Aalborg University - Aalborg

The acceptance of The Intelligent and Caring Home System - TICHS

Master Thesis – Techno-Anthropology
10.th Semester (4.th Master)

Abstract:

This thesis elucidates what determines accept of a home monitoring system for eldercare – The Intelligent and Caring Home System (TICHS), from the perspective of the users.

Through 14 semi-structured interviews with users from 4 different user groups, Elders, Home Care Professionals, Health Care Professionals and Relatives the thesis elucidates the importance of an extended user understanding for understanding and creating successful innovation.

With an out-set in the Technology Acceptance Model (TAM) the report creates its own adaption of TAM - a Context-Specific-Design TAM. Through that the study finds themes and determinants that are fundamental for accept and use of TICHS.

Through the analysis and discussion, the thesis finds five central factors for acceptance and use. These are Function, Usability, Ethics, Experience and Facilitation.

Through that, this thesis has created a foundation for the continued creation and design of the TICHS system to be used in the future.

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1. Introduction

People worldwide are living longer. Today most people can expect to live beyond 60 and the global life expectancy is above 70 years (Roser, Ortiz-ospina and Ritchie 2013) (The World Bank 2022). Furthermore, this growth is expected to continue in every country around the world and the expected proportion of the elderly in the world's population is growing with the life expectancy (WHO 2021). WHO assesses the proportion of elderly in the world (60+) to raise to about 1 in 6 people by 2030. This will increase the amount of elderly from approximately 1 billion in 2020 to 1.4 billion in 2030. This tendency is expected to continue and is estimated to be almost 2.1 billion by 2050. At the same time, the amount of elders 80+ is expected to rise to almost half a billion (426 million) by 2050, which will be almost three times the amount in 2020 (WHO 2011) (WHO 2021). This demographic shift and increase in the elder population are much faster than in the past and it is going to be a major challenge for countries to ensure that their health and social systems can keep up (de Bruin, et al. 2018).

In Denmark, we see the same demographic trend. The population of elders 65+ in Denmark is expected to grow by 40.4% from 2018 (1.1 million) to 2050 (1.5 million) (Sundheds- og Ældreministeriet; 2018). This increase in the number of elderly citizens brings with it an increase in the number of people in need of health care. This comes from the fact that as people grow older, they become more prone to sicknesses and illnesses as the immune system deteriorates and lifestyle sicknesses appear (Milanović, et al. 2013).
This increase in the number of people in need of healthcare, together with a national shortage of workforce with the required skills in the healthcare sector, as well as a health reform, that aims at increasing the quality of health care while reducing costs, can and will result in a congestion of the Danish health system, and become a major challenge to the Danish society (Sundhedsministeriet 2022, WHO 2021). Combined with the way the Danish health and eldercare system is structured, and the aim of increasing the number of elders, that can stay at home and participate in society longer, the challenge becomes even bigger.

The Danish health reform has proposed some routes and solutions to these challenges (Sundheds- og Ældreministeriet; 2018). Digitalization as well as the utilization of AI and Algorithms are one of the proposed ways to solve the problems of the demographic change. The idea is to use technology to overcome the lack of resources (people and money) as well as make the health sector more flexible and easier to scale, as buying more technology is easier than finding and educating new people.

The TICHS project.

Based on the idea of utilizing technology, to solve those problems, The Department of Geriatrics at Aalborg University Hospital has gotten the idea for a SMART home monitoring system to support eldercare; the system is called The Intelligent and Caring Home System or TICHS for short.

The project aims at creating a home monitoring package including non-invasive activity tracker(s), and other health monitoring devices, that can be set up in the homes of older adults with care needs and combined with Artificial Intelligence (AI) and Algorithms to create an alarm system, that can predict the decline in the health status of the elderly and notify health care professionals, if/when the elder patient's condition worsens.

The hypothesis is, that in the weeks before the elderly people become seriously ill and need to be hospitalized, their activity and daily life patterns change. If this change of the pattern of activity is recognized as soon as it happens, it is hopefully possible to avoid or at least shorten hospitalization, since treatment of the person, in order to restore the health or to improve or stabilize a function, can be started early and in the elderly person's home.

The four main aims of the TICHS - project are

1. To ensure that the best, most affordable and most effective activity trackers (and others) are identified and used for the system.
2. To involve older adults with care needs (users) in the process of determining which technologies are acceptable to use in their homes.
3. To develop The Intelligent and Caring Home system and demonstrate the feasibility of this.
4. To explore the effectiveness of The Intelligent and Caring Home system on multiple health outcomes (number and length of hospitalization, number of contacts to physician, quality of life) in older adults with care needs compared to the existing practice.

The belief is that the system can help reduce hospital admissions by moving treatment to the homes of the elderly, while also being able to collect vital health data about the patient to optimize care and ease the burden on the home-care professionals to instead focus on the patient and not on 'routine' data collection. This is also one of the main goals of current Danish government in their proposal for the future Danish health reform (Sundhedsministeriet 2022).

The current state of the project and the focus in this thesis

The project has been in its initial stage for approximately eight months and is working on acquiring funding as well as making the initial literature searches, and technology searches to understand what kinds of technology already exist, that can be used. The current work on the project also includes the initial involvement of users and experts as well as planning the phases of the project after it acquires funding.

This work currently includes the writing of a systematic literature review that maps the current field of technologies that can potentially be a part of the TICHS package, which has led to a variety of technologies being considered such as:

- Activity trackers (Smartwatches or bracelets, such as GARMIN (Polar 2022) , bed sensors such as (Gokalp, et al. 2018))
- Hydration monitoring (Smart drinking glasses such as AQUATIME (Aquatime 2022)).
- Food intake monitoring (Kitchen appliance usage, or monitoring of deliveries and waste)
- Toilet use/visits monitoring (Flush sensors, door/toilet board sensors or sensors for amount of urine released)
- Other kinds of sensors in consideration (Door sensors, GPS, Lighting switch (on/off))

The literature review is scheduled to be ready at the start of 2023 and will be the foundation for the final selection and creation of the package.

The next kind of work that is currently being done, as initial work on the TICHS project, as well as the focus of *this thesis*, is collecting user and expert opinions on the project, system, and idea. This process is to ensure user involvement in the creation of the technology, as well as getting to know what needs and requirements exist, that influence the success and accept of the TICHS project. This is done to ensure, that the system is created in co-operation with the elders, healthcare professionals and others, who has knowledge on the subject and/or will be affected by the system. It is expected that it will open up for ethical concerns regarding the system, such as concerns about privacy and others, and make it possible to adjust the system to take those concerns into consideration in the design (Tram 2017). Furthermore, it will also be possible to explore and address what system requirements and necessary data needs to be taken into consideration in the creation of the system. All these subjects are addressed to ensure that the best possible system can be created in co-operation with the users.

2. Problem formulation

As the previous section indicates there are a plethora of different subjects to take into consideration when trying to create new systems or technologies in general and this is particularly true within health care where people and their well-being are involved in every part of the process. The aforementioned considerations about the ethical concerns that arise are obvious.

Privacy concerns are particularly contemporary but also concerns of technology taking over workplaces and lack of human contact in care facilities are concerns that are very apparent in modern news and people's minds (Rodkjær 2020, Det Etiske Råd 2019, Tram 2017).

All these concerns can become barriers to technological evolution and sometimes they are justified and sometimes they are not. Nevertheless, it is imperative to consider them if you want to create new technological solutions and have them become a success.

Because of this correlation between the technological possibilities and the human aspects (ethical and personal), it becomes important to include approaches such as techno-anthropology and it is with that belief and thought in mind that I, in this master thesis, try to understand:

"What determines users acceptance of TICHS?"

To fully understand what the question above tries to elucidate, two things need to be set straight in the question.

First, who are the "*users*"? and second, what is the meaning of the word "*acceptance*" in this question.

Who exactly are the problem formulation referring to, when it says "*users*"? The exact people and groups, that it is referring to, is a subject, that will be further elaborated on in the following section "Methods", but as a general rule of thumb, "users", during this thesis, are the people, who in some way, shape or form will be influenced by the implementation of TICHS.
This includes the elderly, who the system is intended to help; their relatives, since they are often closely involved in the care of their elder family members; the care professionals, who will be the people to use the system; as well as doctors, nurses and others, who will interact with the system if it is implemented, or who are currently involved with the areas of home care, that the system will impact.

The second elaboration on this research question is an explanation of "*acceptance*".
In this report, the "acceptance" from the research question is not only referring to the positive definition of the word, which is being "willing to allow or approve of something or someone"

(Dictionary 2022) but also refers to the absence of “accept”. It is a scale from no acceptance to acceptance and therefore it is encompassed with “extent”, and the research question tries to find out, to what degree the users accept TICHS, and what determines that.

3. Reading guidance

The following is a reading guide on how this thesis will transpire.

At first a methods section will be presented. This section includes how the empirical data to elucidate the problem formulation is found - from how the needed informants are defined and contacted, to how the interview process was planned.

The following section will present the Technology user Acceptance Model theory TAM (Venkatesh and Davis 1996) in broad terms, and a first step to an adaption of the TAM model, to TICHS, is made.

Following the theory section, a section on the gathered data will be presented. This section will present statements and themes found in the interviews with the informants. The data will be visualized through maps inspired by Clarkes situational analysis and described in the themes found (Clarke, Friese and Washburn 2015).

The thesis will then transition into an analysis, that will dive further into some of the themes from the data and elucidate their connections and meanings. Further the analysis will add the empirical findings to the adapted model, as a step 2 in the transition of the original TAM to a context specific design TAM.

Following the analysis, a discussion on the possibilities and challenges in the developed Context-Specific-Design TAM takes place, followed by a discussion of one specific theme in the model: Ethics. Finally, a conclusion on the problem formulation question is made.

4. Methods

To research and understand the scope of the user's acceptance regarding the TICHS project, it is necessary to figure two things out:

1. Who are the users the study is interested in? and

2. What are the opinions, views, and experiences of those users?

The reason for the interest in the users is to be able to utilize their experiences and expertise early in the design- and decision phase of the project (Lex and Nejrup 2018). This is done, as they are the ones, who know about:

1. what is needed in their (e.g., the Health Care Professionals) own work, (e.g., what tools, data and more) and

2. what they (e.g., the elders) are comfortable with regarding their own homes/lives (e.g., regarding privacy and ethics) and

3. where problems might arise in relation to the project and use of technology (Lex and Nejrup 2018).

This 'everyday knowledge' can be described as expert knowledge as the users, are all experts on their own lives and practices (Flyvbjerg 2015). The healthcare professionals are e.g., experts in the illnesses, tools, data, processes, and practices, which are important in their field. Therefore, as that is where the TICHS is trying to change things, it is imperative to know about it and understand it. The elderly are experts of their own daily lives and how their homes function, as well as how it is to be old and part of the homecare system, and it is essential for the researcher to know, where the limit lies in implementing something in their lives, to ensure that skepticism is minimal, and problems are fixed. The users, who are referred to, are not all experts in the more traditional sense, like what people usually describe researchers as, but all their 'expert knowledge' is essential for the process of making and implementing a successful technology (Flyvbjerg 2015).

The users

To understand and research acceptance of TICHS, it is necessary to find the people who will be influenced by the project/idea; these are what, in this thesis, is called the users.
The consideration of who the users are has been made internally in the team, which works with TICHS, and has constituted the following four user groups.

1. ***The elderly*** are the people, who the system is designed for, and who will have the system in their own homes. Therefore, it is imperative to include them in the process of designing and planning the TICHS, as a total rejection/disapproval from them will make the project practically impossible and unjustifiable.

2. ***The Home Care Professionals***, - this group consists of the wide variety of personnel that currently are responsible for Home Eldercare and are currently the ones that might be the closest to the traditional definition of users (the ones that use the system) as they are the ones the system in its primary form is intended to assist. This group consists, as earlier said, of a wide variety of different professions, such as SOSO assistants, SOSO helpers, home care nurses, 'Visitators' and more.

3. ***Health Care Professionals***, - this group is 'the rest of the health care sector'. It is those who are not directly/solely responsible for eldercare, but those who in some way, shape or form has knowledge on health care procedures, eldercare and other areas that are or could be positive to have on the project. This group is made up of doctors, nurses, specialists, and others.

4. The last group is the ***Relatives*** of the elderly. When people get older, they become more reliant on their family or other relatives and therefore opinions and decisions are made in the confidence of the relatives or maybe, when conditions deteriorate, entirely by the relatives. It is therefore imperative to also include them in the process and to utilize the experience they have and consider their opinions.

These are the four user groups, that will be the focus of this thesis.

How to establish contact with the users

Acquiring users/informants from all four groups requires contacts and makings contacts in a lot of different places. In my process of doing so, I met some challenges, especially as Corona was a big concern in the Elder and Health Care sector at the point of me contacting people regarding participation. Furthermore, to 'find' elders and relatives who were not entirely reliant on care facilities was proving difficult, as they are not someone, you can just walk up to and find.
To tackle those barriers, I made use of whatever contacts I had/have and through there approached it inspired by the snowball sampling method (Vogt 2005). By taking advantage of my initial contacts, I asked them if they wanted to talk to me about the subject, and if they had any contacts, whom they thought would be willing to talk to me and/or interesting for me to talk to. This method got the snowball "rolling", and every time I met with new users, they would have new people to introduce me to. This method and my process through it is visualized below. The User groups of Elders(E), Home Care Professionals (HoC), Health Care Professionals (HC) and Relatives (R) are seen below the Names, they are related to, in the parenthesis. All names have been replaced with pseudo-anonymized names to ensure no possibility of connection to informant.

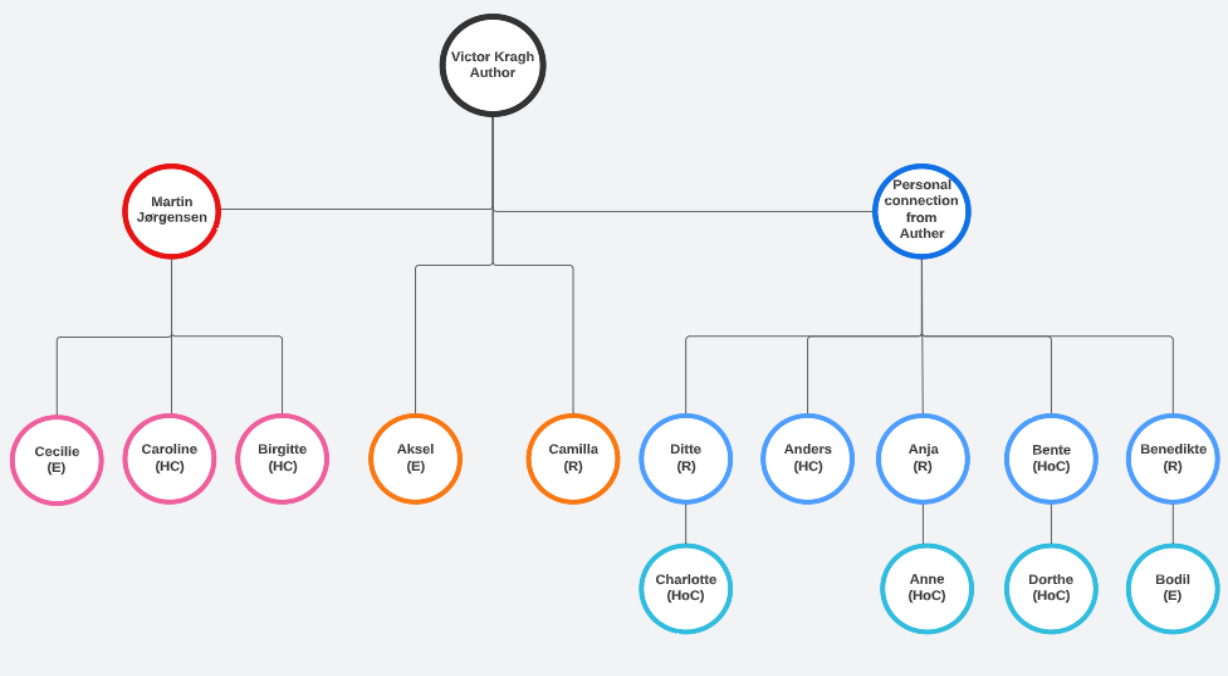


Figure. 1 – Snowball sampling

Through this, I acquired users from the different groups, and it resulted in the following division of users, as seen below:

The Elderly: 3		
Aksel	Elderly	Living at home – No Current care
Bodil	Elderly	Living at home – Currently getting daily Home Care
Cecilie	Elderly	Living at home - No Current care – At hospital because of a fracture
The Home Care Professionals: 4		
Anne	Pensioner	Former Working in Home Care and Nursing Homes - 40 years of experience
Bente	Nursing Home Caretaker	Nursing Home – 20+ years' experience
Charlotte	Nursing Home Caretaker - leader	Department leader Nursing Home – Dementia Department – Area representative
Dorthe	Outgoing Home Care - Leader	Outgoing Home Care – Leader of the department in the municipality
Health Care Professionals: 3		
Anders	Doctor	General Practitioner
Birgitte	Doctor	Hospital Doctor - Geriatrisk department
Caroline	Nurse	Hospital Nurse - Geriatric department – Former Working in Home Care and Nursing Homes
Relatives: 4		
Anja	Relatives	Elderly Parents – Passed away - Prolonged course of illness - + Dementia
Benedikte	Relatives	Elderly Parents - Alive – Is currently getting Homecare
Camilla	Relatives	Elderly Parents - Passed away - Prolonged course of illness
Ditte	Relatives	Elderly Parents - Passed away - Prolonged course of illness – Working as a nursing home "clown" in Dementia wards.

Figure. 2 – Users and user groups.

The interview process.

As I acquired informants, I also did interviews with them. The process from initially creating the questions to having held all interviews with all informants/users went through four phases:

1. Making the Interview questions.
2. Initial Interviews.
3. Re-evaluation of the Interview questions and the approach.
4. The rest of the interviews.

The first phase was forming the interviews and preparing for doing the interviews.
This process was done in collaboration with one of my colleagues also involved with the TICHS project, Nadja Albertsen. Nadja is a doctor as well as a PhD in Health Anthropology.
The main reason for including Nadja in the phase was to get other eyes on the questions and thereby ensure that my own positionality, didn't have too big an influence on the interview questions (Rowe 2014).
The approach I took during the interviews was inspired by the semi-structured interview method as described by Rytter and Olwig 2018 (Rytter and Olwig 2018) as well as Spradly (Spradley 1997). The interview was constructed with that method in mind to focus on the users/informants' experiences, opinions, and expert knowledge about Homecare, medical care and the TICHS. Furthermore, the semi-structured interview method gives more flexibility in the actual interview situation to let the interviewer (me) follow new subjects that may be raised by the informant/user that may not have been expected. But while giving that possibility for flexibility, the method also gives the interview a certain amount of structure to ensure, that the interview doesn't go in 'wrong/random' directions with no purpose (Rytter and Olwig 2018, Spradley 1997).

After those considerations and a lot of discussion regarding how to structure the interview, I ended up with the following questions:

Start with an introduction to what the project is and what we are going to talk about.

- General intro to the project + We would like to hear about your opinions so you should not take it 'too' officially

For the Health Professionals:

Your immediate opinion of the project.
(What do you think of the idea?)

Where do you feel/think that you need help the most?

Have you noticed changes in activity level, or anything else, in the elderly up to an admission?

Are there any specific tools/measurements that you could use in home care?

Do you think you would use a tool like ours?
(What does it take for you to use it?)

What obstacles do you see in such a TECH?

How do you think the format should be when you receive it there?
(Values in the form of Numbers or would a Graphics (e.g., RED-YELLOW-GREEN) be better / more useful?

For the Elderly:

The immediate opinion of the project.
(What do you think of that idea?)

What problems and positives do you see with this project, if any?

What do you think of the idea of wearing a bracelet, smartwatch, necklace, or some other kind of sensor?

(Are there any specific wishes you want for such a thing to use it?)

Appearance, function or other?
How would you like to integrate with it? (Smiley scheme?)

The idea is that it should require as little interaction from you as possible,

- How would you like it if you still had to integrate with it yourself for it to work optimally?
  (Charge it regularly, even uploads data, click on it a few times a day or similar)

If you came to use it, would you like to have access to the data it collects, from home? Or is it ok that it 'just' sends it to the healthcare staff and then you can see it when you are with them?

Possible Grand Tour questions if stuck.

'Grandtour' question

(How is a working day for you? / Take me through a general working day in home care)

Elderly: How is a day when you get help from home care? How is a normal day for you, here after admission? (Has it changed?)

Figure. 3 – Interview questions

After the creation and structuring of the interview were done, it was time for the first initial interviews. These interviews were done with informants acquired through my supervisor in The Department of Geriatrics at Aalborg University Hospital, Martin Jørgensen, and were all in some way related to the department, either as their workplace or as their place of stay/treatment. This initial interview phase consisted of three interviews, one with a doctor at The Department of Geriatrics, one with a nurse of the department, who has experience with nursing elderly people, and one with an elderly woman admitted to the department because of a fall.

After the three initial interviews, there was a period before further interviews and progress were made on the project, and as part of that time, I sat down to re-evaluate the interview questions, and to figure out if they lived up to their intended purpose, or if they limited the information I was getting. This was once again done in collaboration with Nadja to reduce the influence of my positionality (Rowe 2014). This process resulted in changes to some questions, as well as adding, or removing questions that were missing or wasn't needed.

There were three things in particular, which we wanted to change:

1. We wanted to make some of the questions more 'open' and less leading to help the interviewer not influence the informant in a particular direction.
   That made it so the entire part on:

   What do you think of the idea of wearing a bracelet, smartwatch, necklace, or some other kind of sensor?

   (Are there any specific wishes you want for such a thing to use it?)

   Appearance, function or other?
   How would you like to integrate with it? (Smiley scheme?)

   Now became:

   Are there any functions or demands you would like to have?

   Appearance, function or other? (Wristband?
   How would you like to integrate with it? (Smiley scheme?)

2. We wanted to add some questions, which were more focused on other perspectives, coming from more different informants, in particular regarding the relatives as well as the more unspecialised health professionals. This was to ensure, that we had some questions, which were specialized to the different user groups. This could, as an example, be to include the question of "*what is your role when an elderly is hospitalized?"* or *"as a relative, do you have some personal concerns or hopes regarding the system?*".

3. Through the interviews, I realized, that while the question of the immediate opinion of the informant to our idea gave a lot to talk about, the opinions and perspectives of the informants became more thought through during the interview, and we, therefore, choose to both start and end all interviews with that question to see the changes, that had happened in the informants/users' perspectives during the interview. Therefore, the start of the interview would still be "*what is your immediate opinion of the project. (What do you think of the idea?)*". But the interview would now also end with "*Now when we have been talking about the system for a while and you have had some more time to think it through What do you, now, think of the idea?*".

The 'new' interview questions became as follows (on the next page) – the changes are stated in RED/Green, **bold** and *Italic:*

Start with an introduction to what the project is and what we are going to talk about.

- General intro to the project + We would like to hear about your opinions so you should not take it 'too' officially

For the Health Professionals:

Your immediate opinion of the project.
(What do you think of the idea?)

Where do you feel/think that you need help the most?

Have you noticed changes in activity level, or anything else, in the elderly up to an admission?

Are there any functions or demands you would like to have?

Appearance, function or other? (Wristband?
How would you like to integrate with it? (Smiley scheme?)

Do you think you would use a tool like ours?
(What does it take for you to use it?)

What obstacles do you see in such a TECH?

How do you think the format should be when you receive it there?
(Values in the form of Numbers or would a Graphics (e.g., RED-YELLOW-GREEN) be better / more useful?

Now when we have been talking about the system for a while and you have had some more time to think it through what do you, now, think of the idea?

For the Elderly:

The immediate opinion of the project.
(What do you think of that idea?)

What problems and positives do you see with this project, if any?

Are there any functions or demands you would like to have?

Appearance, function or other? (Wristband?
How would you like to integrate with it? (Smiley scheme?)

The idea is that it should require as little interaction from you as possible,

- How would you like it if you still had to integrate with it yourself for it to work optimally?
  (Charge it regularly, even uploads data, click on it a few times a day or similar)

If you came to use it, would you like to have access to the data it collects, from home? Or is it ok that it 'just' sends it to the healthcare staff and then you can see it when you are with them?

Now when we have been talking about the system for a while and you have had some more time to think it through what do you, now, think of the idea?

Extra questions for relatives and doctors:

As a relative, do you have some personal concerns or hopes regarding the system?

What is your role when an elderly is hospitalized? Have you noticed changes in the patient up to a hospitalization?

'Grandtour' question

(How is a working day for you? / Take me through a general working day in home care)

Elderly: How is a day when you get help from home care? How is a normal day for you, here after admission? (Has it changed?)

Figure. 4 – Interview questions after adjustments

After this re-evaluation, the snowball sampling began with more people, and a further 11 interviews were made with people from all the different groups. This constitutes the last phase of the information gathering and is – together with the first three interviews - the fundament of this report.

5. Theory - TAM

To understand user acceptance and what determines this, I examined the literature on the subject. The subject of acceptance of technology is a subject that has been widely studied through the years, and therefore there are a plethora of opinions, methods, and theories on the subject (Lai 2017).

One of, if not the most used approach to users' acceptance of technology is the technology acceptance model or TAM for short (Lai 2017).
TAM was first introduced by Fred Davis (1986) and has since been widely used and discussed (Lai 2017, Davis 1989). Through the years it has been adapted to different fields, e.g., the field of healthcare (Holden and Karsh 2009), and TAM has been further expanded upon, to facilitate different use, as well as address criticism that has been directed towards it (Lai 2017, Holden and Karsh 2009). That resulted in it becoming the traditional version of TAM, as seen in the picture below in 1996, TAM2 in 2000 and later TAM3 in 2008 (Davis 1989, Venkatesh and Davis 2000, Venkatesh and Bala 2008, Venkatesh and Davis 1996).

What is TAM?

TAM is a model made to assess technology acceptance by users, in particular regarding information technologies (Davis 1989). The model is rooted in management information systems, attitude research and human-computer interaction research, and has since its appearance in 1986 gone through various changes and been expanded upon to tackle criticism as well as to make it more precise (Lai 2017, Davis 1989).

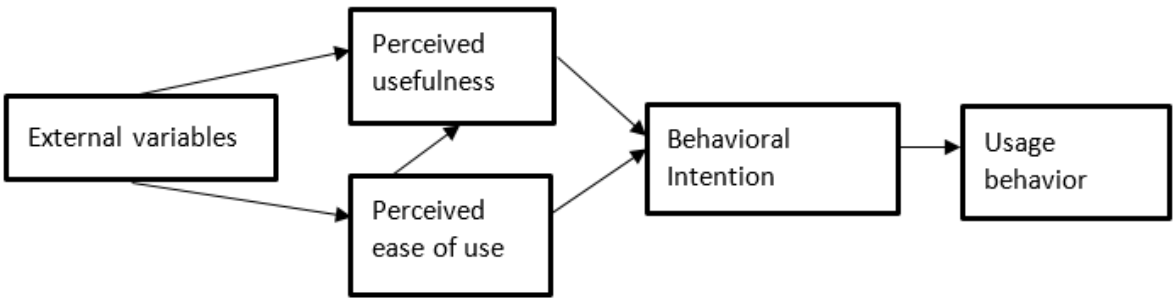


Figure. 5 – Technology Acceptance Model - (Davis 1989)

The core theory of TAM is that one's intent to use (aka. attitude towards using, or as on figure 5, behavioural intention) and thereby accept and use of a system or technology (aka. usage behaviour) is determined by two main factors, ***perceived usefulness***, and ***perceived ease of use*** (Davis 1989). These two concepts are then mediators of different external variables that influences intention to use. These external variables have been expanded and further explored in the later iterations of

TAM (TAM2 and TAM3) (Venkatesh and Davis 1996, Venkatesh and Davis 2000, Venkatesh and Bala 2008).

Perceived Usefulness (PU) is defined as *"the degree to which a person believes that using a particular system would enhance his or her job performance."* (Davis 1989, 320). Perceived ease of use (PEoU) is defined as *"the degree to which a person believes that using a particular system would be free of effort."* (Davis 1989, 320).

Perceived Usefulness is the main determent in regards to the intention to use and accept, but as seen in figure 5 perceived usefulness is also influenced by perceived ease of use, as the ease with which you can use a system or technology influences how useful the technology is perceived as (Davis 1989). On the other hand, Perceived ease of use is less influential to the intention to use, which can be explained by the fact, that no matter how easy a system or technology is to use, it will not be used, if it is perceived as fundamentally less useful in comparison to, what is already used or done (Venkatesh and Davis 2000).

In 2000 Venkatesh and Davis extended the TAM to TAM2 they did this as they believed that *"A better understanding of the determinants of perceived usefulness would enable us to design organizational interventions that would increase user acceptance and usage of new systems."* (Venkatesh and Davis 2000, 187). This extension of TAM and the inclusion of additional key determinants of TAM's perceived usefulness became the TAM2 seen in figure 6 below.

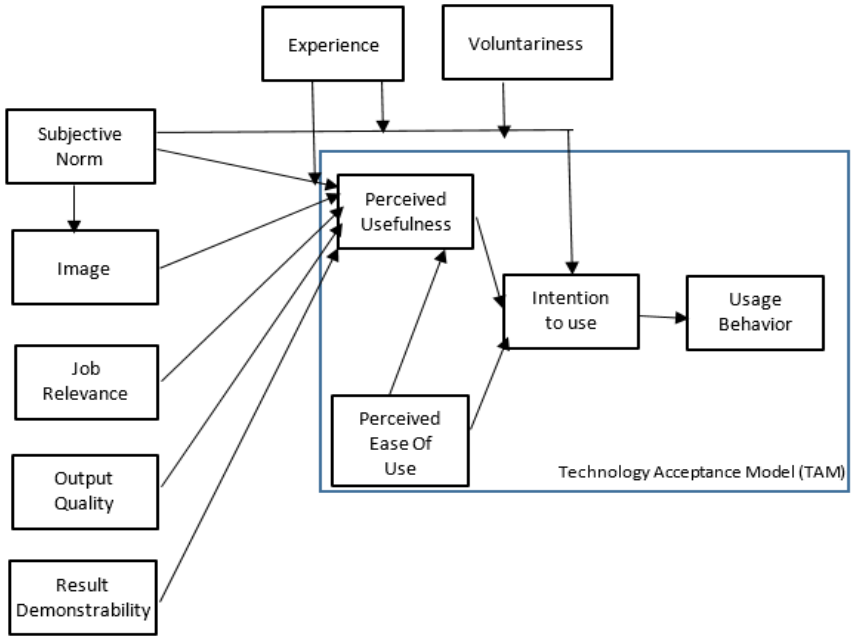


Figure. 6 – TAM2, the extension of Perceived Usefulness - (Venkatesh and Davis 2000)

Subjective norm, Image, Job relevance, Output quality, and Result demonstrability were the five determinants they identified (Venkatesh and Davis 2000). Their details will not be presented here, but the table below explains each definition, as explained by Venkatesh and Bala (2008).

Determinants of Perceived Usefulness

Determinants	**Definitions**
Perceived **E**ase **O**f **U**se	The degree to which a person believes that using an IT will be free of effort (Davis et al., 1989)
Subjective Norm	The degree to which an individual perceives that most people who are important to him think he should or should not use the system (Fishbein & Ajzen, 1975; Venkatesh & Davis, 2000)
Image	The degree to which an individual perceives that use of an innovation will enhance his or her status in his or her social system (Moore & Benbasat, 1991)
Job Relevance	The degree to which an individual believes that the target system is applicable to his or her job (Venkatesh & Davis, 2000)
Output Quality	The degree to which an individual believes that the system performs his or her job tasks well (Venkatesh & Davis, 2000)
Result Demonstrability	The degree to which an individual believes that the results of using a system are tangible, observable, and communicable (Moore & Benbasat, 1991)

Figure. 7 – Determinants of Perceived Usefulness - (Venkatesh and Bala 2008, 277)

Additionally, to the five determinants TAM2 also introduced two moderators, as seen on the figure 6 Experience and Voluntariness. Both concepts are included in TAM2 in their influence on the determinant, Subjective norm. Voluntariness is understood by most and defined as *"the extent to which potential adopters perceive the adoption decision to be non-mandatory"* (Venkatesh and Davis 2000, 188), its inclusion is based on the fact that studies show, that the effect of subjective norm on intention was increasingly significant in mandatory settings, but not in voluntary settings (Venkatesh and Davis 2000).

Experience is also a common understood concept, and it becomes central to TAM2 as it influences the effect of subjective norm on both, perceived usefulness and also on intention to use over time as users gain more experience with a system (Venkatesh and Davis 2000).

These determinants and moderators became the foundation of the new TAM2 and made the theory able to handle some of the critique it met in regards to explainability (Lai 2017).

The lack of explainability was further addressed by Venkatesh (2000) as he explored the determinants of perceived ease of use and his study later became foundation for TAM3 (Venkatesh and Bala 2008).

TAM3 took the determinants of TAM2 and combined it with the determinants of percived ease of use that Venkatesh (2000) found and created a bigger and more defined version of the technology acceptance model, as seen below on figure 8.

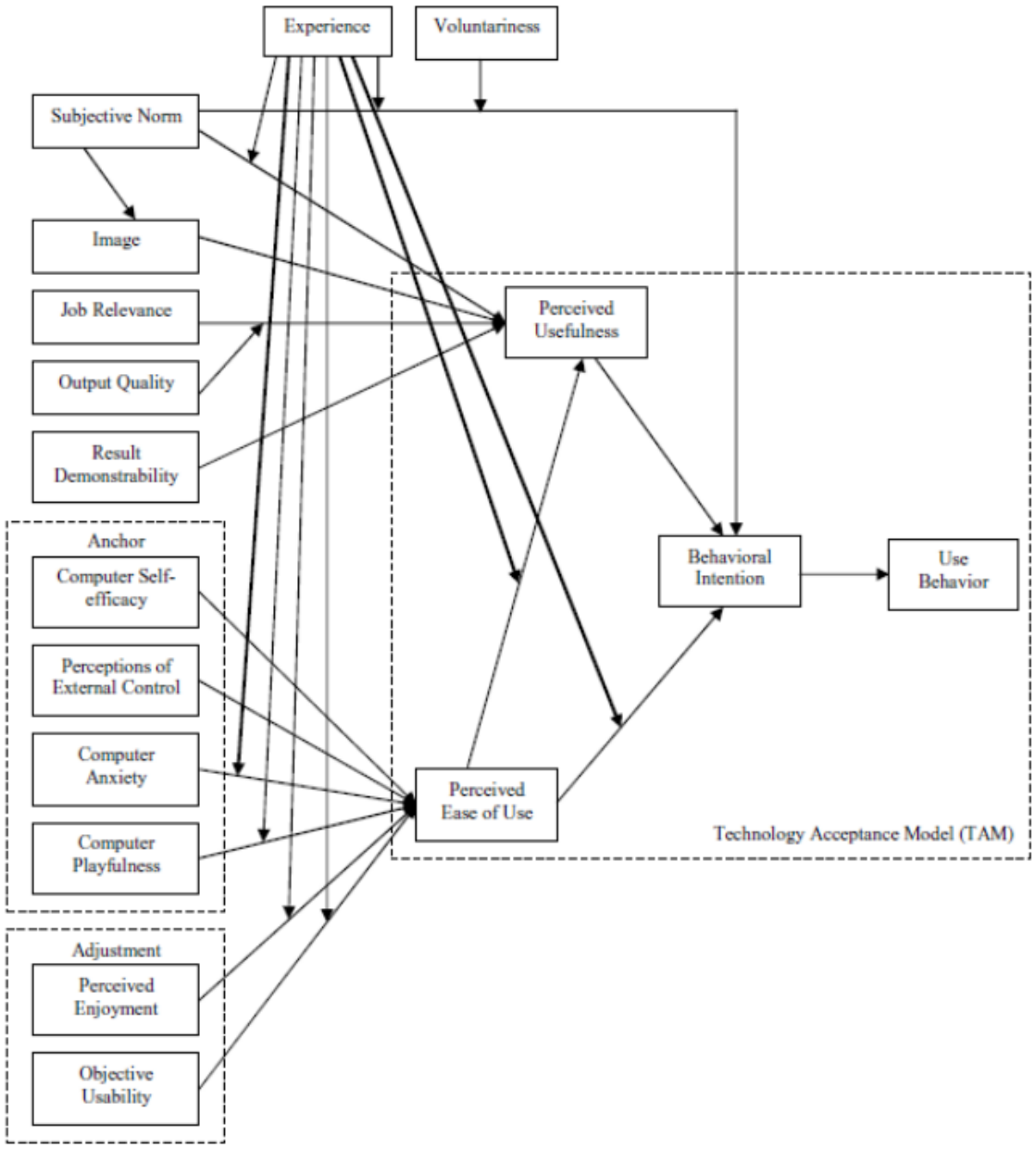


Figure. 8 – TAM 3 - (Venkatesh and Bala 2008, 280)

The six determinants of perceived ease of use from Venkatesh (2000) are computer self-efficacy, computer anxiety, and computer playfulness, perceptions of external control, perceived enjoyment, and objective usability (Venkatesh 2000).

The first four was presented as anchors, understood as the things that drive the initial judgments of perceived ease of use of a system or technology, while the last two was adjustments, understood as

how you adjust your opinion after you gain hands-on experience with the new system/technology (Venkatesh and Bala 2008).

This became the TAM3 and, as with the determinants of perceived usefulness, their details will also not be presented here, but the table below explains each definition, as explained by Venkatesh and Bala (2008).

Determinants of perceived ease of use

Determinants	Definitions
Computer Self-Efficacy	The degree to which an individual believes that he or she has the ability to perform a specific task/job using the computer (Compeau & Higgins, 1995a, 1995b)
Perception of External Control	The degree to which an individual believes that organizational and technical ressources exist to support the use of the system (Verkatesh et al., 2003)
Computer Anxiety	The degree of "an individual's apprehension, or even fear, when she/he is faced with the possibility of using computers (Venkatesh, 2000, p 349)
Computer Playfulness	"...the degree of cognitive spontaneity in microcomputer interactions" (Webster & Martocchio, 1992, p.204)
Perceived Enjoyment	The extent to which "the activity of using a specific system is perceived to be enjoyable in its own right, aside from any performance consequences resulting from system use" (Verkatesh, 2000, p. 351)
Objective Usability	A "comparison" of systems based on the actual level (rather than perceptions) of effort required to completing specific tasks" (Venkatesh, 2000, pp.350-351)

Figure. 9 – Determinants of perceived ease of use - (Venkatesh and Bala 2008, 279)

Through TAM3 the influence of experience was further expanded as the inclusion of determinants of perceived ease of use, opened for even more places where experience had influence. This can be seen on the figure 9 above, where experience is connected to most of the new determinants.

The Context of my TAM

One of the alternative areas that TAM has been adapted to is, as earlier described, within healthcare. Richard J. Holden and Ben-Tzion Karsh explored TAM's role and possibilities within health care in their study from 2009 called "*The technology acceptance model: its past and its future in health care"*. The intention of their study was figuring out if and how TAM can be used in the field of health care. In that study they found that TAM was applicable to health care, but it needed to be expanded and adapted (Holden and Karsh 2009). They found that TAM needed 1) better reporting of

data, 2) a continuation of exploration into new variables and relationships that can be added to TAM as well as 3) to be contextualized to the specific field and situation of the technology (Holden and Karsh 2009). One of the main takeaways from that study was that context is important for an effective use and adaption of TAM (Holden and Karsh 2009).

Because of this, the next part of this thesis will go into detail on the context of the study in this thesis and elaborate on how this project uses TAM and how it changes and adapts TAM to the specific context, and how it, the adapted TAM, will be used in the coming analysis.
In the following, I will not commit to a particular version of TAM (e.g., traditional TAM, TAM2 or TAM3), but instead utilize elements from the different variations of TAM to adapt it to the context and needs of this study and the TICHS-project to create "MY TAM". This new version of TAM will then be used with the intention of finding new variables and relationships (determinants) that can be added to TAM as well as strengthen the creation of TICHS.

Regarding context there are, in particular, four differences between the context of this thesis's study and a more traditional TAM study.

The first difference to the standard TAM is that the study on TICHS doesn't have a technology or system to test, yet. Currently this project is in the stage of creating and designing a new technology and trying to figure out what is needed for it to be used/accepted, how it should look, how it should function, as well as what the users perceive as okay and what is not okay regarding such an innovation.
While Venkatesh and Bala do adress different moments where TAM3 can be used in the implementation of an intervention (system or tech), they look at two particullar stages; pre-implementation and post-implementation (Venkatesh and Bala 2008). Post-implementation has no real connection or relevance to where the TICHS project is currently, since TICHS do not have a tech-system to evaluate. But pre-implementation does have some relevance as it focuses on *"(i) minimization of initial resistance to a new system; and (ii) providing a realistic preview of the system, so that potential users can develop an accurate perception regarding system features and how the system may help them perform their job."* (Venkatesh and Bala 2008, 292). But while those focus points are still some of what I intent to work with, they mainly revolve around implementation of a system or technology, not the creation of it.
Therefore, I state, that what this thesis is doing, is including TAM in a new earlier stage - a 'pre-pre-implementation' stage.

Because of this, some changes must be made in how TAM is used.

Another difference that originates from this project being in the 'pre-pre-implementation' stage is regarding the outset of the study. One of the main reasons for doing the interviews with the users is to answer the question of whether to implement or NOT to implement the system.
This thesis could theoretically end up concluding that a system such as TICHS should be dismissed as it isn't accepted and never will be accepted, instead of concluding things related to creation and implementation of the technology. Specifically, a major opposition from the elders, who are the ones that will be monitored, will inevitably lead to an abandonment of the project.
Opposed to that, TAM has its fundamental starting point in business and management and the decision of whether to implement a system or not is fundamentally taken by the leaders/management of the workplace it is implemented in/on.
It can be seen as TAM traditionally taking a top-down focus in regard to implementation, where this study take a more bottom-up focus.

Because of this, some changes must be made in how TAM is used.

Another way the context of this thesis, when it approaches the question of acceptance, is different from the context of a traditional TAM, is regarding how users are defined. This has already been partly established in the methods section of this report, but as it is a fundamental pillar of the thesis, I will state it again in comparison to TAM's view on users. As earlier stated, TAM approaches the question of accept from a background in management and business. TAM's approach to users is therefore a focus on the employees/workers, and how they use the technology in comparison to what they usually do.

In comparison to that, this thesis expands the concept of users to also include all those, who are influenced by the technology. This includes the elderly, who the system is intended to help, their relatives, since they are often closely involved in the care of their elder family members, the care professionals who will be the people to use the system, as well as doctors, nurses, and others, who will interact with the system, if it is implemented, or who are currently involved with the areas of home care, that the system will impact.

This difference in the concept of users changes how to approach, question, and perceive the users, as well as how and what kinds of answers that can be expected of them.

Because of this, some changes must be made in how TAM is used.

A fourth way this thesis approaches the question of acceptance differently than TAM is regarding how user opinions are collected.
In the traditional TAM, they collect data through questionnaires', as seen below. Here users answer

the questions on a scale of how much they agree with the statement, e.g. the question: *"using the system improves my performance in my job"* (Venkatesh and Bala 2008, 313) is answered on a scale from 1-6 (1 being not agreeing/not at all and 6 being big agreement/ big improvement in job performance.).

This is not how the subject is approached in this thesis. As mentioned, and explained in the methods part of this thesis, I have done semi-structured interviews with 14 users and through that got to hear their opinions, stories, experiences, and views. Furthermore, these interviews have giving us the opportunity to talk about those opinions, stories, experiences and views and ask the users questions regarding them. This is a very different kind of data and is given in a very different format compared to the data from the questionnaires in TAM:

Items for TAM 3 Constructs

Constructs		Items
Perceived Usefulness (PU)	PU1	Using the system improves my performance in my job
	PU2	Using the system in my job increases my productivity
	PU3	Using the system enhances my effectiveness in my job
	PU4	I find the system to be useful in my job
Perceived Ease Of Use	PEOU1	My interaction with the system is clear and understandable
	PEOU2	Interaction with the system does not require a lot of my mental effort
	PEOU3	I find the system to be easy to use
	PEOU4	I find it easy to get the system to do what I want it to do
Computer Self-Efficacy (CSE)		I could complete the job using the software package…
	CSE1	…if there was no one around to tell me what to do as I go
	CSE2	…if I had just the build-in help facility for assistance
	CSE3	..if someone showed me how to do it first
	CSE4	..if I had used similar packages before this one to do the same job
Perception and External Control (PEC)	PEC1	I have control over using the system
	PEC2	I have the resources necessary to use the system
	PEC3	Given the resources, opportunities and knowledge it takes to use the system, it would be easy for me to use the system
	PEC4	The system is not compatible with other systems I use
Computer Playfulness (CPLAY)	CPLAY1	The following questions ask you how you would characterize yourself
	CPLAY2	when you use computers
	CPLAY3	…spontaneous
	CPLAY4	..creative
		…playful
		..unoriginal
Computer Anxiety (CANX)	CANX1	Computers do not scare me at all
	CANX2	Working with a computer makes me nervous
	CANX3	Computers make me feel uncomfortable
	CANX4	Computers make me feel uneasy
Perceived Enjoyment(ENJ)	ENJ1	I find using the system to be enjoyable
	ENJ2	The actual process of using the system is pleasant
	ENJ3	I have fun using the system

Figure. 10 – Example of data gathering in TAM - (Venkatesh and Bala 2008, 313)

Because of this, some changes must be made in how TAM is used.

MY TAM

Because of these differences in context, it is necessary to adjust and/or change TAM to fit this new context. This change entails that some parts of the TAM will be included in this study while other parts might be omitted.

The study is trying to figure out:

"What determines users acceptance of TICHS?"

This is done in the hope of being able to adapt the TICHS idea to those determinants, opinions and perceptions and thereby create a system that WILL BE ACCEPTED.

This also means that while TAM is included in the current step - the pre-pre-implementation phase - a traditional TAM (maybe even a full TAM3) would be beneficial to be done when the technology is created to facilitate the actual implementation of TICHS in the health sector, maybe even twice, both in the pre-implementation phase and in the post-implementation phase as Venkatesh and Bala proposes in TAM3 (Venkatesh and Bala 2008). This/these future TAM(s) would also greatly benefit from this study, as new variables and relationships in regards to the derterminants for perceived usefulness and perceived ease of use, might be found and that discovery will strengthen the future work with TAM and TICHS.

From TAM to MY TAM to CSD TAM

The Changes to TAM that is done to facilitate the TISCH project's pre-pre phase will be presented and explained in the following section.
As the purpose of this thesis is different to how a traditional TAM is, and the stage it is in, is the pre-pre-implementation stage, some of the fundamentals of TAM needs to be adjusted.
The 'goal' of the traditional TAM of acquiring weights of the different determinants and adjusting the implementation to those weights will need to be changed. Instead, the 'goal' will be to find 'points' (determinants) that are central for the users to accept/use the TICHS-idea. As earlier described, there are no technology to adjust the implementation of – TICHS knows the purpose of the technology, but not the technology to support the purpose. To do this, I propose to flip the Traditional TAM and make it 'flow' in the opposite direction.
This is done to answer the problem formulation and thereby end up with what determines use/accept for the users. A visualisation of this is shown below.

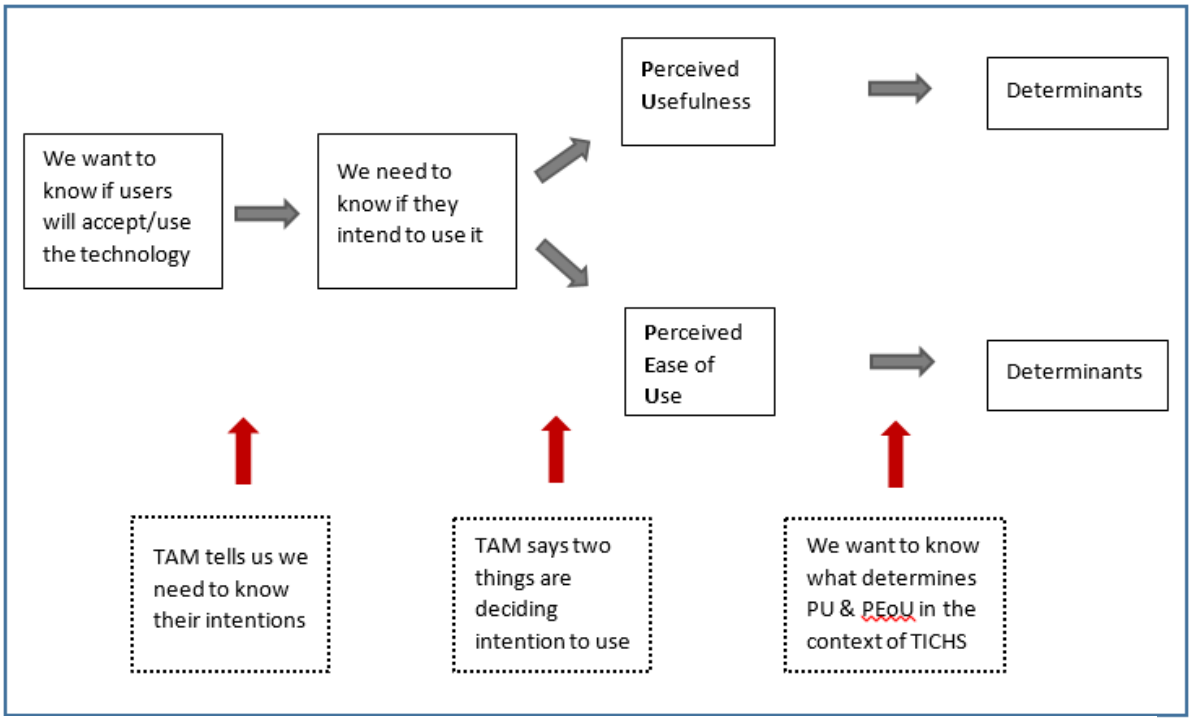


Figure. 11 – "MY TAM" – reversed and simplified from TAM

The next step that needs to be changed, is the user understanding. This has already happened in this thesis as the inclusion of a wider user group already happened as part of the methods section.

This new group of users and the possibility of new kinds of answers, views as well as the purpose of the study and the possibility of total or partial rejection of the TICHS also need to be incorporated in the new TAM and how it is used in this study.

One part of this is done by changing the way of collecting data from questionnaires to semi-structured interviews, as earlier described, as that will ensure the possibility of being open to a wider array of answers as well as higher adaptability to different kinds of users.

This change in data gathering method will, as earlier stated, also have an influence on the TAM as it will change the format of the data produced.

To encompass this a couple of steps will be taken.

1) The reversing of the TAM will ensure that the model can encompass more differentiated answers as it moves from more 'wide' concepts such as perceived usefulness and perceived ease of use towards determinants instead of the opposite.
2) In the work with the data, the format of data presentation will change. In the traditional TAM answers are "easy" to showcase, as they can be shown through numbers, x amount of people answered y, and so on. To showcase/analyse answers in this study, I will borrow aspects from thematic analysis (Clarke and Braun 2016) to thematise the answers given in the interview. Furthermore, I will utilize/be inspired by Adele Clarke's situational maps

(Clarke, Friese og Washburn 2015) to visualize and structure the reporting of the data. These steps will be done with TAM's two core concepts perceived usefulness and perceived ease of use as the centre.

3) The definition of Perceived Usefulness and Perceived ease of use will be slightly altered.
   Perceived Usefulness understood like: The demands to the system for it to be experienced as valuable to use.
   Perceived ease of use understood like: The demands to the system for it to be experienced as easy to use.

The last step of the adjusting of TAM to the context of this thesis is the addition of one determinant next to perceived usefulness and perceived ease of use. That is the determinant of Subjective Norm, but in a slightly different form/format than defined in the TAM. It will be included as its own third factor but changed towards a more social perspective.
There are in particular two reasons for why I have made this special addition to "My TAM" and thereby changed what looked like a very traditional, but reverse, TAM model.
The first reason is the independent influence that subjective norm has on intention to use (as seen in TAM2), TAM2 showed that while social norm has a direct influence on perceived usefulness it also has a separate direct influence on intention to use (the separate line on the TAM2 model, on page 16). This influence would potentially be overlooked if subjective norm wasn't included separately.

The second reason for subjective norm's inclusion in "My TAM" is its focus on other peoples (aka. important others) opinions of the user's use of the system. In Richard J. Holden and Ben-Tzion Karsh's study on TAM in health care they also describe subjective norm as social influence. Based on TICHS's possible social challenges, as mentioned in the introduction of this report, such as ethics, and its possible influence on the Health Care System, as well as the differentiated and broader perspective on users (four very different groups with each their own view on the world) it seems mandatory for subjective norm or social influence to be included.
But to make subjective norm able to 'stand by itself' and also encompass the mildly different social influence, some changes will be made to how subjective norm is perceived.
The main change is to who "important others" includes, and I would like to change it to instead be important *actors*, as it is a broader and more embracing concept. As the concept of actors is a broad and widely used concept, it is also important to elucidate how it is understood in this context.
In this report, I take the actor perspective inspired by Latour (2003) where actors can be both human and non-human. That means human actors (e.g., individuals, particular groups, organizations, and

institutions) and non-human actors (e.g., Technologies, material infrastructures, specialized information and/or knowledge and material "things") exist equally and both have influence and agency in the situation (Latour 2003). This way of approaching the subjective norm with actors as the ones who are important to the user, gives the possibility of encountering and even broader range of determinants for why or why not TICHS is or will be accepted/used.

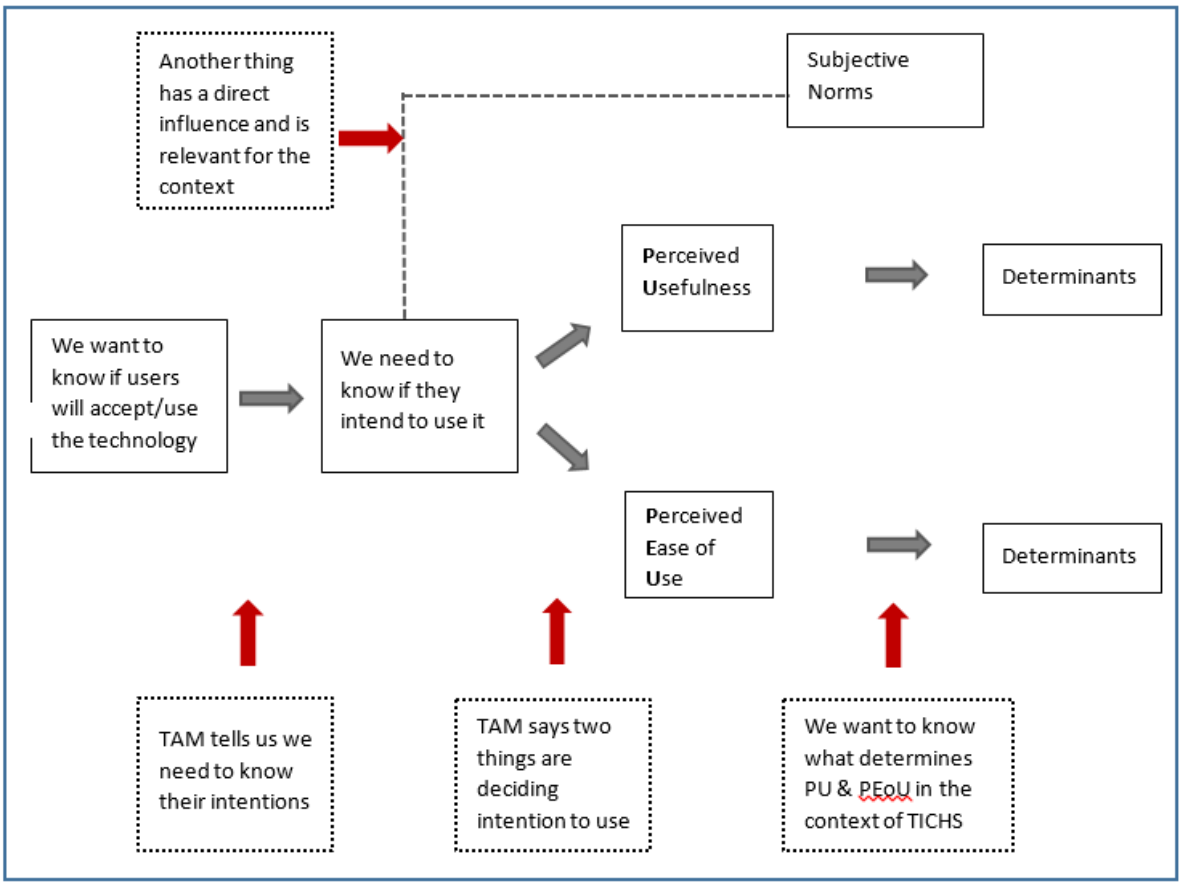


Figure. 12 – "MY TAM" with 'new' subjective norm

This constitutes the contextualization's and adaption of the TAM approach to the context of the TICHS-project.

While "My TAM" might look 'bare-bone' or even a little lacking in comparison to the later versions of TAM such as TAM2 and TAM3 it is important to remember that the purpose of this TAM is not the same as the others. Using TAM as a theoretical basis in TICHS gives the proven/verified relationship between Use behaviour, Intention to use and Perceived Usefulness, Perceived Ease of Use and Subjective Norms, but the purpose of "MY TAM" is to find new determinants that are relevant in the context of the TICHS-project and to elucidate what needs to be done to ***create*** and ***design*** a system that will be accepted and used. "MY TAM" will therefore be called Context Specific Design TAM or CSD-TAM for short. As earlier described, this is the initial stage and in an ideal world another TAM will be made on the TICHS after a prototype is made, and at that stage a more traditional TAM such the original TAM or TAM2 or TAM3 will probably be used. Hopefully my CSD-TAM will at that point

have contributed to a system with less 'flaws' regarding user acceptance and might even have contributed with some additional determinants that needs to be included in the future.

6. Data

Data processing

To examine the problem formulation "*What determines users acceptance of TICHS?*" and define the determinants for the CSD-TAM, empirical data was generated through interviews with 14 informants, each representing one of the four user groups, as described in the methods section on figure 2, and shown again below.

All names have been replaced with pseudo-anonymized names to ensure no possibility of connection to the informant

The Elderly: 3		
Aksel	Elderly	Living at home – No Current care
Bodil	Elderly	Living at home – Currently getting daily Home Care
Cecilie	Elderly	Living at home - No Current care – At hospital because of a fracture
The Home Care Professionals: 4		
Anne	Pensioner	Former Working in Home Care and Nursing Homes - 40 years of experience
Bente	Nursing Home Caretaker	Nursing Home – 20+ years' experience
Charlotte	Nursing Home Caretaker - leader	Department leader Nursing Home – Dementia Department – Area representative
Dorthe	Outgoing Home Care - Leader	Outgoing Home Care – Leader of the department in the municipality
Health Care Professionals: 3		
Anders	Doctor	General Practitioner
Birgitte	Doctor	Hospital Doctor - Geriatrisk department
Caroline	Nurse	Hospital Nurse - Geriatric department – Former Working in Home Care and Nursing Homes
Relatives: 4		
Anja	Relatives	Elderly Parents – Passed away - Prolonged course of illness - + Dementia
Benedikte	Relatives	Elderly Parents - Alive – Is currently getting Homecare
Camilla	Relatives	Elderly Parents - Passed away - Prolonged course of illness
Ditte	Relatives	Elderly Parents - Passed away - Prolonged course of illness – Working as a nursing home "clown" in Dementia wards.

The interview length varied from 20 to 74 minutes but average out at about 37 minutes and summed to about eight and a half hours of interviews. The interviews were recorded as well as

supplemented with field notes to recall and present. The recordings were later transcribed and can be found in appendix 1-14. Furthermore, all citations made from the interviews are marked in bold, in the transcript, to elucidate where they come from. The used citations have been translated from Danish to English and are therefore liable to small adjustments to match meanings across languages.

The handling of the data that has been done in this section was, as earlier described in "My TAM", inspired by thematic analysis to find themes to explain what is important to the users in the current context. Furthermore, the process of handling this was inspired by the guidelines of Clarke and Braun (2016), which suggest analyzing the gathered data multiple times, searching for patterns, themes, and concepts to understand the data in its context and find explanations, that answer the research questions and give meaning to the findings (Clarke and Braun 2016).

Initially the interviews were independently listened and read through while noting every section that was judged to hold relevance for the research question as well as the themes of perceived usefulness, perceived ease of use and subjective norms, as defined in chapter 5. Next, points of interest from the interviews, were compared within the user-groups (e.g., elder 1's points of interest were compared to elder 2's points of interest and so on) and further compared and discussed in comparison to the other users from the group and thereby themes important to that user group were created.
These themes were thereafter structured in maps of importance; these were slightly inspired by the situational maps from Adele Clarkes situational analysis (2015), to create a structured overview of the themes as well as to try to categorize the themes in relation to one of the three CSD-TAM concepts, Perceived Usefulness, Perceived Ease of Use and Subjective Norm. For now, the TAM points are only there to structure the themes; they will be further elaborated on in the final analysis in the next section of the thesis.

In the following section of this thesis the maps will be presented and described to create a foundation for the coming analysis, this is also in the analyze comparisons will be made across user groups.

Maps of importance

The first map of importance that will be presented is the map created based on the interviews with the elders.

The Elders.

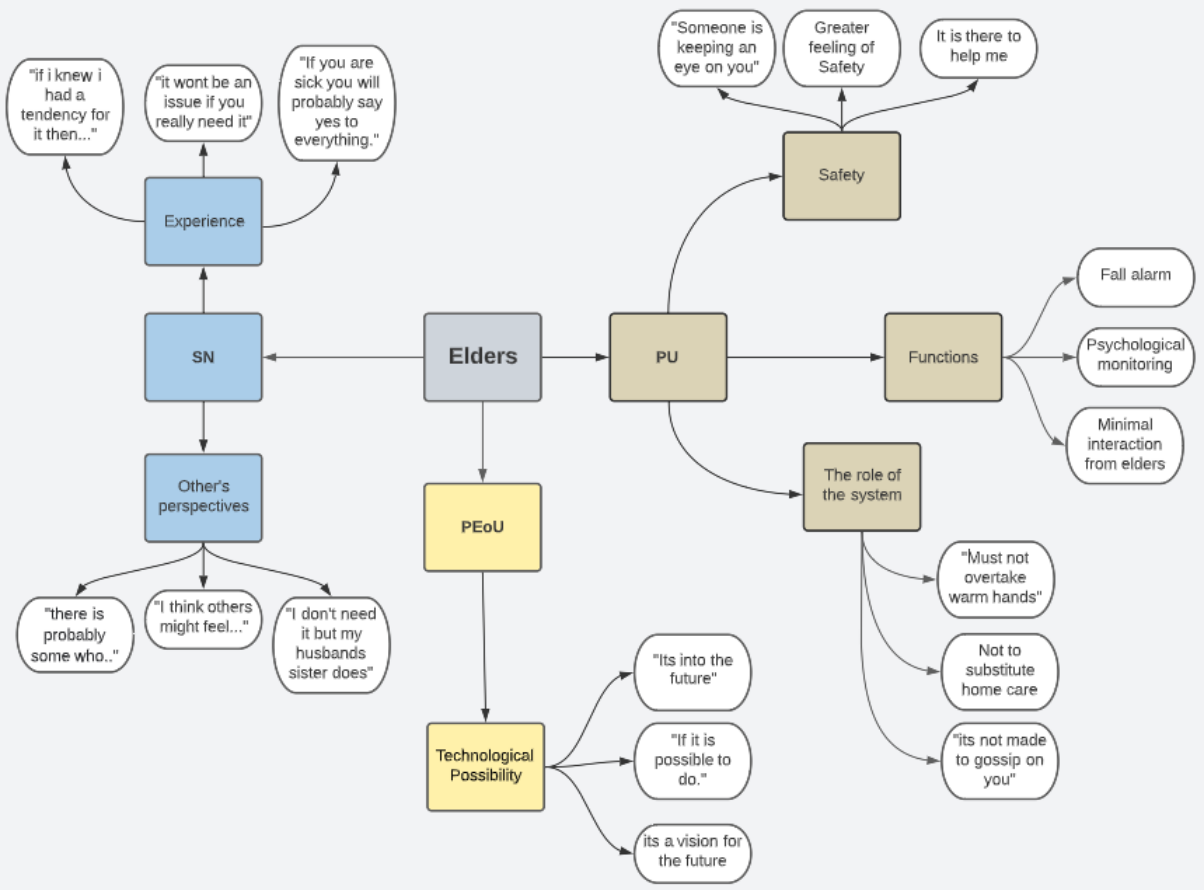


Figure. 13 – Map of themes appearing in the Interviews with the user group, Elders.

Perceived Usefulness

For the elders three themes emerged under Perceived Usefulness: *Function, Safety, and The role of the system.*

The theme of *Function* is about what functions the elders wish to see in TICHS. This constitutes many different specific technological functions such as a turn on/off function on the system, water proofing or as was particularly interesting for one of the elders a fall alarm:

> *"That you can call someone, if you fall - that's really what everyone's probably most nervous about, that you fall somewhere and then could not get up again, right?"*
>
> *(Bodil, elder, appendix 2, page 15 time 00.17.00)*

But also constitutes more general design features such as the hope of the least possible interaction from the elders themselves:

"it would be good with as little interaction as possible"
(Cecilie, elder, appendix 3, page 1 line 18)

Or general hopes of extensions for the system besides health monitoring such as inclusion of mental health:

"*There can also be a mental part of it - there could definitely be someone who, when they are in a sufficiently bad mood, and there is no one coming and looking at them, that they somehow, through that system could send a message to yes, a psychologist or home care"*
(Aksel, elder, appendix 1 page 5, time 00.05.50)

These functions and design features are some between many whom the elders wished to see as part of the system if they had free reign to choose.

The next themes the elders presented was *Safety.* This theme could also be called security as that was one of the major positive factors the elders could see with the TICHS.

"It's nice to know that there are some one, who keep an eye on me"
(Cecilie, elder, appendix 3, page 1 line 17)

This feeling of safety was of major interest to the elders and the knowledge that the system was in place to help them was central for their feelings for the system:

" I think most of the elderly will say that it helps to take good care of us, so we like it. That's how I think it will work." (Aksel, elder, appendix 1 page 3, time 00.04.21)

The last theme under Perceived Usefulness is "*The role of the system*". This might sound a little confusing, but meaning is quite clear. From the elders there is a clear intention to that the role the system takes must not decrease the role of the caregivers regarding the human contact and the "warm hands" work:

"it probably must not be too much either, because human contact with other people - it is very important. There is no doubt about that. We all know it, and if everything becomes too technically, then I think it will be a problem, because then you become lonely."
(Aksel, elder, appendix 1 page 10, time 00.13.16)

And further how the goal of the technology can't be to replace but instead must be to help/relieve some of the burden:

"Yes, it can not replace it - I do not believe that"
(Aksel, elder, appendix 1 page 11, time 00.13.44)

The role of the system is further expanded by a statement from Bodil (elder) when she expresses her opinion on the surveillance the system is going to be doing:

> "*No it will not bother me, it is not like someone who gossips and says," now she has done and said such and such, and it was …"" (Bodil, elder, appendix 2 page 13 time 00.14.22)*

Perceived Ease of Use

For the elders there emerged one theme under Perceived Ease of Use, *Technological possibilities.* This theme originates from the skepticism that the elders had regarding the possibility of creating this kind of system with the technology we have today. They particularly saw it as a thing for the future:

" Yes, but that is the future. I can hear that!"
(Bodil, elder, appendix 2, page 14, time 00.15.37)

and

"It would be a damn great idea, ***if*** *it can be done"*
(Aksel, elder, appendix 1 page 3, time 00.03.54)

Subjective Norms

Under the category of Subjective Norm two themes emerged through the interviews with the elders, *Experience and Other's perspectives*

The first theme that was found under subjective norm is *Experience*. This theme presents how the elders' opinions, and the opinions they are confident others have on TICHS and the questions asked, were widely influenced by previous experiences or their history with disease/illness.

> *"I think if you are –let us put it a little on edge - I think if you're sick enough, then you have to say, yes thank you for all of it. And if you are still quite fit, even if you are old and quite fit still and nimble, then there will be many who will say, no thank you."*
> *(Aksel, elder, appendix 1 page 9, time 00.12.09)*

Particularly experiences of sickness or feeling unsafe and an actual need was expressed as reasons for agreeing to more invasion of the system:

" It would not bother anyone, if it was what you really need it, right?"
(Bodil, elder, appendix 2, page 8 time 00.10.48)

The second theme that was found under Subjective norms was *Other's perspectives. Other Perspectives* revolves around the fact that the elders were particularly focused on elucidating both their own perspectives and the perspectives of 'other's' when being asked for their opinion. This became apparent through answers such as:

"There must be someone - but for me it will be fine - there must be someone who will feel that it will be too much surveillance." (Aksel, elder, appendix 1 page 7, time 00.08.16)

As well as when asked about the use of video cameras as part of the system and the answer was:

" … It would not bother me at all. And it has to do with such a very basic point of view, which says, I do not do anything - than if everyone else could come to know it, - they are welcome. I have every right to do what I do, even if it is unpopular. It does not matter. But I still think there are a lot of people, who would feel like," no, now they keep too much an eye on me. Yes, for me I do not care a damn." (Aksel, elder, appendix 2 page 8, time 00.10.42)

Or from another elder who was insistent on not needing the system but very interested in getting to for her husband's sister:

"My husband's sister, who lives far away and lives alone and has several stairs, could need the system." (Cecilie, elder, appendix 3, page 1 line 4)

This was a shallow presentation of the major themes that were found in the interviews with the elders.

The Home Care Professionals

Next a presentation of the major themes that were found in the interviews with **The Home Care Professionals.**

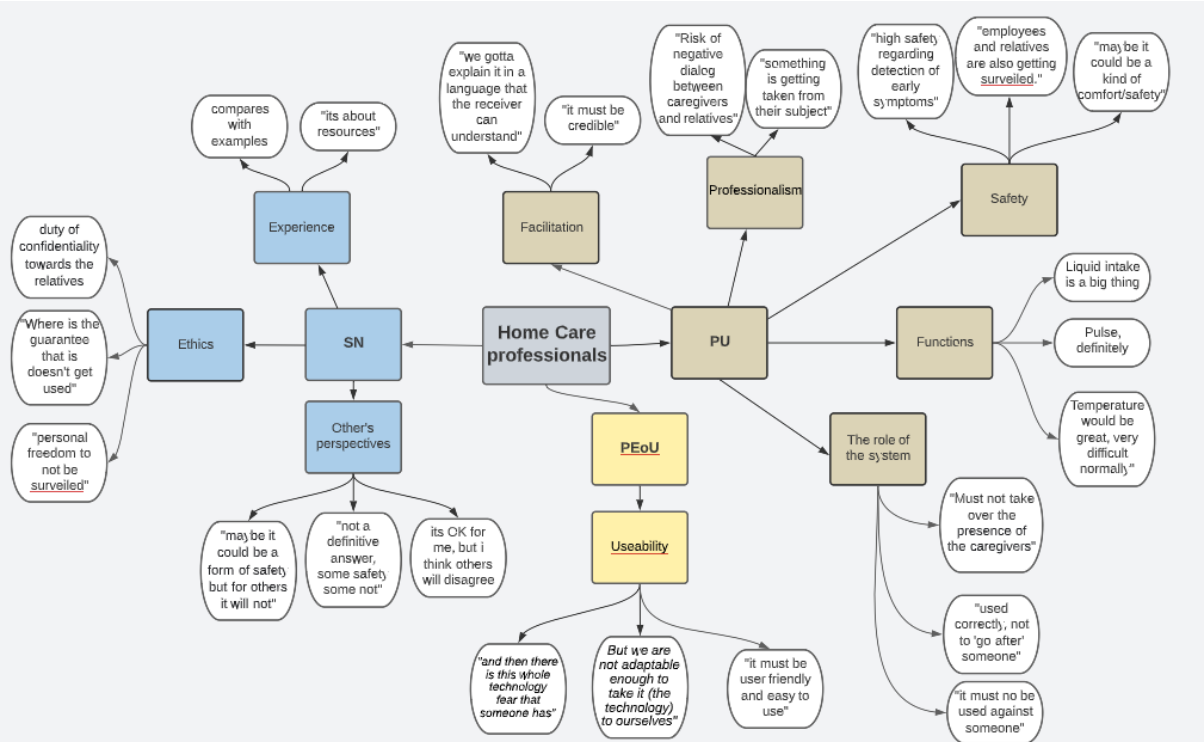


Figure. 14 – Map of themes appearing in the Interviews with the user group, Home Care Professionals.

Perceived Usefulness

For the Home Care Professionals five themes emerged under Perceived Usefulness, they were once again *Function, Safety* and *The role of the system* and then in addition of those *Professionalism* and *Facilitation.*

The theme of *function* is about what functions the Home Care Professionals wish to see from/in the TICHS. This constitutes a lot of different specific technological functions and was in the conversations with the Home Care Professionals particularly focused on specific measurements they wished to have available, as they were important in their job as caregivers:

> *"(Measurement of) fluid intake, yes that's a big part of it"*
>
> *(Bente, Home Care, Appendix 5, page12, time 00.12.55)*

But also constitutes more design features that helps them do bothersome tasks such temperature measurements:

> *"it is very troublesome, when we, during a visit at the elder has to make a rectal temperature" (Anne, Home Care, Appendix 4, page 53, time 01:06:27)*

Or general hopes of extensions for the system besides health monitoring such as inclusion of mental health:

> "*It is actually very interesting also the mental health, because the mental health / physical health - It is simply totally connected*."
> *(Anne, Home Care, Appendix 4, page 40, time 00:50:32)*

These functions and design features are some between many whom the Home Care Professionals wished to see as part of the system if they had free reign to choose.

The next theme the interview with the Home Care Professionals showed was *Safety*. This theme could also be called security as that was one of the major points of interest to the Home Care Professionals regarding the TICHS.
In particular the feeling of safety that the TICHS could give to the elders was of interest to the Home Care Professionals and was seen as a positive part of the system:

> "*And there could also be a high degree of safety in terms of us picking up some early signs on the elder not being well" (Dorthe, Home Care, Appendix 7, page 20 time 00.29.17)*

But also, the feeling of safety for the relatives was of interest and a positive effect of the system:

> "*Yes, they (the relatives) will probably, to a greater extent, experience a form of safety. They are often worried, and relatives are at work and worry about the elderly, so for them it will definitely - there I think, you would meet many more, who have a positive attitude"*
> *(Dorthe, Home Care, Appendix 7, page 19 time 00.27.26)*

But the caregivers were also included and the feeling of being surveiled by a technological system was seen as a concerning by the Home Care Professionals:

> "*The home care professionals have felt themselves kept under surveillance and did absolutely not want to be part of the fact, that some relatives have actually videoed them when they have been visiting" (Bente, Home Care, Appendix 5, page 34, time 00.28.58)*

These concerns regarding the safety and security that the TICHS could give, as well as the flipsides of it, was a constant recurring theme throughout the interviews with the Home Care Professionals.

The third theme under Perceived Usefulness is "*The role of the system*". The Home Care Professionals puts a big emphasis that the role the system takes must not be used in the wrong way. One part of this is that it must not take over the caregiver's role in home care:

"It's some of these things, I think, that can take the presence away from us, and the objective assessment of what it really looks like." (Charlotte, Home care, appendix 6, page 26 time 00.29.06)

Furthermore, the Home Care Professionals emphasizes that the TICHS must not become a reason for relatives not to visit the elder referring to the system sayings it is going well: Bente Home Care Professional imagine the way the relative could think:

"Right, now I (the relative) do not have to visit my elder relative, because things are in order and he or she is fine" (Bente, Home Care, Appendix 5, page 41, time 00.35.48)

A further concern of the Home Care Professionals that the TICHS must not be used against someone:

"Yes, we have to trust, that the system will be used correctly, not to "get after someone"" (Dorthe, Home Care, Appendix 7, page 10 time 00.12.58)

The fourth theme under Perceived Usefulness is *Professionalism.* Professionalism appears in different areas of the interviews and constitutes different concerns regarding the TICHS. It particularly appears regarding opposition to the system from the caregivers when talking about its influence on their job:

".. this about being afraid that something will be taken from one's profession."

(Charlotte, Home Care, appendix 6, page 12 time 00.14.49)

That something is taken from their profession or even more that they are being doubted regarding their work by being filmed/surveiled:

"*The home care professionals have felt themselves kept under surveillance and did absolutely not want to be part of the fact, that some relatives have actually videoed them when they have been visiting" (Bente, Home Care, Appendix 5, page 34, time 00.28.58)*

Or that the system will lead to confrontation between the caregivers and the relatives, regarding what they do or what the relatives believes they should do:

"there will be a risk of a dialogue (in between the home care professional and the relatives) about the experience of the data and how to react to them and act on them"
(Charlotte, Home Care, appendix 6, page 23 time 00.26.25)

The final theme under Perceived Usefulness is *Facilitation*. Through the talks with the Home Care Professionals the importance of how the TICHS system is facilitated to the users became apparent and it is clear, that it is vital for the acceptance of TICHS. In particular, an emphasis on showing the systems credibility was expressed by the Home Care Professionals:

"a*nd then believe in the system, that it <u>should</u> alert if there is anything"*
(Anne, Home Care, Appendix 4, page 43, time 00:53:53)

Furthermore, the Home Care Professionals expressed a big interest in the system being explained (facilitated) in a language the users can understand:

"one must also speak in a language so the recipient actually understands, what it is we are talking about." (Charlotte, Home care, appendix 6, page 7 time 00.09.57)

Perceived Ease of Use

For the Home Care Professionals there emerged one theme under Perceived Ease of Use,

Usability

The Home Care Professionals was quite clear about the demands for the usability of the TICHS system. As a major concern was mentioned a possible "technology anxiety" amongst the Home Care Professionals. Anne, a home care professional explain that it is difficult to implement new technology in the home care system, since there a resistance from Home Care Professionals

"Yes we are some sourpusses ."
(Anne, Home Care, Appendix 4, page 8, time 00:15:35)

This is supplemented by another of the interviewed, Charlotte

"But we are not adaptable enough to take it (the technology) in"
(Charlotte, Home Care, appendix 6, page 11 time 00.14.07)

and

"and then there is this whole technology fear that someone has"

(Charlotte, Home Care, appendix 6, page 12 time 00.15.13)

Another major important factor that the Home Care Professionals want is user-friendliness and easy access:

"So the completely obvious…. Then it must be very user-friendly, ie be very easily accessible."

(Dorthe, Home Care, Appendix 7, page 5 time 00.05.15)

And using a "language" which are recognizable for the Home Care Professionals is also mentioned as beneficial for the usability of the system. Discussing the systems possibility of using red, yellow, and green for categorizing the elder's health-situation, Charlotte said

"Yes, yes - it is a technological triage, you could say - we also triage the citizens every day in the dementia units, where we define their habitus as green, yellow or red"

(Charlotte, Home Care, appendix 6, page 3 time 00.04.53)

Subjective Norms

The last themes the Home Care Professionals presents in the interviews is regarding Subjective Norm. Here three themes appear, *Experience, Other's perspective and in addition to the previous themes Ethics.*

The first theme is *Experience* and as earlier explained, it is about how experiences changes how they or others perceive TICHS. Through the talks with the Home Care Professionals, it becomes apparent how some of their experiences have influenced them and through that their opinions on TICHS and elder care. When talking about the idea of the system, one particular concern arises from all the Home Care Professionals: the influence of cost on inventions:

"*Yes it is about resources too".*

(Bente, Home Care, Appendix 5, page 2, time 00.01.56)

Further a couple of other concerns arise from the experiences of some of the Home Care Professionals

"*So it's been many years since I was educated. We had nothing about technology"*

(Charlotte, Home Care, appendix 6, page 12 time 00.14.26)

and

"Sometimes you say…" Yes, yes", something (new) comes up all the time, and it does. Something comes up all the time and we have to deal with; "Well! new IT systems, damn it" (Anne, Home Care, Appendix 4, page 8, time 00:15:44)

These experiences show a clear influence on the opinions on the Home care professionals in their answers in the interviews. This influence is noted by one of the Home Care Professionals who says:

"So it has something to do with the fact it is new right? So when is it, we take steps to say, well, - of course we have to do it. Well, at least I cant do it right now, but I believe if you ask me in 3 years, I might say something completely different. Because then I would know, perhaps also with greater certainty, what it is you are talking about, and I would have seen it, I would have sensed it. But on these uncertainties - even though one can visualize of whether it could be such a camera placed there, or it could be a sound recording placed there, it is really difficult for me to answer, when I do not know what it is" (Charlotte, Home Care, appendix 6, page 21 time 00.23.20)

The second theme under Subjective Norms is *Other's perspective*. The theme of other's perspectives revolves around the fact that the Home Care Professionals would always present both perspectives (their own and "the others") to a given question when being asked for their opinion. This became apparent through answers such as:

"*Yes, it's okay for me, but I think many (Home Care Professionals) will protest" (Bente, Home Care, Appendix 5, page 34, time 00.28.53)*

As well as when asked about their opinion on the sharing of the collected data as part of the system and the answer was:

"*Maybe it could be some kind of safety, but I certainly think there would also be someone who would not think it was positive" (Bente, Home Care, Appendix 5, page 39, time 00.34.08)*

And with a view on the elders

"Some (elder) will probably experience increased safety - that "someone is keeping an eye on me", and others would think like "You simply should not interfere so much in my life"" (Dorthe, Home Care, Appendix 7, page 18 time 00.26.26)

The third theme as part of the Subjective Norm is *Ethics.* The theme of ethics appears in the interviews with the Home Care Professionals in different kind of ways, but in general, it comes into light through the concerns that the Home Care Professionals have regarding TICHS, such as privacy, self-determination, confidentiality, dignity, and rights.
One example of this is when talking to one of the Home Care Professionals about what worries she has regarding the TICHS, and she explains:

> *"Some of my concerns in this, it might be the ethical - yes ethical considerations - in relation to... it borders on a kind of surveillance" (Dorthe, Home Care, Appendix 7, page 7 time 00.09.11)*

But the theme of ethics shows one of its other sides, when talking about sharing the data with relatives, and the Home Care Professional states:

> "Y*es, but there is also something called a duty of confidentiality towards the relatives" (Bente, Home Care, Appendix 5, page 38, time 00.32.19)*

Another way it becomes apparent is through the concern one of the Home Care Professionals shows regarding the use of the data/technology:

> *"But I'm not there at all. It may be, that you say, it will be made so no humans sees it, but where is the guarantee for that?" (Dorthe, Home Care, Appendix 7, page 12 time 00.15.32)*

These concerns, and many more make up the theme of ethics and have shown a clear presence in the minds of the Home Care Professionals when talking about the TICHS-idea.

Health Care Professionals

Next a presentation of the major themes that was found in the interviews with **Health Care Professionals.**

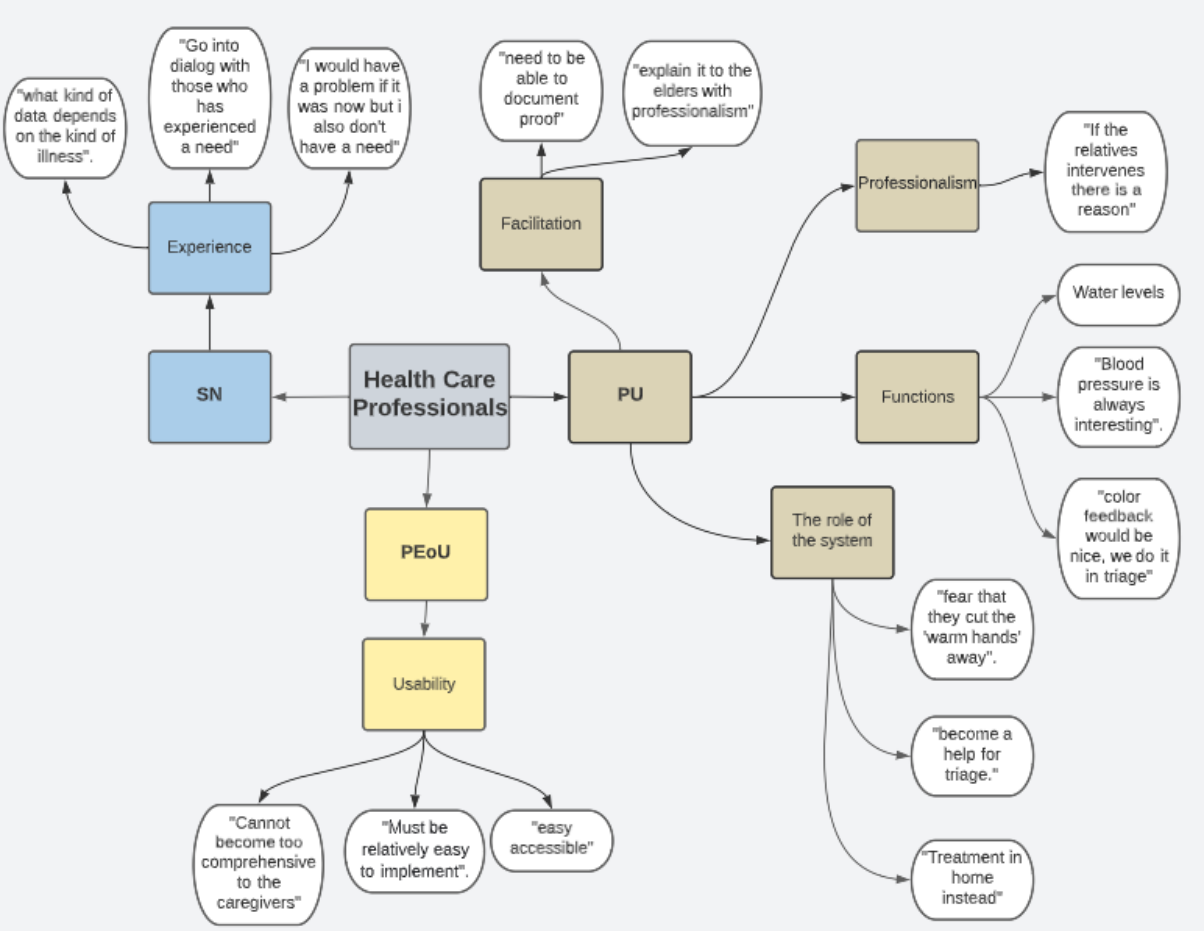


Figure. 15 – Map of themes appearing in the Interviews with the user group, Health Care Professionals.

Perceived Usefulness

For the Health Care Professionals four themes emerged under Perceived Usefulness, *Function*, *The role of the system, and as for the Home Care Professional - in addition to these Professionalism and Facilitation.*

The theme of *Function* is about what functions the Health Care Professionals wish to see from/in the TICHS. This constitutes a lot of different specific technological functions, in particular specific measurements of data that they see as vital and useful for their job. These measurements constitutes of a variety of functions such as hydration measurements, medicine intake, food intake and more, - Birgitte, Hospital doctor was particularly interested in the possibility of measuring blood pressure:

"*Blood pressure is pretty much always interesting*"

(Birgitte, Hospital doctor, Appendix 9, page 7, time 00.07.56)

But the requests also constitute more general design features to avoid to many "unnecessary" possible contacts from the elders, the Home Care Professionals, and the system

"If I have to think from only the perspective of a doctor, then I'm afraid – please understand me correct - that I will be contacted too soon or too often"

(Birgitte, Hospital doctor, Appendix 9, page 1, time 00.00.14)

They also expressed a positive view on the idea of a red/yellow/green feedback design as it resembles some of their usual work practices:

"*Yes, I think so in relation to the colors, it will probably be smart, because it is used already, in relation to the citizens, where you triage already"*

(Caroline, hospital nurse, Appendix 10, page 9, time 00.12.01)

These functions and design features are some between many whom the Health Care Professionals wished to see as part of the system if they had free reign to choose.

The second theme under Perceived Usefulness is "*The role of the system*". The Health Care Professionals makes it clear, that the role the system takes, must not affect the human contact and the "warm hands" work in a negative way:

"My little fear could be that if you get such a tool, that you will then cut warm hands"

(Anders, Practitioner, Appendix 8, page 21 time 00.24.36)

Furthermore, the Health Care Professionals emphasizes that the role of the TICHS is as a tool for the caregivers in general and might be a great supplement to what is already done as part of the triage:

"It could also be something that just helps in relation to triage. So it can easily be something you then also use in the triage" (Caroline, hospital nurse, Appendix 10, page 19, time 00.23.30)

And further how the goal of the technology can't be to replace but instead must be to help/relieve some of the burden of the caregivers and facilitate home treatment:

"we still also try to prevent these hospitalizations by getting contact the elders own doctor or an emergency doctor and measuring these values and making sure that if they suddenly get

a pneumonia, that they are then treated at home"

(Caroline, hospital nurse, Appendix 10, page 16, time 00.19.56)

The third theme within Perceived Usefulness is *professionalism*. This theme appears with the Health Care Professionals when talking about the interference from the relatives with Caroline, the hospital nurse, where she says, it's the caregiver's responsibility to:

"It is the fact that we are health care professionals, and we must have our professionalism in order." (Caroline, hospital nurse, Appendix 10, page 14, time 00.16.51)

The theme also holds the opposite within it. The Hospital Doctor, Birgitte, puts an emphasis on the importance of the work the new system gives to the caregivers not being too comprehensive:

"As long as it does not become too extensive, I would say, it will probably be acceptable"

(Birgitte, Hospital doctor, Appendix 9, page 17, time 00.15.32)

The final theme under Perceived Usefulness is *facilitation*. Through the talks with the Health Care Professionals the importance of how the TICHS system is facilitated to the users have been a major concern and focus. This has in particular been a focus of the practitioner Anders who put emphasis on validating and proving the use of the system and showing the connection between the system and a positive effect:

"….and it is possible to validate it in relation to some kind of endpoint, whether it is called hospitalizing or function level, or whatever it ends up with."

(Anders, Practitioner, Appendix 8, page 20 time 00.24.15)

Furthermore, the hospital nurse was adamant to emphasis the importance of the caregivers being able to explain the system and its importance to the elders and relatives with competence:

"but I just think that I that situation you have to talk to the citizen with the professionalism you have" (Caroline, hospital nurse, Appendix 10, page 11, time 00.14.05)

Perceived Ease of Use

For the Health Care Professionals there emerged one theme under Perceived Ease of Use, *Usability.*

The theme of *Usability* revolves around the importance of how easy the system is to use and specific use correctly. The Health Care Professionals have expressed the importance of the usability of the system, for it to be relatively easy to use in the homes of the users:

"if one can somehow implement something that is relatively easy to implement"
(Anders, Practitioner, Appendix 8, page 20 time 00.23.09)

This is further expressed by Caroline, the hospital nurse, who explicitly says:

"If it must be able to work, then it must be something easily accessible. Then it must be something that show up on your i-pad, for example, that there is something you have to be aware of, so it is easy to find, so it is clear, yes, because there are many things in that we already need to have control of" (Caroline, hospital nurse, Appendix 10, page 18, time 00.22.50)

Finally, the Hospital Doctor puts an emphasis on the importance of the work the new system gives to the caregivers not being too comprehensive:

"*As long as it does not become too extensive (for the caregivers), then I would say, it will probably be acceptable" (Birgitte, Hospital doctor, Appendix 9, page 17, time 00.15.32)*

Subjective Norms

The last theme the Health Care Professionals presents in the interviews is under Subjective Norm. It is the *experience* theme. As earlier explained, it is about how experience changes how they or others perceive the TICHS. The Health Care Professionals focuses on how it is important to include the ones with needs in the project as they are the ones who knows of that need and that might change their opinions:

"I would be sorry if someone right now would measure on and weigh me, but that is also because, I do not have the experience that I need it. I think this acceptance is easier when you, enter into a dialogue with the elderly citizens, who have had some problems in terms of being able to manage in their own home."
(Anders, Practitioner, Appendix 8, page 16 time 00.18.30)

The Health Care Professionals also presents another situation where experience changes how or what is need from the TICHS. The hospital doctor explains, when asked about what kind of data she would like from the system, that:

"*It also depends a bit on what it is wrong with the patient*"
(Birgitte, Hospital doctor, Appendix 9, page 7, time 00.07.22)

and these point of views must be considered in the system.

Relatives

Next a presentation of the major themes that was found in the interviews with **Relatives**.

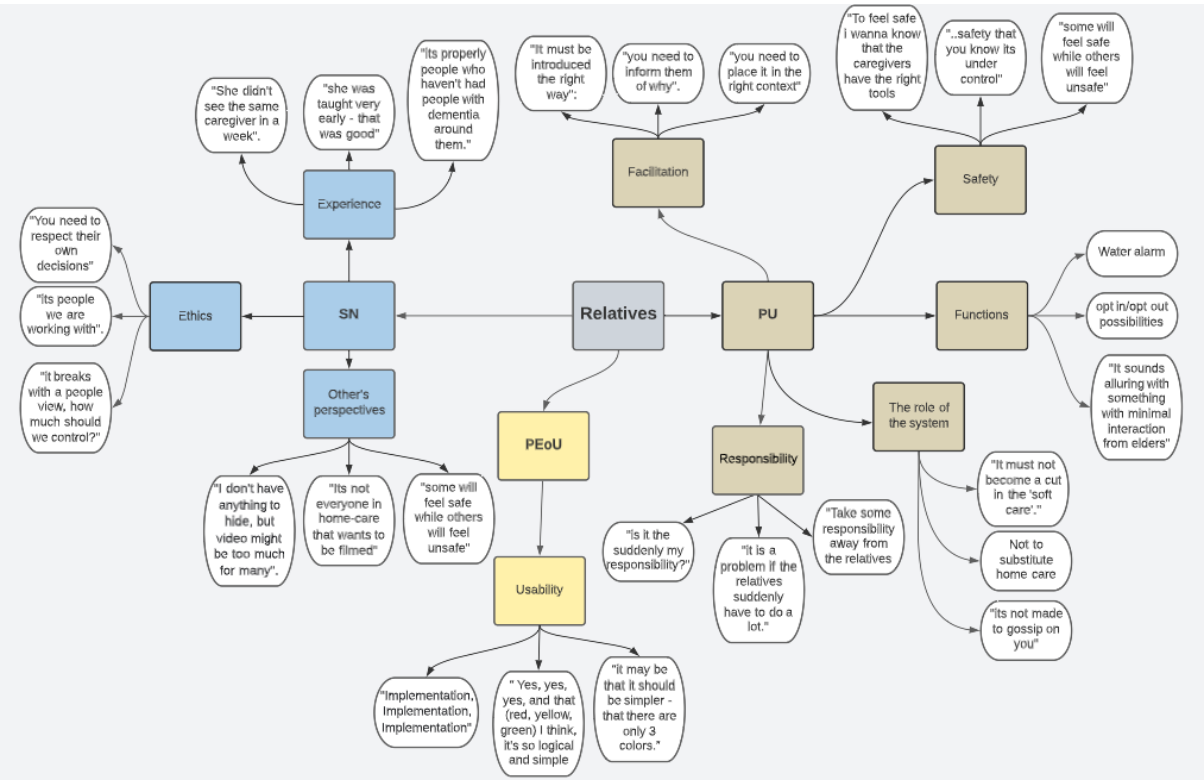


Figure. 16 – Map of themes appearing in the Interviews with the user group, Relatives.

Perceived Usefulness

For the Relatives five themes emerged under Perceived Usefulness, they were once again *Function, Safety, The role of the system, and in addition Responsibility and again facilitation.*

The theme of *Function* is about what functions the Relatives wish to see from/in the TICHS. This constitutes a lot of different specific technological functions such as a turn on/off function on the system, water proofing or – which was particularly important for one of the relatives - measuring water intake:

> "*Well, the biggest problem for, I think many of the elderly, is that they do not get enough water" (Camilla, relative, Appendix 13, page 6, time 00.06.30)*

But it also constitutes more general design features such as the hope of the least possible interaction from the elders themselves:

> "I *think it sounds tempting with something, where the older one should not do it"*
>
> *(Ditte, relative Appendix 14, page 15, time 00.18.55)*

Or general hopes of extensions for the system besides health monitoring such as inclusion of mental health:

> *"Because I think especially the mental part is very low-key in relation to what one can actually do, even with small things, to create well-being and health."*
> *(Ditte, relative Appendix 14, page 7, time 00.08.38)*

These functions and design features are some between many whom the elders wished to see as part of the system if they had free reign to choose.

The next theme the interview with the Relatives showed was *Safety*. This theme could also be called security as that was one of the major points of interest to the Relatives regarding the TICHS.
In particular the feeling of safety that the TICHS could give to the relatives as well as the elders was a positive part of the system:

> *"But it will definitely be a safety, if you knew, that it was under control, even when the phone is not being picked up*" (*Ditte, relative Appendix 14, page 16, time 00.20.55)*

But also, the feeling of being unsafe was a concern to the relatives, especially when considering and talking about video cameras as part of the TICHS:

> *"*some *would be becoming very confident in it and others would actually become more insecure." (Anja, relative Appendix 11, page 16, time 00.18.55)*

But also, the caregivers were included and that the feeling of safety was conditioned by the caregivers having the right tools to do their work:

> *"If I, as a relative, should be safe, it is important that the home care professionals, who take care of the elder and help them in everyday life, have the tools they need and the time"*
> *(Anja, relative Appendix 11, page 27, time 00.30.09)*

These concerns regarding the safety and security that the TICHS could give as well as the flipsides of that was a constant recurring theme throughout the interviews with the relatives.

The third theme under Perceived Usefulness is "*The role of the system*". The Relatives makes it abundantly clear, that the role the system takes must not impact the human contact and the "warm hands" work in a negative way:

> *"it would be hugely important that, that part belong to the project, - that no one think: It's a smart idea. Develop it - Victor and company, and then it can be a way that you can reach more older people in less time" (Ditte, relative Appendix 14, page 9, time 00.10.58)*

Furthermore, the relatives emphasizes that the role of the TICHS is as a tool for the caregivers in general and must not become a way for the caregivers not to need to visit if it is going well:

> *"*Because *it can also become a "then we do not have to visit Mrs. Jensen""*
> *(Anja, relative Appendix 11, page 16, time 00.18.01)*

The concerns of the relatives become apparent clearly in Anja's statement:

> "*(Remember) it's people we are talking about, so the system must not make it up for human beings, but it can help" (Anja, relative Appendix 11, page 34, time 00.38.34)*

The fourth theme within Perceived Usefulness is *responsibility*. This theme appears with the Relatives when talking about them receiving data from the system. Herein particularly one relative becomes concerned with this situation and questions if responsibility follows the data:

> "*Does it suddenly become my responsibility? or is it still - what to say - the responsibility of home care professionals" (Benedikte, relative Appendix 12, page 21, time 00.20.14)*

The theme is further supported by another relative:

> *"But where the relatives are mega stressed, and they have to a lot of everything too, then it is not without… .. problems" (Ditte, relative Appendix 14, page 15, time 00.19.43)*

Some of the relatives also holds the opposite opinion, particularly in the early stages of the TICHS:

> "*so how can you also get the relatives to take more and more, yes, yes, part of it - be active in one way or another" (Anja, relative Appendix 11, page 3, time 00.04.12)*

The last theme under Perceived Usefulness is *Facilitation*. Through the talks with the Relatives the importance of how the TICHS system is facilitated to the users has been emphasized again and again

and it is clear that they see it as vital for the acceptance of TICHS. In particular an emphasis on introducing it correctly to the elders was central to the relatives:

"*I also think it's a question of it being introduced in a correct way for the older people"*
(Camilla, relative, Appendix 13, page 5, time 00.05.01)

Another major important factor that the relatives want to be conveyed/facilitated is that the system is automated and that the gathered information is not being looked at by people:

"if it is facilitated, that it (the data) enter into a computer, which then, with some algorithms, generates the information without people seeing it, then it is ok"
(Ditte, relative Appendix 14, page 26, time 00.32.53)

Furthermore, the relatives expressed a big interest in the system being introduced into the right context and be mindful of the situation:

"*So I think it's very situational." (Benedikte, relative Appendix 12, page 22, time 00.21.18)*

And finally, one of the relative summed it up:

"it may well be "the gadget" and so on. But it is also the wrapping and it is the facilitation of it" (Ditte, relative Appendix 14, page 34, time 00.42.12)

Perceived Ease of Use

For the Relatives there emerged the same theme under Perceived Ease of Use, as for the above-mentioned groups*, Usability*

The theme of *Usability* revolves around the importance of how easy the system is to use – and for it to be used correctly becomes vital for the adaption of the system. The Relatives have expressed a major focus on the importance of an ease implementation of the system; so much that a relative when ending the interview with their last comments said:

"*implementation, implementation, implementation"*
(Ditte, relative Appendix 14, page 34, time 00.41.40)

The ease of the use is described by the wishes for it to be recognizable – for example with references to existing "information models" in the health care system

"*Yes, yes, yes, and that (red, yellow, green) I think, it's so logical and simple."*
(Ditte, relative Appendix 14, page 16, time 00.20.27)

Subjective Norm

The last themes the Relatives presents in the interviews is regarding Subjective Norm. Here three themes appear, *Experience, Other's perspective* and *Ethics*.

The first theme is *Experience* and as earlier explained, it is about how experiences changes how they or others perceive the TICHS. Through the talks with the Relatives, it becomes apparent how some of their experiences have influenced them and through that their opinions on the TICHS and elder care. When talking about the use of GPS in eldercare and the possible resistance against it one of the relatives was very adamant:

> *"Well those are probably the ones, who do not have people around them with dementia. It is my position, that if one has experienced that one's mother with dementia has disappeared out of some door, and no one knows where she is, one would like the help to reach her, and one would be able to that with a tracker, - in that case there are no doubt, that she should have a tracker on." (Ditte, relative Appendix 14, page 27, time 00.33.37)*

The relatives also show how their experiences as relatives to elders have shaped their opinions in other ways:

> "*I think it's absolutely excellent, I think there are far too many different ones (Home Care Professionals) visiting the elders in question, that is, when my mother was sick at home - Well, she actually did not see the same (Home Care Professional) for several days," (Camilla, relative, Appendix 13, page 3, time 00.03.00)*

and

> *"Yes, my mother learned very early, that she should have it (the alarm) around her neck, and I do not think she forgot it, so it was learned so early, because - and that's also part of what you mention, that is, the fact that it must come so early - before she becomes very demented"*
>
> *(Anja, relative Appendix 11, page 18, time 00.20.30)*

These experiences show a clear influence on the opinions on the relatives in their answers in the interviews.

The second theme under Subjective Norms is *other's perspective*. The theme of other's perspectives revolves around the fact that the relatives were particularly focused on elucidating both

perspectives (their own and "the others") to a given question when being asked for their opinion; this became apparent through answers such as:

"*some would be becoming very confident in it and others would actually become more insecure***."** *(Anja, relative Appendix 11, page 16, time 00.18.55)*

As well as when asked about their opinion on the use of video cameras as part of the system and the answer was:

"Well, for me. I have nothing to hide, so that it will be perfectly okay with me. But I think that if it's about video, then I think, there are many who have a lot against it."
(Camilla, relative, Appendix 13, page 11, time 00.12.13)

Or from another relative who was interested in the perspective of the caregivers:

"After all, not everyone who comes from the home care is interested in the fact, that when I (the home care professional) come, I will be photographed"
(Benedikte, relative Appendix 12, page 1, time 00.00.44)

The third and final theme as part of the Subjective Norm is *Ethics*. The theme of ethics appears in the interviews with the Relatives in different kinds of ways, but in general, it comes into light through the concerns that the Relatives have regarding the TICHS, such as privacy, self-determination, confidentiality, dignity, and rights.
For the Relatives the concern is in particular regarding the fact that it is people the system is catering to:

".. the ethical aspect of it. In other words, this is people we are dealing with, both the relatives and the citizen himself and those who care"
(Anja, relative Appendix 11, page 34, time 00.38.34)

But the theme of ethics shows one of its other sides when talking about the possibility of creating a surveillance society:

"Yes uha, it will be the surveillance community. But what is the purpose? What is the purpose? With this surveillance?" (Ditte, relative Appendix 14, page 28, time 00.35.33)

This is further enhanced by one of the relatives setting the question of surveillance versus safety:

"The dilemma, which is present is "Big Brother Watching You" contra "I feel safe""
(Benedikte, relative Appendix 12, page 29, time 00.26.32)

These concerns, and many more makeup the theme of ethics and have shown a clear presence in the minds of the relatives when talking about the TICHS-idea.

7. From data to analysis

Relational structure of the themes

These examples are some of what the users have said during the interviews, structured under the themes, which showed up in the thematic analysis, and grouped under the CSD-TAM factors, that they at first sight seemed to be relevant for. In the following analysis I will dive deeper into the themes, how they compare across user groups, what they might insinuate and what they mean to the acceptance of TICHS.

This will be based on the following relational map (inspired by Clarke et.al Situational Analyses (Clarke, Friese og Washburn 2015) of themes across user groups and their relations to each other

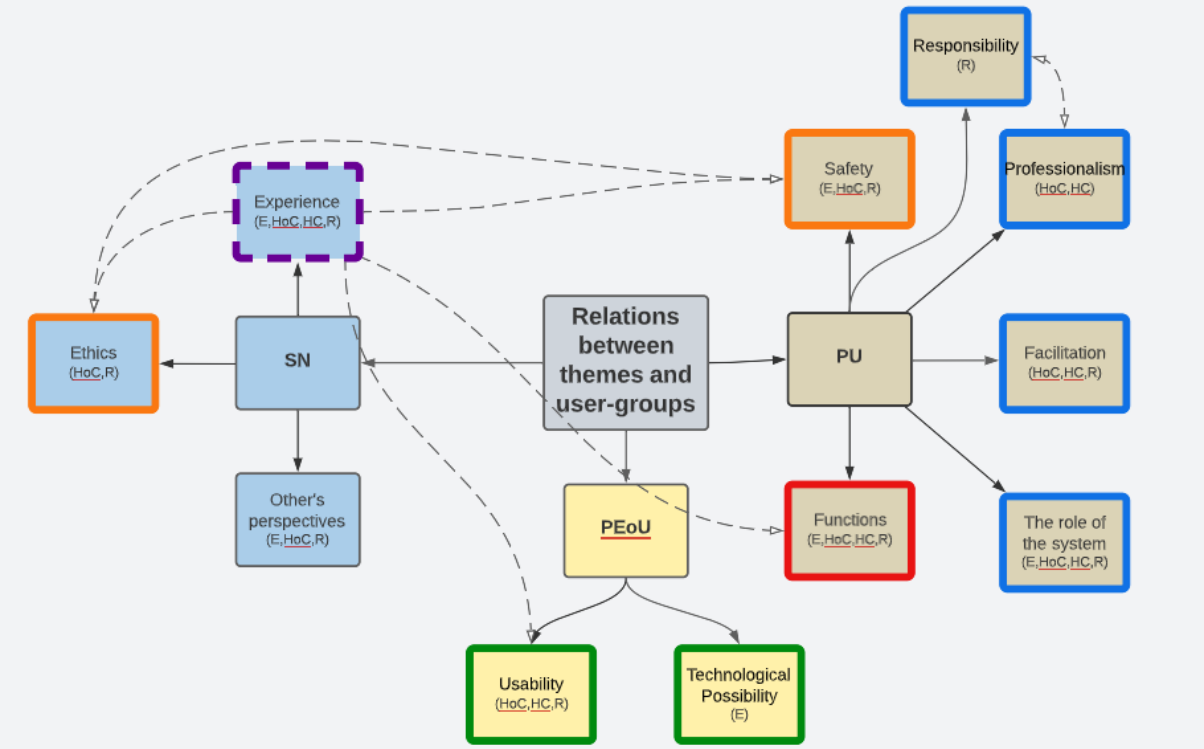


Figure. 17 – Map of relations between themes appearing across all four the user groups.

Seen above is the relational map, fig 17 made to elucidate the connections between the different themes as well as the relation between themes and user groups.

All themes are represented in a square.

The User groups of Elders(E), Home Care Professionals (HoC), Health Care Professionals (HC) and Relatives (R) are seen below the themes, they are related to, in the parenthesis.

Next; each theme has received a color, which represents its connection to other themes. This connection will also represent categories of which themes will be analyzed together. "*Other's perspective*" has not received a color, as it is so closely related to Subjective Norms that it, in the analysis, will be addressed as part of the introduction of Subjective Norm's.

Arrows with a dotted line represents influence that certain theme has on other themes, such as e.g., *Experience* on *Functions,* or *Safety* and *Ethics* on each other's.

Lastly *Experience* has a dotted color around it, which is made to represent the broader influence of experience on several other themes and this is also why the theme of experience will not hold a separate place in the analysis, but instead be part of all analysis points.

8. Analysis:

The analysis will be separated into the four themes from the relational map above, *Functions*, *Usability, Ethics* and *Facilitation*. The other themes will be included in the work with the representing theme from their corresponding categories.

Perceived Usefulness

Under Perceived Usefulness several themes have emerged, but only *functions* will be analyzed as part of Perceived Usefulness. This is because - as seen in the relational map - *safety* is connected to ethics and will therefore be addressed as part of that theme. Furthermore *facilitation*, while originally being a part of Perceived Usefulness, has a broader influence and will therefore be addressed as a separate theme.

Functions – what functions are needed for TICHS to be useful for the users?

The theme of function might be the most primal of the themes under Perceived Usefulness as it relates to the most fundamental part of what this thesis is looking for; what functions is needed in the TICHS for it to be useful to its potential users for the purpose of avoiding hospital admissions of elder people.

In a design TAM, like the CSD-TAM, it is even more obvious, since the technology is not designed yet, only the purpose of the invention of the technology is known. It means it is important to listen carefully to the user experts to get information about all what they think is relevant for fulfilling the purpose and by that be useful for the users.
These functions were, as earlier mentioned, divided between different kinds of functions.
Some users presented specific health data, which they found important for the usefulness of the technology to fulfill the purpose of TICHS, such as Blood pressure, Hydration, or oxygen levels:

"(Measurement of) fluid intake, yes that's a big part of it"

(Bente, Home Care, Appendix 5, page12, time 00.12.55)

Other users focused on what ways the data was to be gathered, such as by GPS, watches, fall sensors or bed sensors:

"That you can call someone, if you fall - that's really what everyone's probably most nervous about, that you fall somewhere and then could not get up again, right?"

(Bodil, elder, appendix 2, page 15 time 00.17.00)

Some users introduced their hope of extending the scope of what kind of data the TICHS should collect:

"Because I think especially the mental part is very low-key in relation to what one can actually do, even with small things, to create well-being and health."

(Ditte, relative Appendix 14, page 7, time 00.08.38)

Finally, some users introduced and put emphasis on how the TICHS should function:

"it would be good with as little interaction as possible"

(Cecilie, elder, appendix 3 page 1 line 18)

Below is a list of all the concrete functional requirements the users presented through the interview as well as which user groups mentioned the functions in their statements.

Functions for the TICHS	User Groups who presented the function
Specific Health Data:	
Hydration	Home Care Professionals, Health Care Professionals and Relatives
Activity	Elders, Home Care Professionals, Health Care Professionals and Relatives
Food/nutrition	Home Care Professionals, Health Care Professionals
Excretion, (Urine and stool)	Home Care Professionals and Health Care Professionals
Pulse	Home Care Professionals, Health Care Professionals and Relatives
Blood pressure	Home Care Professionals and Health Care Professional

Oxygen levels	Health Care Professionals
Night activity/bed sensor	Home Care Professionals and Relatives
Temperature	Home Care Professionals
Medicine tracking	Elders, Home Care Professionals and Health Care Professionals
Fall alarm	Elders and Relatives
'Hit' sensor	Relatives
EKG	Health Care Professionals
How the data is gathered:	
Restroom visits	Health Care Professionals
Watches/wearables	Elders, Home Care Professionals, Health Care Professionals and Relatives
GPS/location tracker	Elders, Home Care Professionals and Relatives
Bed Sensor	Home Care Professionals and Relatives
Fall sensor	Elders and Relatives
Extensions of the Scope:	
Psychology	Elders, Home Care Professionals, Health Care Professionals and Relatives
Fall alarm/safety button	Elders
Data sharing function	Home Care Professionals
How it should function:	
Minimal interaction for the elder	Elders and Relatives
Flexibility/adaption	Home Care Professionals, Health Care Professionals and Relatives
Red/yellow/Green indicators	Home Care Professionals, Health Care Professionals and Relatives
Waterproof	Elders
Opt-in/opt-out functions	Elders and Relatives

Figure. 18 – List of functions mentioned by users in interviews.

Though the structuring of the different functions the users have presented in the interviews a large number of possibilities and ideas has been visualized for the future design of TICHS. While a full implementation of all functions in TICHS is probably impossible and even unnecessary a couple of

functions stood out. The reasoning for why and how it stood out differentiated between the functions, some were mentioned by several different user groups, others were mentioned by all users within a single user group, and others were particularly emphasized by some users.

Activity tracking was the only specific health data function mentioned by all four user groups. This might be a slightly screwed observation as TICHS was presented as focusing on activity in its current state, but it was still mentioned multiple times throughout the interviews, also without any immediate connection to the presentation of TICHS.

Hydration was frequently mentioned by the users, all users from the groups of Health Care Professionals and Home Care professionals mentioned its importance, it was also mentioned directly by one of the relatives, and its importance was acknowledged by users from both the elderly and other relatives.

Medicine tracking is another one of the functions that were often mentioned by the users. Only the Relatives did not mention it explicitly.

The possibility of the format of the TICHS being **a watch or similar wrist worn accessory** was also received positively by most users, and the only data gathering method mentioned by all user groups.

One particular area of extension of the scope of TICHS was interesting to all user groups. **Psychology**, to incorporate measurements of mental health was of great interest to the users when given free rein to expand TICHS in any direction they wished.

Regarding functionality of TICHS one particular function was mentioned by most users either directly or indirectly, through their statements or concerns. Their hope was t**o make the system adaptable/flexible**, to ensure it is capable of being adapted to different kinds of people and their often very different needs.
This feature is particularly interesting when taking the vast span of different functions that the users want from the system.

As it is impossible to facilitate all the “wished for” functions into one technological solution, and likewise impossible to encompass individual people’s differences, the solution to the functions/format of the TICHS matches better with a system package. A system package, which holds multiple technologies, that together can create an elaborate system to encompass all or most of the needed functions, while still having the ability to be adapted/utilized in a way that accommodates the individual differences in the Elder in need of care.

The following part of this section will try to accomplish this by describing some of the above-mentioned features in more detail and try to present a case of a technology that might give that feature to the "system-package".

Case studies of existing technologies

The possible solutions, that I will present here, are case studies of already existing technologies or inventions that are currently under development and the following sections are intended to give an overview of what technologies either are already on the market or soon might be.

Activity tracking

The first function I will elucidate is the most mentioned function across the different user groups, **Activity tracking**. As mentioned above all the different user groups mentioned activity in one way or another, one of the Home Care Professionals mentioned its potential use regarding getting to know what kind of elder/patient they are meeting:

> "*We have an old woman, who sits and sleeps constantly …, Here you can say that there would be beneficial if we can see her activity levels, right?*"
> *(Bente, Home Care, Appendix 5, page 25/26 time 00.22.55/00.23.49)*

Another user, a Health Care Professional mentioned regarding what they usually are keeping an eye on regarding the health of the elder/patient:

> *"Yes, yes, but that is, among other things, what we keep an eye on in the triage. After all, it is to figure out, what their habitual state is, and if it is starting to change, - they start eating less, they become more bedridden and have more difficulty in walking and many things?."*
> *(Caroline, Hospital Nurse, Appendix 10, page 15 time 00.19.10)*

Activity was also seen as a good tool to measure if they had fallen and a reason for why they had homecare, when talking to one of the elders:

> *"I have only been into this (home care) quite briefly and what they have used it for has been to get me up in the morning, and be sure I do not lie in the bathroom and bounce and can not come up again, right? (Bodil, Elder, Appendix 2, page 1 time 00.00.01)*

While the technological solution to monitoring activity, in all its different forms, might be a video camera system implemented in the homes of the elders, this brings with it several other considerations, also presented by all the user-groups, such as privacy, safety and surveillance. Therefor that approach will not be presented here, but it will be discussed in the later section on Ethics and Safety.

While looking through cases of other technologies that can accommodate the request for activity tracking, especially through my writing of a literature study for The Department of Geriatrics on existing technologies for the TICHS (expected to be published start 2023), several cases of technologies that could solve some of the problems were found. One of those cases was an activity tracking bed plate that would track night movements and unrest during the night (Gokalp, et al. 2018). Another case of a possible activity tracker was a pair of insoles for shoes that would track how far you walked and if you fell by the pressure you exerted on them (Zulfiqar, et al. 2020). Both technologies were interesting solutions but neither could accommodate several different kinds of activity. As the search continued the technology that became most likely to accommodate the functions of activity tracking seemed to be smart watches. This way of incorporating the function in a watch will also help incorporate some of the other functions that have been requested by the users - one of them being the format of data gathering, through wearables/watches:

"So my immediate thought is that I think it's easier if it's something that is body-worn"
(Anders, Practitioner, Appendix 8 page 9 time 00.11.55)

One case of smart watches that seems to accommodate several different types of activity tracking is The Apple Watch (Apple 2022). Smart watches have during the last couple of years become more and more accurate in their measurements, while also becoming capable of monitoring additional kinds of data.

The Apple Watch is a case of this, it can measure several kinds of activity such as steps, GPS tracking, sleep activity, pulse, and falls.
Steps is as mentioned one of the forms of activity tracking that The Apple Watch is capable of, and studies have shown that its accuracy in monitoring steps walked have been proven to be incredibly precise:

Figure. 19 – Example Apple Watch (Apple 2022)

"We found that Apple Watch tested to be an extremely accurate device for measuring daily step counts. (Veerabhadrappa, et al. 2018)*"*

Furthermore, The Apple Watch also holds similar functions to traditional pulse/sports watches used by athletes as it is capable of monitoring GPS placement as well as the pulse of the user. It is further capable of taking that data and expressing it in statics and parameters, of max/min or rest pulse during the day like pulse/sports watches such as the polar watches do.

Figure. 20 – Example of data expression from a pulsar watch – Picture taken by author.

Furthermore, The Apple Watch is also capable of accommodating the feature of sleep activity monitoring. This feature has also been scientifically studied and compared to specialized sleep monitoring technologies, such as Philips Actiwatch (Roomkham, et al. 2019). Those studies emphasized that The Apple Watch sleep monitoring function could work as an adequate alternative to some of the sleep monitoring technologies (Roomkham, et al. 2019).

The Apple Watch is also equipped with a fall alarm and the possibility of making emergency calls.

Those are some of the tried and scientifically tested features of The Apple Watch, which also corresponds with the expressed wishes of the user groups.

The functions of the apple watch also incorporates some of the other functions the user groups wish for, even though they are not scientifically tested it is capable of making an EKG as well as a newly incorporated feature of tracking oxygen levels in your blood (Apple 2022).

These are the features of The Apple Watch and while they might not all be fully medically functional; they present a great insight into the possibilities of the Smart Watch. The functions that The Apple Watch has incorporated to various degree represent thirteen (Activity, Pulse, oxygen levels, Night activity, Fall alarm, Hit sensor, EKG, watch/wearable, GPS, data sharing, waterproof, safety button, opt-in/opt out functions) of the functions that the user groups present.

While The Apple Watch can accommodate a plethora of different features there are still a lot of features that it is yet to be able to provide.
Some of these features have been found provided in cases of other smart watches, particularly two features are solved by these cases of other smart watches, Blood pressure and Temperature.
Omron - a digital health product manufacturer has created a smart watch called “HearthGuide” that can measure the blood pressure of the user (Omron 2022). Fitbit, another electronics and fitness manufacturer, has created a smart watch called “Sense” that can measure the temperature of the wearer, as well as a variety of other health features, like The Apple Watch (Digitalhealthcentral 2021).

Criticism

All these features in different kinds of smart watches points to the unquestionable potential of the technology, but some problems also arise; price, battery lifetime as well as the fact that a watch doesn’t work if you do not wear it, are some of the challenges such a technology face. Further, the maturity of the technology is a question. While some of its features (such as step tracking and sleep monitoring) have been tested and have matured over time, some of the features (EKG and oxygen level) are, as established above, new and untested in a scientific and medical field, and still need time and testing to reach a stage, where it can be used in healthcare.

Hydration

Another feature that was widely mentioned particularly by all the Home Care- and Health Care-professionals was **hydration**. Hydration is a major concern in eldercare as a plethora of illnesses or health issues can be tributed to a lack of hydration. It is conditions such as confusion, weakness, urinary tract infections, pneumonia as well as other conditions (Gaunt 2020).

Furthermore, because of the natural aging process, elder often have a reduced sense of thirst which can further increase the likelihood of dehydration. An example of this condition is given by one of the Home Care Professionals:

“Many of the elderly they get annoyed. They say, "I'm not thirsty, what are we going to drink it for?”
(Bente, Home Care, Appendix 5 page 16 time 00.17.05)

The problem of hydration is further drawn up because of the difficulties to know if an elder has been drinking water, as it might have been poured into the plants or the sink. It is also difficult to know the amount of water that has been consumed by the elder; this frustration is expressed by one of the Home Care Professional users:

"You have no idea if they pour out the glass of water you have given them"

(Bente, Home Care, Appendix 5 page 15, time 00:16:11)

Hydration is a function that is hard to encompass into a system as the problems mentioned above will get in the way; do the elders just pour the water out? How much water was in the glass? and so on.

During the work with finding technological solutions to the TICHS I stumbled across a case with a SMART glass, that might be able to solve all these problems, and provide the function of in-home hydration tracking.

AQUATIME is an intelligent drinking glass that is capable of monitoring fluid intake and send data to home and health care professionals as well as relatives. (Aquatime 2022).

Figure. 21 – Smart glass from Aquatime - (Aquatime 2022)

The glass is capable of measuring the amount of fluid poured and consumed through a weight placed in the bottom of the glass, and is further equipped with a accelerometer as well as an intelligent algorithm that is capable of registering if the liquid is being consumed or, as an example, poured into the sink (Aquatime 2022). The AQUATIME glass is also capable of sending the data to the cloud where the system presents and summarizes the data to be viewed and used. The glass is also equipped with features to remind the user to drink more water, through sound and lights (Aquatime 2022).

Criticism

The AQUATIME glass might be the solution, if TICHS intends to incorporate hydration tracking into its system. A couple of concerns are still present with it. 1) The elders MUST use the glass for it to have any effect. 2) How easily can it be incorporated into a 'bigger' system and communicate with that. 3) The price of the AQUATIME glass is currently 229 DDK pr unit (Aquatime 2022). Another concern there can be is the maturity of the technology. The glass is relatively new and has yet to be tested on a major scale. This is expected to be done in the future as it has been adapted on some care homes in the UK (Aquatime 2022).

Tracking of medicine

The next function that was mentioned was tracking of medicine. This function is particularly on the intake of medicine, and to help the elders remember to take it, as also mentioned by one of the elders:

“We can take an example "hmm.. have I remembered to take all the tablets I need?" "oh.. yes, I have got it .. how is it right now?" and it probably gets worse and worse the older you get, I think, and therefore it could also be an idea that you could say “hey, you forgot to take the tablet you need” (Aksel, Elder, Appendix 1, page 7/8, time 00.09.15/00.09.30)

To find a technological solution that incorporated this function was both easy and hard. To get something to remind you to take medication is relatively easy, as an alarm clock is capable of that. But it becomes increasingly harder as you want to incorporate insurance of that the right medicine is taken. Further the difficulty increases when you want to incorporate it into a system, so that the system can track this medicine intake, as well giving the data to others, e.g., the home care professionals.

Through the search for technological possibilities, an older technology became the path to the solution, a pill box. Pill boxes are commonly used when taking several kinds of pills, furthermore, pillboxes have advanced to also have alarms or dispensers as part of them.

Figure. 22 – Pill Box with reminder from TabTimer - (TabTimer 2022)

This technology incorporates most of the features, which is mentioned above as needed to make a useful and functional medical tracker, except for the tracking part because the pillbox on the picture here cannot send information elsewhere.

Figure. 23 – SMART Pill dispenser - (Wellnesspharmacy 2022)

The research for a case of a technology that could deliver the medical data to the TICHS system continued until I found a case of a high-tech intelligent dispenser. The SMART dispenser from Wellness Pharmacy in America (Wellnesspharmacy 2022).

Their SMART Dispenser is a high-tech adaption of the pill dispenser, it features an automatic pill dispenser, alarm/reminder capabilities and the ability to send SMS messages to Health Care Professionals, relatives or whoever the user desires, with information on whether the medicine has been received.

Criticism

While this is a case of a technological solution that can track medication, it also has some downsides regarding its incorporation into the TICHS package. Firstly, its price it is a high-tech solution from America and developed by a private company and therefore it can be assumed that the price isn't cheap. Secondly, while SMS is a form of communication it needs to be incorporated into the TICHS so it can communicate with the rest of the system. Third and final downside, while it can, with its face recognition feature, recognize who gets the medicine dispensed, it does not have a function to ensure that the patient also takes the medication. Another concern there can be is the maturity of the technology. The dispenser is relatively new and might not have been tested in a bigger context.

Psychology/mental health

The last function that was widely talked about by the user groups was psychology. The ability to track psychological or mental health was extremely interesting and desirable to the users.
The main reason for that was, as one of the users said, the impact of psychology on psychical health:

"*There can also be a mental part of it - there could definitely be someone who, when they are in a sufficiently bad mood, and there is no one coming and looking at them, that they somehow, through that system could send a message to yes, a psychologist or home care"*
(Aksel, elder, appendix 1 page 5, time 00.05.50)

While the psychological view was widely mentioned by multiple people in the groups of Elders and Relatives, it was less mentioned by the Home Care - and Health Care professionals – or at least less direct mentioned. Instead, they expressed interest in the psychological through concerns on loneliness:

" Many of the hospitalizations that we also see, they can actually be based solely on insecurity, ie that the elderly become afraid of being in their own home and being alone because they may have fallen, are insecure and so on. And the more we take some safety visits from living people out of the equation, the greater the number of hospitalizations."
(Anders, Practitioner, Appendix 8, page 6/7 time 00.08.30/00.08.50)

A lot of the Home Care - and Health Care professionals stayed away from talking about the psychological as a possible function, and the reason for this might be the difficulties there is in tracking or measuring mental health, if you are not talking to a psychologist.
Never the less tracking or measuring psychological or mental health has been widely done for a

while and is usually done by utilizing a variety of different measurements of general health, such as movement, sleep duration, heart rate, electrocardiogram, skin temperature, etc. (Sheikh, Qassem og Kyriacu 2021). These kinds of measurements are practically the same as what this study has been trying to find case studies of to monitor physical health in the elder.
This co-incidence shows that the best way to monitor mental health might be the solutions already presented above in this analysis. Other ways or additions to the monitoring of mental health could be microphones, and call logs, which could be utilized to identify voice features and social activities indicative of depressive symptoms (Sheikh, Qassem og Kyriacu 2021).

Criticism

Other technologies that have been tested in monitoring mental health is solutions such as smart glasses to track eye movement, and portable systems to measure a variety of bio-signals related to stress and many more (Sheikh, Qassem og Kyriacu 2021). But studies are still needed to create better solutions for measuring mental health, *"technology needs to be established in mental health as it has in other fields of medicine to provide practical and point-of-care devices for those who are affected"* (Sheikh, Qassem og Kyriacu 2021, 17).

A final comment on the "mental health-tracker wishes" might be, that even though TICHS was not originally intended to cover mental state, and although it is difficult to fulfill the users' desire to include mental state tracking in the technology, a side effect of TICHS could be, that it is given space to take more care of the elderly's mental health, because some of the functions Home Care Professionals perform today, must in future be taken care of by the TICHS-system, which is why - in the ideal world - time is freed up at Home Care Professionals - a time that can be used to also support the elderly's mental state

Functions, possibilities and the influence of experience

When looking isolated on *functions* as a determinant for a useful and accepted system (Perceived usefulness), the above-mentioned functions and case studies of technologies that already exist, might not be a direct recipe to how the TICHS package should be. There are several other factors that need to be taken into consideration, such as e.g. price and the compatibility to function together with an algorithm. But they still represent a great basis for what functions are central for a useful and accepted TICHS system. Furthermore, the cases of technologies that already exist represents clear proof for the possibilities that already are available and further an interest from the commercial market to develop similar technologies.

Beside the above-mentioned examples of other factors, that must be taken into consideration when designing a useful and acceptable technology, experiences of the users also influence the acceptance. The theme of *experience* (see the relational map figure) ends up becoming a moderator for other themes/determinants similar to, how it does in the traditional TAM (Venkatesh og Davis 2000). Different from the experience in the original TAM is that the experience in CSD-TAM is broader and encompasses more.

An obvious example of this is the different users' experiences in using different tools, e.g. trackers on elder with dementia, which Ditte, one of the relatives, has no doubt about in using, since she had experienced her mother disappeared without a tracker. But also experiences from earlier health care projects, like when the Home Care Professional Bente expresses her concerns regarding resources, which originates from her experiences with implementation of other project in Home Care:

> "*Yes, but it is also about resources" (Bente, Home Care, Appendix 5, page 2, time 00.01.56)*

Perceived ease of use:

Perceived ease of use became the focus point that held the least themes. It constituted two themes, Usability and - for the elder exclusive - Technological Possibilities.

The reason for this lack of themes can be contributed to many reasons but the fundamental difference between the context of the CSD-TAM and the traditional TAM from TAM1, 2 and 3 is probably the greatest difference maker.

As explained, when describing the difference between the CSD-TAM and the traditional TAM, the study on TICHS does not have a technology or system to test, yet. Currently this project is in a 'pre-pre-implementation' stage, where it is trying to create and design a new technology as well as trying to figure out what is needed for it to be used/accepted, how it should look, how it should function, as well as what the users perceive as okay and what is not okay regarding such an innovation. What this thesis is doing, is including TAM in a new earlier stage a 'pre-pre-implementation' stage.

This early stage results in a lack of a specific technology and that makes it difficult to address what makes the system easy to use as it is impossible to show the users how the system works.

In a standard TAM the users would evaluate the technology by trying it, or at least by trying a mock-up of the technology and thereby be able to answer questions about the ease of use, like

Perceived Ease Of Use	PEOU1	My interaction with the system is clear and understandable
	PEOU2	Interaction with the system does not require a lot of my mental effort
	PEOU3	I find the system to be easy to use
	PEOU4	I find it easy to get the system to do what I want it to do

Figure. 24 – example of questions from TAM3 on Perceived Ease of Use - (Venkatesh and Bala 2008, 313)

But even with this difference/difficulty two themes still appeared.

Usability became, as mentioned in the data section, quite similar to TAM's PEoU and elucidates some of the concerns that the users wanted to see to, or believed would, make the system easy to use.

Some of these were general, as Dorthe, Home Care Professional says:

"So the completely obvious…. Then it must be very user-friendly, ie be very easily accessible."
(Dorthe, Home Care, Appendix 7, page 5 time 00.05.15)

And some were more specific:

"*Yes, I think so in relation to the colors, it will probably be smart, because it is used already, in relation to the citizens, where you triage already".*
(Caroline, Hospital Nurse, Appendix 10, page 9, time 00.12.01)

The second theme of Perceived Ease of Use is exclusive to the elders and is the theme of *Technological Possibilities.*
This theme is simple to understand and explain as it is fundamentally about the lack of knowledge on what technology is capable of and what technology currently exists:

"*but that's a bit of a prospect from my point of view"*
(Bodil, elder, appendix 2 page 31 time 00.29.59)

and

"It would be a damn great idea, ***if*** *it can be done"*
(Aksel, elder, appendix 1 page 3, time 00.03.54)

While the theme of Technological Possibilities is not directly correlated to the theme of usability, it is fundamentally in a similar spot for the elders as usability is for everyone else.
This comes from the belief the elders have, that the technology doesn't exist yet, or their doubt that it is a possibility. This belief restricts the elder's ability to talk about ease of use (as can be seen by

the lack of themes on perceived ease of use for the elders) while it doesn't keep them from addressing TICHS usefulness.
The analysis will therefore continue with the theme of Technological Possibilities fused into the theme of usability.

Usability- what is needed for the users to find TICHS to be easy to use.

As there is no technology to make easy to use, the theme of *usability* becomes a little abstract in relation to perceived ease of use and the users are instead making wishes to how they hope TICHS will be to use.

Those wishes or concerns spans as earlier described from the elder's doubts in the technological possibility, to technology fear from both the elders and the caregivers, and finally to implementation and a vast span of ways to do that.

When looking through the statements regarding usability and the wishes from the users regarding it, similarities between them and the determinants of perceived ease of use in the original TAM3 appeared.

Three of the determinants of perceived ease of use in TAM3 was overlapping with the statements from the users. Computer Self-Efficacy, Perception of external control and Computer Anxiety. These three determinants held similarities with the statements of the users as shown in the following sections and dealt with one by one.

Regarding Computer Self-Efficacy, which in TAM3 is described as:

> *The degree to which an individual believes that he or she has the ability to perform a specific task/job using the computer* (Venkatesh og Bala 2008, 279)

When looking at the definition of Computer Self-Efficacy from TAM3 it is clear that the wishes for TICHS, that some of the users have been focused on, is ensuring that Computer Self-Efficacy is as high as possible. This is, in the interviews with the users, expressed through their concern for technology not being a bigger part of the caregiver's education:

> *"So it's been many years since I was educated. We had nothing about technology"*
> *(Charlotte, Home Care, appendix 6, page 12 time 00.14.26)*

And in the situations where the users express the wish for the TICHS to be easy to implement, not too comprehensive, manageable and easy assessable:

"If it must be able to work, then it must be something easily accessible. Then it must be something that show up on your i-pad, for example, that there is something you have to be aware of, so it is easy to find, so it is clear, yes, because there are many things in that we already need to have control of"

(Caroline, Hospital Nurse, Appendix 10, page 18, time 00.22.50)

and

"if one can somehow implement something that is relatively easy to implement"

(Anders, Practitioner, Appendix 8, page 20 time 00.23.09)

and

"As long as it does not become too extensive (for the caregivers), then I would say, it will probably be acceptable" (Birgitte, Hospital Doctor, Appendix 9, page 17, time 00.15.32)

These are all concerns regarding the difficulty of the system use, and a hope of it being as easy as possible.

When looking at Perception of External Control, which in TAM3 is described as:

The degree to which an individual believes that organizational and technical ressources exist to support the use of the system (Venkatesh og Bala 2008, 279)

When looking at the definition of Perception of External Control it is not directly clear, how this determinant matches up with the statements from the users, as the organizational and technical resources of a system is often something that appear later in the process of designing a technology. Nevertheless, when looking into the determinant more closely and looking at the questions asked in TAM3 regarding the determination of perceived ease of use, a particular question under Perception of External Control matches with the observations of the statements of the users:

Perception and External Control (PEC)	PEC1	I have control over using the system
	PEC2	I have the resources necessary to use the system
	PEC3	Given the resources, opportunities and knowledge it takes to use the system, it would be easy for me to use the system
	PEC4	**The system is not compatible with other systems I use**

Figure. 25 – example of questions from TAM3 on Perceived and External Control - (Venkatesh and Bala 2008, 313)

This question revolves around recognition and that is a concept that is very apparent in the statements from the users, in particular the Health Care and Home Care professionals, but also from the relatives:

> *"Yes yes if you put it into some smart design that looks like what they already have, or the things they already use" (Ditte, Relative, Appendix 14, page 31, time 00.38.43)*

And from Anders

> *"So you can implement it in some of what already helps them"*
> *(Anders, Practitioner, Appendix 8, page 10, time 00.12.46)*

This preference towards known quantities, from also the Home- and Health Care Professionals, becomes even more clear when talking about the presentation of data in TICHS, where the idea of a Red/Yellow/Green feedback design was received very positively because of its likelihood to triage, a commonly used system in healthcare.

> *"So not necessarily detailed information, you can also get a lot out of getting a red, yellow, green indication on how quickly you need to contact them"*
> *(Birgitte, Hospital Doctor, Appendix 9, page 12, time 00.11.50)*

Finally, regarding Computer Anxiety, which in TAM3 is described as:

> *The degree of "an individual's apprehension, or even fear, when she/he is faced with the possibility of using computers* (Venkatesh og Bala 2008, 279)

The last of the determinants of perceived ease of use that resonated with the statements from the users is Computer Anxiety. This computer anxiety or even fear was clearly expressed by two Home Care Professionals not just for themselves and their profession, but also regarding of the elders:

> *"But one is, that the elderly have a hard time dealing with technology, but no matter how strange it sounds, there are also many employees (Home Care Professionals) who have a hard time with it"*
> *(Dorthe, Home Care, Appendix 7, page 5, time 00.06.23)*

"and then there is this whole technology fear that someone has"

(Charlotte, Home Care, Appendix, page 12, time 00.15.13)

Usability - the influence of experience and possibilities

When looking isolated on "Perceived Ease of Use" these three determinants of perceived ease of use in TAM3 are clearly visible in the case of TICHS and influences the user's perception of the system, and their expected behavioural intention, which mean they have to be taken into consideration creating the TICHS system. That does not mean, that the other determinants of perceived ease of use in TAM3 have no relevancy, but more, that my study could not document their influence in this case. Furthermore, if the general expression is anxiety towards computers, it is difficult to image, that the users would describe their wishes to the technology as playful (the last determinant under Perceived ease of use, not referring to actual use). What this study can say though, is, that in this Context Specific Design TAM no extra determinants for perceived ease of use showed up.

The fact that this study could only document some of the determinants of perceived ease of use, could also be explained by the fact that TICHS is in, as I earlier described, a Pre-Pre-implementation phase. Because of the lack of a product to see, feel, try, and test it was difficult for some of the users to imagine, what was needed for ease of use.

> *"So it has something to do with the fact it is new right? So when is it, we take steps to say, well, - of course we have to do it. Well, at least I can't do it right now, but I believe if you ask me in 3 years, I might say something completely different. Because then I would, then I would know, perhaps also with greater certainty, what it is you are talking about, and I would have seen it, I would have sensed it. But on these uncertainties - even though one can visualize of whether it could be such a camera placed there, or it could be a sound recording placed there, it is really difficult for me to answer, when I do not know what it is" (Charlotte, Home Care, appendix 6, page 21 time 00.23.20)*

Through the statement above it is clear how experiences of the users again influence the acceptance, and, as above under the theme of *functions*, the theme of *experience* ends up becoming a moderator for other themes/determinants similar to, how it does in the traditional TAM (Venkatesh og Davis 2000) Different from the experience in the original TAM is, that the experience in CSD-TAM is broader and encompasses more.

This information is important for the TICHS project. They tell what determinants are important to be aware of, to get acceptance from the users. They also tell that it could be beneficial to start the design of the system by examining, how the existing information solutions in Home Care (with and without IT) works. By making the TICHS solutions close to existing technologies or systems, in language and expression, or if possible incorporate TICHS with those existing systems, it must be expected that acceptance will be easier to get.

Subjective Norm

Subjective Norms is the focus point, which has been extended compared to the original TAMs definition. With reference to chapter 5, subsection "FROM TAM to MY TAM to CSD-TAM" the main change is to who "important others" includes. In this thesis "important others" are changed to be important actors, inspired by Latour (2003), as it is a broader and more embracing concept.

Having said that, the fundamental existence of Social Norms in its original form has been verified by the theme "*Other perspectives*", which is discovered in three out of four user groups.

As Bente, Home Care Professional says:

> "Yes, it's okay for me, but I think many (Home Care Professionals) will protest"
> (Bente, Home Care, Appendix 5, page 34, time 00.28.53)

These comments from the different informants are almost identically and can, from a direct interpretation of the words, be understood like the informants want the survey to take other people's opinions into consideration, but it could also be seen, as they keep a door open for changing their opinion, if it shows up that other "important" people means differently.

In the extended version of Subjective Norms the theme, *Ethics* is present.

Ethics– the extended subjective norm

This section of the analysis is about the theme of ethics within the user interviews. As already established in the introduction to this thesis, ethics are an issue in the case of in-home monitoring in particular regarding the view on surveillance. The users have ethical themes that they express their concerns about such as privacy, self-determination, confidentiality, dignity, and rights.

“It also breaks with the view of human rights, right? In other words, this is where there is a view of human rights that comes into play here, with how much do we have to control, even if it means that you feel bad.” (Anja, Relative, Appendix 11, page 12 time 00.13.39)

These concerns are ethical in nature and are similar to what The Danish Ethical Council define as ethical principles (Haupt 1995). In particular, they align with the four most important principles, expressed by the council: autonomy, non-maleficence, beneficence and justice (Haupt 1995). Especially the principle of autonomy is clear in the concerns of the users:

The freedom to choose for yourself, what is to be done to you:

And you also have the personal freedom, not to be surveilled, and say no thank you"
(Charlotte, Home Care, Appendix 6, page 14, time 00.16.38)

Or to choose to be left alone:

“Because some, just wants to be left alone.”
(Anne, Home Care, Appendix 4, page 51, time 01:04:27)

But also, other concerns such as a right to privacy:

“*I think there should still be privacy in there"*
(Bente, Home Care, Appendix 5, page 49, time 00.42.18)

Or simpler ‘rights’ such as:

Dignity:

"often, I think we have to remember the dignity for every single citizen."
(Anne, Home Care Professional, Appendix 4, page 10, time 00.18.37)

Or respect:

"Because, I also think we have to respect that my mother is an older lady with her own life, and as long as she is in her senses and it works, I would rather not interact more than is absolutely necessary.” (Benedikte, relative, Appendix 12, page 21, time 00.19.51)

But as earlier mentioned the concern that clearly represents the biggest issues, is the feeling of being put under surveillance. This concern regarding the feeling of being surveiled and the repercussions of this is clearly expressed in the interviews.

"It will be some kind of surveillance"
(Caroline, Hospital Nurse, Appendix 10, page 15, time 00.18.28)

And

"Yes uha… it will be the surveillance community. But what is the purpose? What is the purpose of that surveillance? (Ditte, relative, Appendix 14, page 28, time 0035.33)

This concern of being kept under surveillance, - seen as being an invasion of privacy and people's autonomy is being countered by another principle. This is the benefits that the system gives. This is the potential benefits, that the system can have regarding health care, but even more, in the minds of the users, it is the feeling of safety that the system can give:

"… and that has something to do with safety, right?"
(Aksel, Elder, Appendix 1, page 7, time 00.09.08)

This conflict is clearly expressed by one of the relatives:

"The dilemma that is, it is "Big Brother Watching You" versus "I feel safe" (Benedikte, relative, Appendix 12, page 29, time 00.26.32)

This statement from the relative, Benedikte, is also why this section in the analysis similar to the previous section on usability, includes other themes. The theme of usability also encompassed the theme of technological possibilities. In this section the theme of ethics also encompasses the theme of *safety* as they are truly interconnected in their main conflict within the statements form the user groups.

This conflict between the two ethical principles of autonomy and beneficence is where the main issue lies regarding ethics and TICHS. It emphasizes an ethical dilemma that is quite common in health care, how much can you invade on the patient's autonomy, when the intention is to care for and help?

There is one other theme, which must be taken into consideration in this conflict of ethics. The moderation of *experience*. As also apparent in the earlier themes of *function* and *usability,* experience has a central influence on how the users perceives the ethical issues of the TICHS. Where most user groups had high resistance towards the use of cameras in the TICHS package, the elders expressed way less concern and one of the elders gave his reasoning as to why:

"*I think, if you are –let us put it a little on edge- I think if you're sick enough, then you have to say, yes thank you for all of it. Yes, and if you are still quite fit, even if you are old and quite*

fit still and nimble, then there will be many who will say, no thank you."
(Aksel, elder, appendix 1 page 9, time 00.12.09)

This influence of experience - or the current situation - is also evident in the statements of the other users when it comes to using GPS as a part of TICHS, and one relative clearly expresses that any resistance to GPS is because of a lack of experience with dementia:

"Well those are probably the ones, who do not have people around them with dementia. It is my position, that if one has experienced that one's mother with dementia has disappeared out of some door, and no one knows where she is, one would like the help to reach her, and one would be able to that with a tracker, - in that case there are no doubt, that she should have a tracker on."
(Ditte, relative Appendix 14, page 27, time 00.33.37)

This once again showcases experiences ability as a moderator for the determinants of use.

Through this it becomes clear that Ethics are an influential determinant on how the users perceive TICHS and their possible intention to use it, and that an ethical dilemma arises as a result of the conflict between the two ethical principles of autonomy and beneficence. Further it is clear that the experiences of the users moderate how clear they see the differences between the two principles and to which side they lean. This dilemma will be further explored in chapter 10.

Facilitation

The last theme that I will present in this analysis is the theme of facilitation.
This theme is, within the data mapping, part of the Perceived Usefulness category, but because of its general influence it will be presented separately.

Through the interviews, the users have consistently emphasized the importance of 'correct' facilitation of the TICHS system.

"it may well be "the gadget" and so on (which is important). But it is also the wrapping and it is the facilitation of it" (Ditte, relative Appendix 14, page 34, time 00.42.12)

This 'correct' facilitation has focused on a lot of different areas:

The language/way that the system is explained in:

“one must also speak in a language so the recipient actually understands what it is we are talking about.” (Charlotte, Home Care, appendix 6, page 7 time 00.09.57)

The importance of good introduction of the system to the elders:

"I also think it's a question of it being introduced in a correct way for the elder people.” (Camilla, Relative, Appendix 13, page 5, time 00.05.01)

The importance of placing the system in the right context and making a framework for it:

"This invention, which you want to make, that it is placed in the right context and that you are aware of how it should unfold, ie because there are side effects of this." (Ditte, relative, Appendix 14, page 11, time 00.12.52)

This about “placing it in the right context and making a framework for it” has also become clear through three of the remaining themes, *The role of the system*, *Professionalism* and *Responsibility*

The role of the system is a theme focused on the importance of making sure that the TICHS is used correctly – and the fear from the users that it is not.
One part of this is to ensure that the system is not used against people, as one of the Home Care professional mentions:

"Yes, in fact it is important to be able to believe that it is being used correctly, that it should not be used to go after anyone!" (Dorthe, Home Care, Appendix 7, page 10, time 00:12:58)

But the main concern in “*The role of the system*” is the concern of the system being used to remove the “warm hands” from the homecare:

“My little fear could be that if you get such a tool, that you will then cut (financially) warm hands” (Anders, Practitioner, Appendix 8, page 21 time 00.24.36)

This fear is widespread between the users that has participated in the interviews, and is also a general concern in society regarding technology and automation in healthcare (Tram 2017):

"Cold technology and Warm hands" (Tram 2017, 1)

As this, the removal of 'warm hands' in healthcare, is not the intention of the TICHS, it is important to ensure that the actual intention and goal of TICHS is clearly facilitated to the users. The intention of TICHS is rather the opposite, if less time is used on getting data and answers on hydration and other health conditions, more time can be used on "warm hands" work.

The second theme that is also influenced or handled through facilitation is *professionalism.* Through the theme of professionalism, it has become clear that there have appeared some concerns regarding TICHS in correlation with jobs and responsibility.

The concern regarding TICHS, and the job of the Home Care professionals is a fear that, TICHS is taking something from their profession:

".. this about being afraid that something will be taken from one's profession."
(Charlotte, Home care Professional, appendix 6, page 12 time 00.14.49)

This fear could also be handled through correct/good facilitation as the misunderstanding is the same as mentioned above. TICHS is not intended to substitute the Home Care professional, it is intended to support them, and make it possible for them to use their time more efficiently and more on "warm hands"-tasks.

The focus on professionalism is also a focus of being the one, who with his/her professional knowledge into healthcare, decides what is the best to do for the care of the elder, and taking responsibility for it.

This concern and the reaction to it is expressed by one of the Home Care Professionals, who is concerned that the responsibility is put on the relatives, if they get access to the data, and she advise against it.

"I do think it is a bad idea (giving the data to the relatives), because then it is as if you place the responsibility on them, instead of us as care-givers having to take responsibility for those things" (Bente, Home Care, Appendix 5, page 36, time 00.30.37)

The same concerns exist for the relatives, as mentioned under the theme "*Responsibility*" - one of the relatives exclaimed:

"does it suddenly become my responsibility? or is it still - what to say - the responsibility of home care professionals" (Benedikte, relative Appendix 12, page 21, time 00.20.14)

This concern is also extended to cover the implications this sharing of data can have on the relationship between the relatives and the Home Care Professionals, and that it leads to negative dialog between the Relatives and the Home Care Professionals:

"there will be a risk of a dialogue (in between the Home Care Professional and the relatives) about the experience of the data and how to react to them and act on them" (Charlotte, Home Care l, appendix 6, page 23 time 00.26.25)

This fear for the Home Care Professionals of where the responsibility for dealing with the data is placed, could be an expression of a similar fear as mentioned above, of losing a part of their profession. It could also, from the perspective of the relatives be an expression of not wanting more responsibility, or simply needing a clarification of the situation.

As always, when there is unclearness about who, amongst more people, have the responsibility for something, the risk could be, that one interferes unnecessarily in another person's responsibility, or that no one is doing anything, since they expect each other to be the one taking responsibility – ie. for the data, and in the end, the care of the elder. This is similar to what in Team Work Theory is called "The free wheel-phenomenon" (West 2014) – "*Characteristic of human behavior (s) is that you work less hard in groups, than when you are solely responsible for a task, especially if… the "team" is not perceived as particularly close-knitted*" (West 2014, 37). Translated to the "team" of Home Care Professionals, Health Care Professionals and Relatives, who together take care of the elder: if it is not completely clear, who is responsible for dealing with the data or the system, every member of the "team" could react less on the data, than if he or she had the responsibility by himself or herself.

The Story about TICHS

All these concerns, from the concerns of the role of the system being facilitated and understood correctly, to fear of losing a part of your profession, or the fear of responsibility in all its facets, are all partly, if not in their entirety solved by and through correct communication and facilitation of TICHS. Thereby it becomes clear that facilitation is influencing on how the users perceives the systems and thereby their intention to use and accept the system.

It is not up to this study to solve the challenge about the right communication, but it is worth to notice that many of the concerns from the users could be a picture of the users fear for or resistance to changes.

With a reference to Darryl Conner in "Power i Projekter og Porteføljer" (2019) it is said that "*All change is costly; it is also costly not to change; we only change if it is cheaper than not to change*" (Olsson, Ahrengot and Attrup 2019, 307), which means we do only change behavior, if it is beneficial for us.

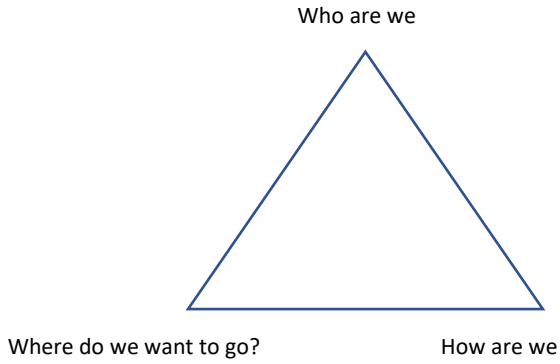
The dilemma showed by the interviews is, that the concerns from the users are concerns that could be avoid, because the intention with the project is not to remove warm hands or change the responsibility for the care of the elders. It is to avoid hospital admissions and as a side effect give MORE time to warm hands.

The resistance could be removed by a deliberate branding of the project towards the users. With a look into the literature on project managing, John Ryding Olsson et.al states, in their book, that it is important to brand a project towards the interested parties of the project (Olsson, Ahrengot and Attrup 2019). Users are "interested party" in this context (Mikkelsen and Riis 2007) since "*their contribution and acceptance are needed for the project to be a implemented"* (Mikkelsen and Riis 2007, 31) and "*as everyone, who has an interest in the project or the result of the project, are interested party"* (Olsson, Ahrengot and Attrup 2019, 63) - a definition quite similar to my definition of users.

By working on the branding towards the users, the pre-resistance could be avoided or minimalized. Branding is about creating positive expectations to the project which is especially relevant in change projects (Olsson, Ahrengot and Attrup 2019).

To create such positive expectations – without being too specific into communications tools – one thing is basically important – that the branding is trustworthy.

John Ryding Olsson et.al explains what to be aware of by presenting the “Reliability –triangle”



“Who are we?”	is about the identity of the project - what is the purpose.
“How are we experienced?”	is about the interest parties expectations to the project.
“Where do we want to go?	is about how the project want the interest party to see the project.

Figure. 26 – “Reliability –triangle”- (Olsson, Ahrengot and Attrup 2019, 300)

With references to the informants concerns, we have to realize, that it is needed to work on the “Story” of the project. The purpose is clear – we (the project) know, who we are, but there is an unnecessary gap in between “how we are experienced” and “where we want to go”. We need to tell “a story” about where we want to go, that the users can identify themself with, based on the Burning platform-mindset (Olsson, Ahrengot and Attrup 2019). We must make a “story” with these “chapters”:

1. Make the Burning Platform we are standing on clear (More and more Elders, leads to elders hospitalization and bigger expenses in health care)
2. Make the vision for the project clear (we can avoid hospitalization and these costs, by using the system (TICHS))
3. Explain the way from the burning platform to the vision (designing and implementation of TICHS in co-operation with users) and finally
4. Be open and precise on “What does it mean for the user” (the project will result in less hospitalizations for the elders and more time to warm hands and care).

That could be the first step to to avoid, that resistance against the system shows up just because of lack of information about the idea of the project

9. CSD-TAM

Through the analysis of the interviews, determinants for the acceptance of TICHS have been found and explored. This, together with the first iteration of the CSD-TAM – the adaption of the original TAM made in chapter 5 - resulted in the finished version of the CSD-TAM looking like below.

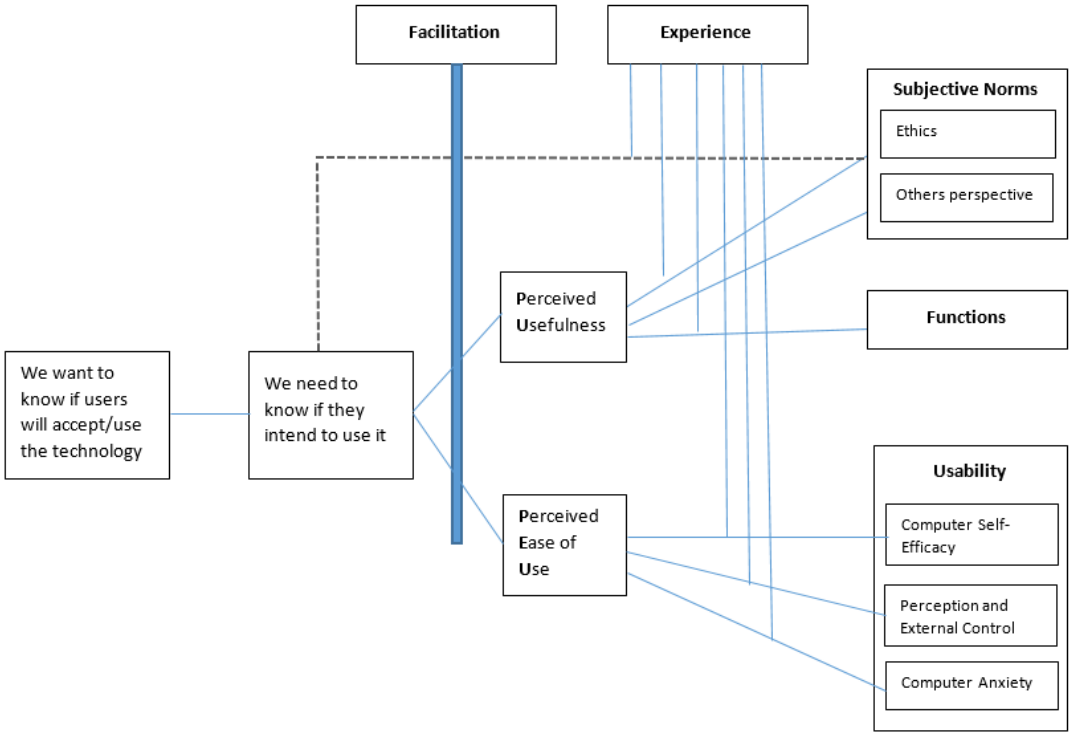


Figure. 27 – The CSD-TAM with the found determinants and moderators.

On the illustration, it is seen how Perceived Usefulness is influenced by two main determinants, Function and Subjective norm (Consisting of Ethics and Other's perspectives). It is further seen how Perceived Ease of Use is influenced by Usability, which consists of the three determinants from the original TAM, Computer Self-Efficacy, Perception of External Control and Computer Anxiety. Next it can be seen how the moderator of Experience, as explained in the analysis, has an influence on how users perceive Subjective norm, Function and Usability (through Computer Self-Efficacy, Perception of External Control and Computer Anxiety) and moderates their influence on Perceived Usefulness and Perceived Ease of Use. Facilitation is the last addition to the CSD-TAM and holds its influence between the Intention to Use and Perceived Usefulness and Perceived Ease of Use, as it facilitates this transition, from perception to intention.

Below is seen a table of the general definitions of the determinant in CSD-TAM.

My definitions of the found determinants and moderators:	
Perceived Usefulness	The demands to the system for it to be experienced as valuable to use.
Functions	The features the users need for the system to be useful
Perceived Ease of use	The demands to the system for it to be experienced as easy to use
Computer self-efficacy	The ability to perform a specific task/job using the computer
Perception and external control	The expected existence of organizational and technical resources to support the use of the system
Computer anxiety	The apprehension, or even fear, when an person is faced with the possibility of using computer
Subjective Norms	Important actors influence on the user
Ethics	Ethical concerns influence on the user
Others Perspective	Important peoples influence on the user
Experience	General experience in life, in technology, in …. Influence on the user
Facilitation	The communication about the system influence on intention to use

Figure. 28 – The definition of the aspects in the CSD-TAM.

10. Discussion

Through the section of data as well as the analysis, there have been found two subjects for discussion. The first subject is the CSD-TAM; what are the benefits for using the method and model for approaching the user acceptance in the TICHS project, and what are the challenges, - and as a next step – the possible use in future projects.
The second subject is regarding one of the found determinant for Subjective Norms, and by that the influence on the intention to use for the users - the subject of ethics, particularly regarding the question of surveillance as care.

In the following, the two subjects will be presented and discussed to open up for further discussion and use in the future.

CSD-TAM – to be used in the TICHS project

The question in this section is fundamentally; is it beneficial for the project to use the TAM-model as a starting point –reverse it - seeking for context specific determinants influencing the intention to use the invention.

The use of TAM as a frame of reference gives the research a theoretical basis, regarding the proven relation between use, intention to use and perceived usefulness, perceived ease of use and subjective norms. With the following adaption, based on e.g., the extended user-group concept and the open questionnaire, the project is given an early idea on, if the project meets so much

resistance, that it must be given up, which would save work and money. Besides that, the approach in the CSD-TAM gives new determinants and moderators for the main factors in the TAM model (Perceived Usefulness, Perceived Ease og Use and Subjective Norms), like it opens up for new understandings of existing determinants and moderators and new connections in between them, all useful for the next step in the process with TICHS. Finally, it gives specific ideas to functions in TICHS, functions which can be incorporated in the coming prototype.

The challenge in the approach is, that the open questionnaire doesn't guaranty that all relevant determinants are found, and beside that there is a financial aspect. The research cost for CSD-TAM is present on an early stage of the project, and even though it is the expectation, that this part of the research save money for the project in total, it is not yet documented.

A final issue with the use of the method is the concern that was also expressed by one of the users:

> *"Well, at least I can't do it right now, but I believe if you ask me in 3 years, I might say something completely different. Because then I would, then I would know, perhaps also with greater certainty, what it is you are talking about, and I would have seen it, I would have sensed it. But on these uncertainties - even though one can visualize of whether it could be such a camera placed there, or it could be a sound recording placed there, it is really difficult for me to answer, when I do not know what it is" (Charlotte, Home care Professional, appendix 6, page 21 time 00.23.20)*

This difficulty of imagining how a system will and should function, when you have never seen or tried the system, is understandable, and can provide problems regarding the usefulness of the information gathered through the interviews.

The solution to this problem might be a reforming of the data-gathering format. Instead of 'only' gathering data through standard semi-structured interviews, the addition of supplementing techniques could prove effective. Methods such as simulation and scenarios are often used to give the informant an easier way to imagine the situation or circumstances of a difficult subject. As an example, it could be scenarios such as the Vignette method (Barter and Renold 1999) or with the help of simulations or mock-ups as presented by Dalkjær and Fredskild in *"Innovation Sundhedsvæsnet"* (Dalkjær and Fredskild 2017).

The next step for TICHS

The next step for the TICHS project is now to develop a prototype with the help of the determinants and moderators found in the analysis. To do this, I propose the design of a technology (TICHS) based on the foundation of the discovered determinants.

The project on TICHS will thereby develop a prototype of the system, through these context specific design requirements. Thereafter the system will be tested and evaluated, - this might even be done with the help of a traditional TAM, to create a finished product - I will recommend including the additional determinants from "MY TAM" in such a process and still be open for new determinants also in that process.

This is how I imagine and propose the process of creating the TICHS system is done, but it opens for a more general question to MY TAM – the CSD-TAM and the process I have been through in this thesis.

CSD-TAM to be used in general.

"CSD-TAM" (as shown in the figure above) is made with the intention to be used in relation to the TICHS project. It is therefore, as described, very context specific and only intended to be used in this project with these kinds of actors, concerns, and circumstances. But when looking at the CSD-TAM in general, it can also be seen as a case study of how to design technology to be accepted in a healthcare context. If you look at it that way, instead of it becoming a limit for how the CSD-TAM can be used, it can, as Bent Flyvbjerg explains, be a foundation for a general truth (Flyvbjerg 2015). Because, as he explains, a case study can give particular, context dependent knowledge on what you examine, and when the case is selected strategically, depending on what you want to use the research for, the generalizability of the findings increases (Flyvbjerg 2015).

Because of this it can be said that the CSD-TAM can be used in a more general context. In particular some of the additions, such as the broader concept of Subjective Norm (to include a broader actor understanding and include Ethics), and the broader user group inclusion (all who are influenced by the project), are additions, that I would recommend to the traditional TAM - especially if it is used in a design and development context.

Using the method in future projects

Another interesting question could be: Is it possible in general to use the *method*, which has been used in this thesis, as a method for finding design features and circumstances for an invention or

idea? Meaning: is it beneficial to approach a project of designing a technical solution the way it is done in this thesis, by using the TAM-model as a starting point “bare boned” with only the Perceived Usefulness, Perceived Ease of Use and Subjective Norms as factors –reverse it - seeking for context specific determinants influencing the intention to use the invention.

On the one hand it seems to be beneficial to use the method since the thesis shows that the method used, creates a better foundation for the future design and work with the technology. The “Bare Boned” model gives both a theoretical starting point and an open approach to what needed from the users for a future design to be accepted. Further, referencing to the creation of the CSD-TAM from the theory section, this approach makes it possible to ‘give up’ on a bad idea, or bad application of an idea/technology, before a substantial amount of time and money has been invested into it, and further give a basis for knowledge generation on the subject before the same.

On the other hand, the concerns mentioned above arise. While you might ‘save’ money and time if the system is to be given up on, it is still an expense on a ‘pre-pre-phase’ where concrete progress on system creation is more difficult to see. This ‘transaction’ between expenses before the ‘actual’ project starts and later phases must therefore be positive. What is implied in this is, that the implementation of a pre-pre-phase, like the one in this thesis, would reduce the number of complications regarding changes, that must be fixed ‘later down the line’. The consequences of that are, that the design project hopefully will save money in total.

Likewise, the issue explained above concerning the fact, that on such an early state of a project, there are no system to show. It means, it can be troublesome for some informants to imagine the system, which can influence the value of the data gathered. Depending on the system to develop, it must be taken into consideration to involve simulation or scenarios as a supplement to the open interviews for gathering data.

To sum up the CSD-TAM and also the method used in this thesis are useful for more general purposes (maybe with some slight additions), but when used, you must have respect for and consider the context of your project.

Ethics

In extension of the discussion above, it becomes apparent, that one of the determinants, which haven’t been used in the traditional TAM, is central for TICHS, - that is Ethics. Ethics has appeared through the interviews with the users and became a part of the Subjective Norm determinant because of the changed definition of Subjective Norms. This change in who the important people (actors) can be, have opened the theory up for more abstract concepts, such as ethics, to take a

bigger role in determining acceptance of a technology.
Through the analysis of ethics it has, as mentioned earlier, become apparent that in particular one ethical dilemma is central for the TICHS project, and might be one of the most central dilemmas in future health care: The conflict between surveillance and care.

Surveillance as care:

The dilemma between surveillance and care is, as it has been made clear in the analysis, a dilemma between the hope of being able to provide better and needed care for the elderly, and the idea that everyone has a right to privacy and to autonomy and to make decisions yourself.

This conflict is common in healthcare, as well as when talking about surveillance technology in general (Widmer and Albrechtslund 2021).
If taken further, the discussion becomes if surveillance *can* be care, and then how far you can go with surveillance, when acting in the name of care.

The discussion on surveillance becomes an example of taking control away from the people being surveilled, in the instance of TICHS, this is the elders, and giving the control to others. This concept of giving other people control over you, or those you hold dear, is for many what keeps them away from using surveillance more commonly (Widmer and Albrechtslund 2021).

When starting this thesis, before holding any interviews, my hypothesis as well as the general belief of The Department of Geriatrics was, that there would be quite some resistance against the project. I expected, it might not be overwhelming from the Home Care Professionals and the Health Care Professionals, but clear from the Relatives and particularly from the Elders, as they (the elders) were the ones who would be under surveillance. My hypothesis was that particular technologies would be especially opposed; Camera and GPS were the two biggest concerns in my hypothesis.

While some of these hypotheses held up after the interviews, some of them would, to a greater or lesser extent, be proven wrong.

Starting with the elders, who were expected to provide the biggest resistance to surveillance and TICHS, because they would be the ones surveilled, a surprising revelation showed. The elders showed almost no resistance to surveillance of any kind.
While the elders did express the thought, that other people might oppose the idea, their own opinion was in general, that they would be glad for it.

> *"I think most of the elderly will say, that it helps to take good care of us, so we like it. That's how I think it will work." (Aksel, elder, appendix 1 page 3, time 00.04.21)*

This positive look on TICHS and surveillance also extended to video cameras, the solution I imagined no one would like, - regarding video cameras the elders expressed that

"*No it would not bother me at all*" *(Bodil, Elder, Appendix 2, page 13 time 00.14.22)*

Furthermore, GPS was encouraged, as a GPS would help someone to find them, if something was wrong.

This positive onlook on surveillance and therefore TICHS from the most exposed user group leads to a possible conclusion, it's a green light, they say it's okay, so we can do it, let's do it.

But through the extended user understanding, and thereby the inclusion of Home Care Professionals, Health Care Professionals and Relatives, it was possible to realize, that there were more to the question of whether it is okay to use surveillance as care, than what the elders expressed.

In particular from the relatives and Home Care Professionals there were concerns regarding surveillance as part of a care system. The relatives, as explained in the analysis, expressed a general concern regarding the invasion of privacy of the elders, as well as a fear for the elders losing autonomy and control in their own lives.

On the other hand, the Home Care Professionals, while expressing a similar concern as the relatives, also introduced an entirely new concern to the discussion of surveillance as care. Their concern was that the system also surveils those, who visits the elder, in particular the Home Care Professionals. The introduction of TICHS as a Health Care system would therefore not just be an invasion of the elder's privacy, but also of the visitors and caregivers.

While one could say that this might not be of major concern to personal visitors such as family and friends, as they themselves decide to visit the elder in their homes, and thereby themselves decide to enter a surveilled home, this might be too easy. If the relatives do not visit their dear ones, because of existing surveillance in the elder's home, you take away the possibility to be together in the name of care. When it comes to the Caregivers, they are doing a job where they don't have the leisure of deciding to stay away. Furthermore, the feeling of being surveilled while doing your job might introduce additional stress and anxiety to an already stressed work environment. The potential concern of being surveilled in your job is expressed by one of the Home Care Professionals:

"But I'm not there at all. It may be, that you say, it will be made so no humans sees it, but where is the guarantee for that?" (Dorthe, Home Care, Appendix 7, page 12, time 00.15.32)

It has become clear that the dilemma of surveillance as care, is more than just a question of whether the elders are okay with being surveilled or not. There are more factors, which play a role, and that leads to another question:

How much “good” must the system provide the elders, to make up for the “bad” it does to visitors?

This question is asked with the assumption that all elders are of a similar positive opinion about surveillance, as the elders, that have participated in this project is. If that is not the fact, the question becomes:

How much “good” must the system provide the elders, to make up for the “bad” it does to elders and visitors?

If this question of surveillance is taken a step further and to the extreme, the question asked becomes a question of voluntariness. If the system becomes good enough, and thereby provides a substantial positive effect to society through, less hospital admissions, less elder deaths, time saved in home care, and more time for “warm hands”, is it then going to become an obligatory implementation, when people reach a certain age? Or even further, not age restricted, but as soon as you get sick?

While these thoughts are big if’s and far into the future, they are still food for thought.

11. Conclusion

Through this thesis and through my own modified TAM, a CSD-TAM, I have been trying to answer the question:

"What determines users acceptance of TICHS?"

Through the help of the CSD-TAM, it is seen how Perceived Usefulness, Perceived Ease of Use and a modified Subjective Norms are central for answering the problem formulation.

Through interviews with users, a following data handling and analysis, I have seen how 5 factors are central for the acceptance of TICHS. These factors are the following three determinants, and two moderators.

Function: The TICHS system must have functions that the users find useful. Through the analysis a plethora of different useful functions have been discovered, but in particular 6 were widely expressed as useful for the users, they were Activity tracking, Hydration, Medicine, Psychology, Adaptability and a wearable format.

Usability: The TICHS system must be easy to use and three determinants from TAM were found to be very important to ensure ease of use in the context of TICHS, Computer Self-Efficacy, Perception of External Control and Computer Anxiety.

Ethics: Through the modified subjective norms as well as the interviews it became apparent that a consideration of ethics, such as the dilemma of surveillance as care, is central for the acceptance of TICHS.

A conscious look on the determinants function, usability and the dilemma of surveillance as care is central to the acceptance of the design, implementation, and future of TICHS.

Experience was shown as a clear moderator of the perceptions of the users in the interviews. Even though some perceptions of TICHS were perceived directly through the determinants mentioned above, the experiences of the users influenced this perception and moderates their influence on Perceived Usefulness and Perceived Ease of Use.

The last realization that came from the interviews and the analysis is the role of facilitation. Facilitation was shown to be important for the users as it influences between the Intention to Use and Perceived Usefulness and Perceived Ease of Use, as it facilitates the transition, from perception

to intention. The ethical aspect and the presence of vital interests of many user groups made it obvious that facilitation of the system might be critical for the acceptance.

Through this thesis it has been shown that a variety of factors determine if users accept TICHS and that if you want to design a successful TICHS you must take these factors into account. It also shows that the degree of acceptance various from user group to user group, and by that it shows the value of a broader user concept, the extended Subjective Norm and the open approach to the research for a design TAM like CSD-TAM.

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Appendix