the target group and assistive technologies. They proved a few barriers, like optimizing service versus quality of citizen due to pressure from the

government as well needed other capabilities to manage the data from IoT devices. In the care service, caretakers are more like friends to many citizens and in extreme cases their only network. Using caretakers as messengers and representative of technology can be an effective tool to reach the target group. More so for the late majority psychographic group than early adopters, because caretakers can help bridge the support need and lack of knowledge that late majorities has. An important factor is the target groups freedom, which is being questioned with IoT technology and its use for monitoring. Having small sensors can proves useful for given use cases and does not monitor other things than e.g. smoke in the room. Thereby enabling security for a small cost of monitoring which opens for the barrier of ethics. Furthermore, the municipalities differed in their data, mostly in the economic aspects due e.g. the robot vacuum cleaner where one municipality called it an implemented success, another had tried the technology but failed to implement it and the third found it provided no economic gain for them.

Both the middleman and the organizational strategies opened the barrier of ethics. The expert stated that one should communicate like everyone else to be able to function in a society. Therefore, the ethical barrier is important due to the commonly need for affiliation and communication every human being possesses. There have been made attempts to manage the various factors and ethical opinions, but the surface has only just been touched.

The innovator typical have a high level of knowledge and a low level of fear and distrust. Overall, the level of knowledge of data in general decrease trough the evolvement of the life cycle, that means the fear will rise when the knowledge decrease. Hence, the later psychographic groups showed an increasing concern towards the complexity through data gathering, monitoring, private life and misuse of data. The participants showed a considering amount of concerns regarding monitoring due to distrust of technology, they tended to be critical because they did not know where their data ends and what they are used for. The participants were afraid of being violated of their privacy and dignity and therefore related 70 % critical to assistive technology in their homes.

Through the participants and interviewed experts' important factors was established. To take into consideration is the need for rules, guidelines and transparency. The further in the technology life cycle the product gets, less knowledge is obtained by the psychographic group. So, the ethical concerns will be considered more important due to the increasing lack of knowledge and the increased emotional/physical safety need. This factor can be neutralised by transparency through awareness in the data knowledge field. As the test showed, even people from the late majority managed to accept assistive technology if the implementation was transparent so that trust was establish and thereafter acceptance. Making guidelines

and facing the problems have proved to be the way with ethics and example is the GDPR law that have surfaced due to ethical failures and discussions and have now become more than guideline but a rule.

Nudging proposition

The analysis has identified what the target groups behaviour currently are. Which is that the context of assistive technologies is not commonly used by the target group to increase their welfare in Denmark. In Denmark the context of assistive technology is, that it is distributed through the municipality for people getting eldercare or organizations selling to private people. This context is important to note because it plays a role for the involved people's actions. Lastly through the context of what the target group are doing now the analysis have identified why their behavior is as it is through the classifications. Furthermore, it identifies the underlying rationales and how users justify their behavior through the core needs mapping. This provide a picture on the current context of the target group (Thaler & Sunstein, 2008).

Before behavior can be changed into a specific direction, the wanted behavior must be identified so that one or more relevant nudge strategies can be designed (Thaler & Sunstein, 2008). The wanted behavior is for the target group to be overall open and trusting of the assistive technology, so that it is more common to own these technologies. Some psychographic groups are more trusting than other, but all the groups should be as trusting as their mindset allow them to be e.g. laggards have a harder time trusting technology but can do it under some circumstances, if the requirements are met. The incentives should be the increased welfare potential and expect error through e.g. misunderstandings from the target group (Thaler & Sunstein, 2008).

The table below show the relevant analyzed ethical factors from the analysis and their relevance to the barrier. The privacy, dignity, data protection and safety are the ones that the target group fear the most where the rest are important factors the target group should and could use to neutralize these fears.

Ethical factor	Relevance for barrier
Private	Respect for the user's private life.
Dignity	Data should not be used to collect unauthorised private information.
Data protection	Personal information should be respected and used correctly.
Safety and security	Protect users against harm.
Transparency	Access to information.
Autonomy	Individuals self-determination.
Participation	Engage.

Table 20 – Relevant ethical factor overview

Technologies with ethical problems will have huge trouble going forward because they do not get the users trust, as demonstrated less knowledge equals more fear over technologies and its impact. Thus, the further the product get in the technology life cycle the harder it gets establishing trust. The farther in the technology life cycle the product gets, less knowledge is required by the psychographic group. Therefore, the ethical concerns will be considered more important due to the increasing lack of knowledge and the increased need for safety. Furthermore, the amount of people will increase which means there will be more users expressing their concerns.

For around 90% of the time people act on the basis of system 1, the automatic system. System 1 means that people act fast, automatic, uncontrolled, unconsciously, intuitive. But there is a great need to identify with system 2, which is slow, reflected, controlled, consciously as the reflecting human being (Thaler & Sunstein, 2008).

Transparency is the main design solution in this thesis, for which it could increase knowledge through awareness spreading, discussions addressing issues and common guidelines that can become a rule or a law in the future. The goal with these nudge strategies is to affect the target groups behaviour positively towards assistive technology, is to make the actions required as easy as possible (Thaler & Sunstein,

2008). Transparency through knowledge sharing and open discussions, makes it easier for the target group to participate due to the more knowledge on actual impacts on their daily life and their ethical concerns. But the transparency makes it less easy to communicate, because there is more work associated with organizations and users in sharing data and include more discussions.

A good place to start is with a nudge strategy, that will require relevant organizations to provide transparent information e.g. the ethical council in Denmark (The Ethical Council, 2020) or (GovTech, 2020). They should increase other organizations attention on the topic more directly than they are doing today by addressing the topics. Through contact with the council, they informed that regarding data ethics they are focussing more on (Lykkeskov & Andreasen, 2018). They show no interest in the ethical perspective regarding data gathering, storing, owners and usage in private homes through assistive technology - see appendix ten for mail correspondence. It would mean more work e.g. educating employees, for them to start including a wider perspective on ethics, but it would make their organization more memorable.

Furthermore, these nudge strategies provide a benefit for the propose of being addictive by transforming tasks, actions, and behaviors to becoming habits, and thus to move tasks from system 2 to system 1 (Thaler & Sunstein, 2008). The need for transparency is a large topic and should be addressed by organizations such as the ethical council, IoT Denmark and the municipalities so that there can be made several separate nudge strategies to how each included participant can address the issue and alter behavior so that organizations in unity can neutralize barriers. IoT Denmark have a web page where they could start making data available to users. The idea is to nudge people to be part of the enrollment of transparency, so through their web page they could share their initiatives and the ethical concerns by including their customers to increase validity of their products. Lastly, it is important that every participant emphasizes transparency and addressing ethical issues in a simple manner so that every person can understand the purpose and initiative. The separate nudge strategies should not violate a person's ethic e.g. violating of autonomy can happen when informed choices are not included in a nudge (Sunstein, 2015). Worst case scenario is a nudge strategy designed to allow manipulation, which should be avoided at all costs in this thesis (Sunstein, 2015).

Typically, people behave like the bandwagon effect, this means that the behavior of others are used to decide what the individual will do, because people like to be part of the norm (Thaler & Sunstein, 2008). This is an important factor regarding a nudge strategy, used to overcome barriers in the process of implementing behavioral changes. When all the participants make their contribution to the mass

communication of transparency it will become a norm to have a high transparency through awareness and knowledge sharing. Mass communication is quite effective at informing so therefore this is the way to go for the assistive technologies and its barriers. Furthermore, the process of feedback to consumers through better information and disclosure should be followed more closely in combination with high transparency and appeal to the reflective system (Thaler & Sunstein, 2008).

Through time the mass communication will increase common knowledge on data in general for the target group and make them more trusting towards assistive technologies. When they are more trusting, it will trigger a behavioral change by the target group starting to use the technology more commonly and the sales will increase on the B2C market. Through a higher sale and awareness, the users will require the organizations and government address the ethical problems that should rise or still are a problem. This can result in new laws like the GDPR that will address the user's ethical needs.

The process will first of all need traffic through organizations sharing knowledge, communication and addressing of problems and common concerns. Thereafter, the engaging of users and organizations monetizing their engagement. Users who engage in the matter will require the organization to increase the transparency of knowledge communication and addressing of problems for it to become a norm in the society. These gears will require engagement of organizations and later users for it to thereafter secure acquisition (Moore, Crossing the Chasm, 2014, s. 249). The process will take many years and will probably never stop due to new assistive technologies being developed and the target groups behavior will change with time so new ethical barriers will emerge. By including many organizations and their separate nudge strategies the chance of having effective impacts increase which is important because it is difficult to design a nudge strategy "just right" (Dholakia, 2016).

Chapter 6. Discussion

The discussion will be a critical evaluation of the learnings from the literature review versus the findings from the thesis. Furthermore, the discussion will grant an understanding on how the findings contribute the concepts from the literature review and challenge either point critically. Lastly, future assessments and a process evaluation will be presented.

The current body of knowledge is mostly based on case studies on a specific technology e.g. smart home. Many of these studies provide positive results on which assistive technology could benefit the welfare of the user whereby many of these are from the target group. Assistive technology has the potential to overall improve the welfare of the target group by introducing ways for caretakers to perform rehabilitation with the target group or monitor the health or habits of the target group and thereafter give notifications when conditions are not healthy. Thereby giving assistive technology the power to improve welfare by making it easier to improve bad habits or unhealthy conditions. Sigfox is one of the IoT ecosystems that exists today, and they have over 700 different devices in their partner network. With this large number of devices, one wonders why assistive technology is not more prevalent.

The products from this thesis were products important at the market e.g. the Dose-can, wash-dry toilet or the IoT smoke detector. The target group have a specific set of needs with different importance according to their psychographic group. But mutual for all, is that these people are extremely needs driven to the degree of not noticing important device failures due to the need for the device's functions being so strong, that the criticism is forgotten. An important factor to notice is that technology is not unethical, but the use of it can make it unethical. Therefore, when these people have a high need their criticism is forgotten because their usage intentions are not unethical, and they trust other involved parties to not use the technology with unethical intentions.

The implementation attempts towards assistive technology was both from municipalities and organizations trying to sell to the private user or influence the municipalities. As found municipalities explained they did not have the capabilities today to manage this sensor data coming in. Thus, is far from being able to leverage and build predictive service as Skubic suggest sensor data can be utilized to.

With municipalities current implementation strategy being to products are controlled by their way through the life cycle which affects if the product will be implemented successful or not. The target group have control over products by their involvement contributing to the products development through the life

cycle. For products that do not make strategies according to the psychographic group they sit in and appeal to them and the next psychographic, will fall into the chasm or cracks. By ignoring these strategies, the organizations will neglect the users core needs and the users will resist the product e.g. the robot vacuum cleaner that is too complex with a too little compatibility.

The testing of a simple assistive technology went as expected by following the findings of the barrier analysis. Thereby the findings of being transparent regarding knowledge communication and addressing of ethical problems was successfully. Therefore, the behavioural changes suggested is to engage the users and organizations monetizing their engagement. Then, the users who engage in the matter will require the organization to increase transparency for it to become a norm in the society. By making the organizations engage the users will start to also engage which will hopefully start a loop of which organizations and users follow a norm of being transparent which will secure acquisition.

Assistive technology

There are three main groups assistive, user involvement and ethics. The groups start as being specific but will become more of a general discussion by which patterns and key relationships will be discussed regarding the findings and the body of knowledge.

Bratteteig focus primarily on municipalities, which shows in our findings to have a slow integration of technology solutions. Because they need a complete solution whereas the individual senior can easier grasp their own need and find a solution in the market. Making it more difficult to use different technologies as more care is needed, supporting the inverse relationship. Bratteteig illustrates an inverse relationship between active use of technology and formal care, indicating the worse the condition or more help needed, the less they can do themselves. Which can be elaborated by the adoption of technology, see the picture below for the illustration. Where Bratteteig finds less use of active technology the care tasks needed to be done is personal grooming and care, in this segment have this thesis found the target group does not notice the sensors as per “Testing” and the municipality Alpha reported how with many visits they felt their home like a station. Thus, IoT devices could be a solid solution to provide the right level of care, without running in and out of their homes, when testing and our findings show that the target group does not feel monitored by sensors. As per interview with early majority, they consider video monitoring as critical and other monitoring e.g. environment monitoring sensor, more towards helpful monitoring. Considering the municipalities priorities to efficiently solve care taking tasks, this reflects with the more care needed and less technology being used. The technology used is more passive which also provide less caretaking heavy tasks. IoT devices seems to cover the gap to monitor on acceptable levels and provides a

level of information that tell if a citizen needs a physical caretaker. Thus, IoT could extend the selfcare from Bratteteig's study with less need for formal caretaking.

The target group only accepts a certain technology if they can see the benefits of its use through some form of coverage of a behavioral need. Early majority, who can understand the technology, need front runners to clear out bumps on the way.

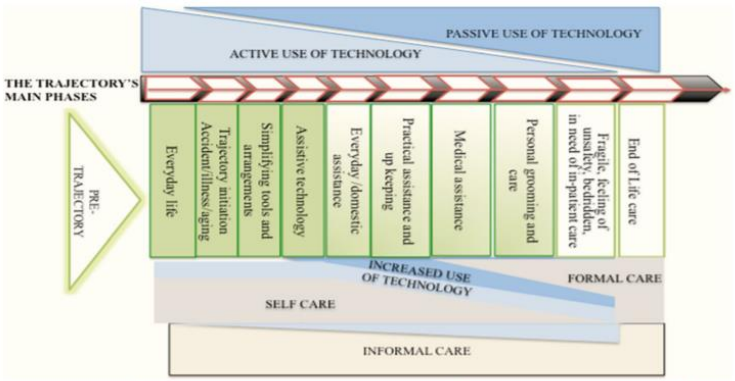


Figure 6. The figure shows how technology provides layers of increased support in the care services including self-care, informal care and formal care, prolonging elderly persons' time within a phase of the trajectory.

Picture 27 – The technology layers

The illustration above shows a form of the staircase trajectory of which the green color indicates the number of technologies included in each section trough the trajectory. There is a higher level of active technologies used in the user's daily life, with a user who lives in their own private home. When the user grows older and have an increasing need for help, an increasing level of passive technologies take over the active ones e.g. through hospitalization. Taken this into consideration, there is a pattern with the other concept of starting to implement assistive technologies to the old adult's group. The goal for this is to stretch the passive use of technologies to cover more of the users that is still living in own private homes. In that way the assistive technology will be implemented and accepted earlier by the target group and provide greater potential when the user grows less independent.

As already stated, is the factor of it being beneficial to start earlier with a technology implementation so if the target group is above 65, it could be beneficial to start implementing the technology when they are in their fifties. Through this thesis the target group have been people above 60 years because the goal was to reach people that potentially could benefit from assistive technology today or in the nearby future. It was clear that the ones that did not need help from assistive technology was clear about their situation but was

also the ones that was positive towards it, when they one day needed help. Therefore, this rule of including people from an earlier group have been beneficial to this study but it is important not to reach too far out and include people that are too young. This could easily give negative consequences.

Smart home technology is a very used principle regarding assistive technology and may be part of the answer in helping keep seniors independent and at home longer while reducing the workload on care takers since the number of seniors are increasing. Through the test it is concluded that assistive technologies provide data that can improve the target groups welfare and independence. The importance is for data to be understood and used in the correct way. Data provide no information but in a context of a situation and understanding of the data structure it could provide important information. For the best scenario, the information should influence the data providers behaviour through learning that the fridge is not used enough and learn from it. If awareness of the possible learnings, understanding and behaviour habituation then the target groups welfare could increase even though the numbers of the group are increasing.

Marketisation in Danish eldercare has mainly been fostered by the Free Choice in home care legislation. It was introduced in order to improve efficiency, quality in care and user autonomy, and was expected to lead to more user-led services and to result in a more cost-effective and quality-conscious eldercare sector. The welfare has the potential to increase with the target group, but the work conditions of the caretakers could also increase due to more structured work and some assignments that will be removed from work schedule. Through assistive technology eldercare could further improve in efficiency, quality and user autonomy by following technological developments of the future.

Furthermore, as the technologies development goes forward the municipalities need to evolve their organization with it, which means making strategies that combines the employees and the technologies. Researchers found resistance from nursing staff due to the common fear of being replaced by the technology, this matched with the observations that the caretakers fear the technologies will take their jobs and their negative view easily converts to the target group. Furthermore, it was observed by the leaders of these caretakers that they felt that good care is linked to genuine relationships and social interaction. Therefore, these caretakers who are employed by the municipality plays a big part in the middleman barrier.

For the municipalities to be part and prepared for the future, they need to take into consideration that better information is necessary so the caretakers understand that technologies are not coming to take their jobs, there is still a high need for “warm hands” but the technologies will cover the tedious assignments,

so the care takers can focus on what is important. This is the goal, but there are challenges by the extremely high need from the municipality of efficiency that press the caretakers, like the municipality being pressed by the government. There is a pattern here going in evil circle – this needs to be broken by strategies.

User involvement

When writing and searching for information to the literature review it was quickly discovered that there were many case studies on the field but not many who used the users in their studies to more than just the necessary. The ethical study by Zwijsen, Neimeijer, & Hertogh from 2010 were very specific about their disagreement with the level of user involvement and ethical considerations. Of all the research papers included in the literature review approximately 50 % of the studies did not include the users at all and most of the ones that did include users included them to a small degree.

An interesting concept was the one that investigated the potential of adding a client perspective to an already existing model. By adding a client perspective to the original Orlikowsky and Gash, it was interesting to study the use of the technology in close physical proximity to the clients and the impact on service delivery. The interesting thing about this is that the primary interest in this study was with the caretakers. The product was a robot vacuum cleaner that caretakers installed in a senior's home which is making the caretakers and the senior the users of this device. This is a classic example on how the actual user is forgotten.

As stated in the analysis, there is a tendency for the target group to feel the need to outdistance from technology due to the quick development. Therefore, the target group tend to withdraw and is easier to oversee them in studies. As a result, it is harder to include them and as a result, their opinions are not included and is overall harder to get. This is clear from the literature review.

Through an ethnographic study, concepts were discovered that a difficult situation happens by trying to satisfy both the designers and users' point of view. Designers of welfare technology tend to generalize the elderly but at what cost? Generalization can function but is not a good approach when dealing with a big group of many different individuals. Like this thesis have showed it is hard to just generalise the target group down into the life cycles psychographic groups e.g. the interviewed person from the early majority had tendencies to switch group to the early adopter at times.

In Denmark, there has been invested in developing national strategies to speed up the uptake of welfare technology in Danish municipalities but many municipalities experiences barriers. As is the thesis section about the middleman, it is a hard role with a lot of pressure to manage e.g. the political pressure. Furthermore, there is other barriers for the seniors e.g. pricing because the assistive technology in general still is not cheap. It is a relevant question on how to lower the prices so that more players can function on the market. Primarily there is a lack of higher supply which should lead to a higher demand via more user involvement.

Ethics

More and more technologies are being developed and implemented in the homes of elderly people, while the ethical implications using such devices remain underexposed. The findings state that the ethical implications are known for the short run but not the long run e.g. Installing assisting technology devices in homes just because technology is available could lead to the loss of skills because a person becomes over reliant on the system. This could be a long-term implication, but because ethical perspectives are not commonly reflected upon with every development process the topic remains overlooked. This should be assessed in the future as to challenge the perspectives, opinions, and fears.

Researchers found resistance by stigmatization. The primary findings of this thesis did identify no form of stigmatization between the target groups individuals. This could be due to the data difference in this study versus the researchers who experiences stigmatization in their study. The two studies had different settings which reflects on the data by social group, country, year and so on. The data difference presented conflictions by the different results. This was the most frequent conflict in this thesis but neither of the studies are wrong, both are correct in their own ways.

Previous study results state that most of the seniors need for devices overrule privacy concerns but this conflicts slightly with this thesis. In this thesis, this is not the case because 50 % of the participants showed concerns towards surveillance and privacy. This differentiation could occur due to the difference in the written year, the statement is from 10 years ago and surveillance are a bigger and more important topic today due to the examples in the world e.g. China and social medias.

However, some contradictions are present due to the declaration that seniors feel that they do not want anybody to automatically know when they fall, because they would like to cope with it themselves. This

statement match with the participants opinions of this thesis, that they would like to maintain their privacy and dignity.

Ethical principles are more commonly used by nursing staff or caretakers to consider the e.g. beneficence, which is the requirement to benefit the patient. Or non-maleficence which is that no harm should overcome the patient. These principles are commonly used today e.g. confidentiality which is to not disclose information considered to be secret, the confidentiality has become a part of the law, just as the GDPR that have been created to respect privacy to some extent. Slowly ethical principles are implemented into laws and maintained daily, but the process is slow and there are many ethical factors e.g. the toolbox.

In Denmark, the moral principle and value-based principles have dominated since around 1996. The principles that are important are equality, solidarity, security, and autonomy. These have similarities to the ethical factors that also includes autonomy and security. The principles are achieved by transparency and accountability. Denmark is a country that have had transparency as a value for many years, because in Denmark we like transparency and what the words is associated with e.g. honesty, openness, and credibility. But it seems that the target group have not noticed the desired ethical transparency due to their fear of being violated ethically. As the thesis states there is a need for transparency to share and spread guidelines and rules regarding ethics to maintain a commonly higher knowledge about data in general so that the fear of ethical violence will be minimized e.g. by having the ethical council, GovTech organizations or the Danish DaneAge association starting neutral discussions on the topic. Furthermore, relevant organizations need to act and start making the topic more transparent and look on a wider perspective. There are a number of ways organizations can start the transparency awareness campaign e.g. social events, share gratitude or distribute brochures, cards and other objects (Miller, 2014).

Future research

As discussed above the long-term ethical consequences are unknown could it be beneficial to experiment with these consequences. The participants of the thesis showed that the level of monitoring is important. So, a high level of monitoring e.g. video monitoring in a private home is not considered ethical acceptable, but lesser e.g. the Sens'it is fine. Researchers have experienced that after two months seniors seem to get used to the technology and do not consciously think about it. This should be analysed on why this could be a common trend that happens with a wide variety of assistive technologies with monitoring

traits and what the long-term consequences is for a human with assistive technologies in their private homes.

"*As a researcher, it is not our job to determine if a decision is right or wrong. Ethics is about providing a framework and structure to reflect on the decision you make.*" (Ahlbom, 2020). Ethics is about providing a framework and structure to reflect on the decisions a developer, municipality or associate make. As the thesis states there should be created guidelines and from them rules should be established. The road forward is transparency and discussions, so that everyone can gain a common knowledge and use that knowledge to minimize fear and distrust for assistive technologies. So that the 70 % of the thesis participants that was afraid of being violated of their privacy and dignity, would be less afraid and thereby decreasing the percentage. There are examples where these laws are introduced e.g. the GDPR law that was recently introduced and required a new way of thinking of privacy than before. There are many guidelines to ethics, the toolkit used in this thesis is a solid way of including many of the important factors. In the future there will be a need for the general population to make more laws regarding ethics and some of the factors from the used toolkit will probably be taken into consideration, but this process is very slow. Which is why there is a need for awareness spreading so the population know in which direction the government should be pushed.

As stated in the user involvement discussion, the target group tend to exclude themselves from technology due to the fast development. Therefore, the target group is harder to get a hold of e.g. in studies, and consequently their opinions is not included e.g. in studies that deals with them. In this thesis it was important to overcome this obstacle due to the importance of the target groups opinions. Through the participants, important knowledge was gathered e.g. the importance of the ethical barrier and the fear associated with no knowledge on the field. Through the thesis it was identified the importance of including all the relevant groups to an assistive technology. As a result, there should in future assessments be included all relevant users' statements even though the target groups are hard to reach, some wanted to be included and found it exciting to be part of an ongoing study. The advice is to include seniors in studies where it is relevant, they have excellent opinions and statements that are highly usable.

In anticipation of future assessments there is a lot of potential in further research on the relations between assistive technology and the technology life cycle through the six criteria to relation spreading and crossing the chasm. There is much potential to further identify tendencies on assistive technologies and its important factors regarding a goal of increasing the usage. An example of a way to go forward is through the important factors of form, function, logic, and a sensible user-friendliness. The important relative

advantages a product needs, is that the form of design should be presentable, and the complexity needs to be low through user friendliness. These factors decrease the risk associated with a product and will make the product more adoptable to the life cycle, but further research could reveal any potential and specific usage in regard to improving the ethical barrier.

Municipalities experiences barriers and as a middleman between users and suppliers, they provide barriers as well due to external and internal pressures e.g. the external political pressure and the internal pressure from employees. As discussed in a previous section, the municipalities require strategies to deal with their need for efficiency and pressures driving them in different directions. Therefore, a future study that would address specifically the municipality through their barriers when implementing assistive technologies. The research should investigate the pressure from the government, the pressure from the employees, the technologies and how it is implemented and from there develop strategies to manage the players in the most efficient and ethical correct way to implement assistive technologies for people that need help. Municipalities are hard to establish communication with and keep the communication alive. It is a complex organization which makes this a future study that needs to be researched over time and probably over several studies.

Lastly, the findings from this thesis could be used to further testing in later studies. Testing often takes as long as the rest of the project which is why the further testing of findings should happen in a future study. There are a lot of reasons to not test findings mainly because the results can show that you have wasted your time through contradicting results. In short, testing is often not attractive, but it must be done to verify, validate and identify contradictions regarding the findings for them to be proven useful (Thaler & Sunstein, 2008).

Process considerations

Through the process of writing this thesis difficulties have occurred which contributed to discussions. By looking back on the process, it is recognized that the target group have been hard to map due to their extreme needs driven behaviour. It was identified several times that a person from the target group which had a specific mindset that fit into a psychographic group could deviate from that group if the need to obtain a product in another group occurred and was strong enough. The deviation from the traditional psychographic group was a challenge but was overcome by identifying the persons traditional group and introduce the tendencies of temporarily switch group through examples.

The user involvement in this thesis was important to make sure the level of validity was higher regarding the results. It was important that the data sample reached out to different social groups in the target group to maintain generalizability e.g. by handing out surveys in a wide variety of locations and so on. The study covered a specific target group and it is this groups opinions and concerns that was important. The continued involvement of these people proved useful due to the continued conversations about further questions and so on. In future study process this level of user involvement can be advised. The involved people were open and shared their opinions easily and because provided many unexpected comments and opinions to the data provided, which provided a huge potential for many different forms of analysis and tests.

The theory crossing the chasm is primarily used on the B2B market for a group in this field. The theory can be effectively used on the B2C market but was created for the B2B market. This theory was used to understand a market that was the target group for the thesis, even though this target group consisted of private people, this theory was determined the be relevant because of its expertise in the understanding an analysing of a market segment. There were difficulties with this model because it is created for the organization to use and consequently some of the theory is not used because it did not provide useful information or data output.

Through the survey there was gathered 35 answers. By looking back on the process, it was difficult getting out to the target group, many did not find it interesting to answer and therefore did not answer it. The goal with the survey's significance was to maintain a confidence level of 80 % and thereover along with a margin of error of maximum 13 %, so the generalizability was maintained as well. By not having the surveys online there a lower level by margin of error due to not only having innovators answer the survey. Likewise, with the surveys being spread in city as well as out of the city to get a variety of people. But there is a margin of error on at least 10 % because there was only included people from Zealand due to the surveys not being online and paper surveys were restricted to Zealand. The population in Jutland, Funen and Bornholm that have not been included which is 857.867 of the target group. Which correlates to 57,18 % of the total number of people above 60 years in Denmark. To have overcome this there could have been made an online version of the survey and distributed paralleled to the paper version but concerns for the online participants being mostly tech-friendly part of target group made that idea not used. Furthermore, it was not easy to convince the target group to participate. Some found it interesting to participate but many found it annoying and had no interest and by forcing these people the purpose of the thesis is violated and force should therefore not be used. If there was more time available for the thesis a much larger group could have been reached. Conclusively this thesis sample data has a margin of error

around 12 % and a confidence level of 85 %. The goal of having a confidence level of above 80 % is reached and having a margin of error of 12 % does not mean that the data is useless but rather that there is room for improvement by reaching out to more people e.g. Jutland in future studies. But in overall terms, the thesis has a fair level of quality.

Every study has limitations; therefore, it did not come as a surprise when there were difficulties establishing and maintaining contact with reliable people relevant for interviews. However, the interviewees from both municipalities and seniors, were deemed very relevant. Achieving a high quality, the municipality interviewees worked daily with eldercare and the interviewed seniors are considered part of the target group. Throughout the process of writing this thesis there were difficulties contacting the municipalities who took many days to respond to emails and most of the time they did not answer. This made it hard to gather the necessary data and made cooperation challenging. Furthermore, it remained impossible to get into contact with the Danish DaneAge association, they were not cooperative because of their critical view on university studies regarding seniors and technology. It was sought that the DaneAge association were a part of the project due to its differentiation regarding the involvement of senior's relation to most of other studies. This thesis should be read by these groups that were hard to establish contact with, so they can understand underlying tendencies are relevant to them because of their common involvement with the target group. We hope that by making the findings from this thesis public, these groups will learn and be more cooperative when another study similar to this study occurs.

Choosing to work within the interpretivist paradigm has in general proven to be a good choice. Using the seniors themselves opinions and world view on what assistive technology can do, aligning these conventions between municipalities and seniors proved rather difficult. Since seniors is the individual and has certain needs and municipalities in general wants to effectuate boxes of use cases to work as efficient as possible, aligning these into one world view has proven difficult. Found the need for statistics to recreate a part of the truth for seniors, thus using mixed methods being a necessity. Furthermore, the coherence between methods, theory and research question worked positively for this project.

In the process of writing this thesis the Corona virus broke out over the world resulting in many countries closing, including Denmark. This thesis was affected by this situation because the target group being in the high-risk group to the virus. The target group had to isolate through longer periods and not all had the skillset to an online meeting. Throughout this period the situation diminished further data collection session capabilities and a large amount of time was used to process and preparation establishment because everything became online.

This thesis provides a set of findings that compared to the body of knowledge, can be used in further study and by organizations striving to implement assistive technologies to people above 60 years. Through the process there was coherence between the research question and the theory, methods and analysis because of the findings providing a relevant output to the thesis. Through this discussion and analysis, the findings have been analysed, discussed generalized to maximize the quality of this study. This thesis made use of the target group to a higher degree by looking at their opinions and concerns as to identify why the group have not accepted the technology yet. This differs a lot from the literature in the body of knowledge due to many of these not including the users that much. Hence, this thesis did make use of some testing and product examples, but it was not a case study because the target group was to be understood rather than tested on. The findings do all in all provide an understanding of the target group e.g. by them being extremely needs driven. Thereby, their concerns were analysed and through that the barriers and a propose for neutralising the barrier was concluded.

The conclusions for this thesis on what hinder and enables full adoption of assistive technologies for the target group are the user's ethical concerns leading to barriers. It is a problem for organizations trying to implement assistive technologies for the greater purpose of increasing people's welfare. The target group that hinders the adoption are the psychographic groups later in the life cycle that have an increasing amount of distrust due to less knowledge on data. If the welfare of people above 60 should increase due to higher enablement of assistive technology these barriers, mainly the ethical barrier needs to be overcome be behavioural changes from organizations and users. Therefore, this thesis is significant for the understanding of the target group as users, so that organizations can manage their assistive technologies through the life cycle rather than let it fall into cracks or the chasm.

In Denmark there are 1.5 million people being older than 60 years. Around 120.000 receive homecare and around 40.000 live in a nursing home. This has been increasing the last 10 years with around 30 % and will continue to increase. This thesis is significant due to the increasing amount of people in the target group, when the amount of people increases their welfare is in danger of decreasing. By providing the organizations with a better understanding of their products life cycle and dangers, they can with their products increase the welfare of the increasing target group e.g. by providing help to the 46% of the participants that felt they needed more help. Also, make it possible for them to live in their private homes for longer rather than going to a nursing home. The government have an economic benefit by a decreasing tendency of people not living in nursing homes along with the 97 % of the participants that will get their wish of not living in a nursing home. Thus, the nursing homes will not become full when the amount of people in the target group further increase.

Chapter 7. Conclusion

The relevant research question for this study was to identify what hinders and enables the full adoption of assistive technology for seniors, this research question is of high relevance due to the number of seniors increasing and their welfare being at risk. Assistive technologies can provide an increase in welfare and thereby the research question have steered the research process towards relevance.The relevant methods and theories used demonstrated an increase in the quality of this academic writing. This conclusion will provide the overall answers to the research question.

The participants strived after technologies as the Dose Can technology, robot vacuum cleaner, IoT smoke sensor, the wash and dry toilet and the tablet. Conclusively these assistive technologies are all in different stages of their life cycle and makes use of different innovations and ecosystems to function. Conclusively to the concept of assistive technology is currently that there is a higher level of passive technologies the further up a person goes Bratteig's trajectory. This thesis concludes that the increased usage of assistive technology could enable the passive technologies more commonly used earlier in the trajectory so that the user's development through the trajectory as it currently is, could be slowed. This is to maintain a high welfare contributing towards 97% of the target groups wish to not be move into nursing homes. Because the target group holds their freedom and autonomy very dearly.

The target group have been split into the psychographic groups of innovator, early adopter, early majority, late majority and laggards. Every one of these groups act on different core needs e.g. the Innovators map of core needs is that power and competences is the most important. Justice and affiliation are neutral where security and order are less important. The opposite is the laggards, that finds security very important, affiliation and order somewhat important. Lastly, the power, competence and justice are mapped as neutral.

These psychographic groups act upon a unique profile and through this thesis analysis it can be concluded that the target group act heavily on their core needs. This means that there happen leaps between psychographic groups when an assistive technology covers a core need strongly. 88% of the participants in this thesis, feel that technology helps them in their every day and the most frequent technologies that are being used is a variation of phones and computers. Compared with the 77 % of the participants

wanting more help from technology, it can be concluded that there is a market potential for increased sales and need of assistive technology within the target group.

The barriers analysed in the thesis are the middleman barrier and the ethical barrier which both hinders the full adoption of assistive technologies in different ways depending on the product and the psychographic group. The municipalities act as middlemen between the target group and assistive technologies. They proved a few barriers, like optimizing service versus quality of citizen due to internal and external pressures. These municipalities have many care takers that positively can help the target group with assistive technologies e.g. support. The negative side is that they also can hinder the technologies, as a barrier if their leaders do not explain the placement of assistive technologies so that care takers do not fear the technology will take their job.

The analysis kept going back to the ethical question regarding assistive technology. The concerns of the participants were that distrust of monitoring and fear of being violated of their privacy and dignity, so therefore 70 % of the participants related critical to assistive technology in their homes. The level of knowledge on data in general decrease through the evolvement of the life cycles psychographic groups. That means the level of fear will rise when the knowledge decrease. Hence, the later psychographic groups showed an increasing concern towards the complexity through data gathering, monitoring, private life, and misuse of data.

It can be concluded that there is a need for rules, guidelines, and transparency regarding ethics. The factor of increased fear due to lower data knowledge can be neutralised by transparency through awareness on knowledge about data. As the test showed, even people from the late majority managed to accept assistive technology if transparent was included both before and after the implementation, so that trust could be establish and thereafter acceptance.

The need for transparency is a large topic and should be addressed by several organizations such as the ethical council, IoT Denmark and the municipalities in Denmark. So, there can be made several separate nudges to how each included participant can address the ethical issue and increase data knowledge. Lastly, the worst-case scenario should be avoided at all cost, so that assistive technology is not being manipulated into the market. The conclusion for the nudge proposal to reach mass communication through time, which will increase common knowledge on data in general for the target group and enable them more trusting towards assistive technologies. The higher level of trust will trigger a behavioural

change, by the target group starting to use the technology more commonly. This enables the target group require initiatives from the organizations and government e.g. address of new ethical problems. The process will take many years and will probably never stop due to new assistive technologies being developed and changing human behaviour.

Conclusively to the concept of user involvement is that the target group have tendencies to withdraw themselves due to technologies quick development. As a result, it is harder to include these people, so their opinions are not included and is overall harder to get. This reflected on the body of knowledge where only 50 % included the users. It is important to include the users because the designer and users' point of view is different, and it is hard to satisfy both. But it is impossible to somewhat satisfy the designers and users if the users are not included. This thesis conclude that the users can contribute with relevant data and therefore, should be included in studies.

Conclusively to the ethical concept is that in Denmark the moral principle and value-based principles have dominated for many years which includes the principles of equality, solidarity, security, and autonomy. These principles are achieved through transparency and accountability. Conclusively, Denmark is a country that have had transparency as a value for many years, but the transparency of the ethics regarding assistive technology should be increased.

The future assessments are addressed through the road forward regarding spreading transparency through awareness, discussions and establishing common knowledge. So that the 70 % of the thesis participants that was afraid of being violated of their privacy and dignity, would be less afraid and thereby decreasing this percentage. Conclusively, the target group should be included in future studies so that this percentages development can be monitored, and the ethical view can be studies further. Lastly, the municipalities should be studies further on their implementation of assistive technologies. It is a complex organization which enables future studies, probably several studies. The overall conclusion to the future assessments is that the findings from this should be used to further testing in later studies and that there are many ethical points that needs to be researched.

The conclusions for the process considerations are the primarily the target group that have been hard to map due to them being extreme needs driven and the limitations all studies experience e.g. difficulties

establishing and maintaining contact with people relevant for interviews. Conclusively, this thesis is significant due to the increasing amount of people in the target group, when the amount of people increases their welfare is in danger of decreasing. By enable the organizations through better understandings of their products life cycle and associated dangers. This enables the organizations to overcome the hindering factors and therefore have a better chance at establishing full adoption of assistive technology and thereafter increase the welfare of people above 60 years. Also, enable them to live in their private homes for longer rather than going to a nursing home. The government have an economic benefit by a decreasing tendency of people not living in nursing homes along with the 97 % of the participants that will get their wish of not living in a nursing home.

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