Adoption of voice technology

A qualitative study of Finnish consumers

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Abstract:
The objective of the study is to identify and find drivers and barriers to adoption of voice technology amongst Finnish consumers. A research framework based on different technology adoption behavioural theories, in particular the theory of resistance to innovation (Ram & Sheth, 1989) and the diffusion of innovations theory (Rogers, 1962) was used to identify what is presently known about the drivers and barriers affecting the adoption of technology, in this case the barriers and drives for voice technology adoption amongst Finnish consumers. Three focus group interviews were held online, with eight participants in total, both female and male, ranging from 18 to 62 in age. This provided a small, but valuable sample that reached fair saturation results, as some topics repeated themselves in different interviews. The research question was "What are the drivers and barriers to adoption of voice technology amongst Finnish consumers?". The main drivers found were convenience and entertainment. Examples of drivers found were typing when driving, changing songs when listening to music, settings alarms while cooking and helping with spelling in multiple languages. The main barriers found were related to inconvenience and technology issues as well as social settings. Examples of barriers are frustration when technology is not working as intended, misunderstandings and misspellings, fear of sharing private search topics and lack of positive word of mouth creating a social barrier. It can be concluded that the process of voice technology adoption amongst Finnish consumers has started, but there is still not enough value seen in it to drive adoption at a higher speed. The most popular use cases for Finnish consumers are "silly" small everyday tasks such as asking about the weather or changing songs. For businesses it is important to start preparing for voice searches, as they differ drastically from traditional type queries, in order to not be left behind the evolution and loose sales and online visibility once adoption of voice technology takes off in Finland.

Keywords:	Voice technology, consumer adoption, barriers to adoption, drivers to adoption, voice search.
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CONTENTS

Figures

Tables

1 INTRODUCTION

As the technology in the world advances and develops, one might wonder which technology will be the one that comes out on top in the next few years, or which technology will see an upswing in usage amongst consumers. Several different sources have for years been saying that voice search will be used for 50% of the online searches by 2020 (Ray, 2021; Gartner, 2016). Now 2020 has past, and the estimations and expectations for voice search are not met, at least not in Europe. The statistics for internet users who have conducted a voice search within the past month around the world is topped by Asian markets (49%), followed by the Latin American market (39%) and the US (35%) (Statista, 2019a). According to the same statistic, Europe with 27% still has some way to go.

1.1 Voice recognition and voice technology

Going back to the roots of this "new" technology, it may be surprising for some to hear, that voice recognition has been around for a long time.

> "Voice recognition actually predates email, harking back to IBM's 16 word recognising Shoebox in 1962 but it's only recently through Google, Apple and Amazon that it's really been widely available and usable" (Lee, 2017).

Some of the first voice technology use cases were "Audrey" in the 1950's, that was invented in the Bell Laboratories and that could only understand numbers and "Julie" in 1987, a doll for children who could understand short sentences (Kikel, 2020). Taherdoost (2018) emphasises the importance of user acceptance and confidence in using said technology for further developing any kind of new technology.

Why is voice technology not more used? According to Lee (2017) it is not used, because it has not really worked as it should, it has not been easy enough or user-friendly enough, and because it is potentially embarrassing to use in public, as this has not yet been made a normal part of life for the majority of the population. Using voice search is currently mainly happening for example when asking your smartphone to tell you the weather forecast, changing the music on a smart device or in the car finding directions while driving without having to type (Abramovich, 2018). This is where the home voice assistants have

come in and filled a niche purpose, as it is less embarrassing to talk to a device in the comfort of your own home.

Singh (2019) points out that "voice is the most natural, intuitive means of interaction. It is basic communication". This brings forward the question of why it is not used more in the daily life of the consumer, if using voice commands is the most natural way of interaction. What drives the adoption in the US and Asia, but hinders it in Finland? Is it the local language, is it cultural differences in consumer behaviour, or something else? What barriers are there preventing Finns from adopting voice search and technology? Georgiev (2022) brings forward statistics from Statista, stating that every month in 2018, one billion voice searches were made. Out of these, 55% of the teenagers are using voice search every day and amongst the adults as many as 40% use mobile voice search at least once daily, all which means that there is a clear interest in the technology (Georgiev, 2022; Petrov, 2022). In Asia-Pacific, an iProspect study found that close to two thirds of the consumers were using voice technology in 2018 (Staffreporters, 2018). To better understand the differences, Laukkanen (2016) explains that all innovations are first met with resistance, and it is only by overcoming this resistance that product adoption can take place. In this study the author will try to identify possible drivers and barriers for the adoption of voice search and voice technology utilization amongst Finnish consumers, as great business and use potential can be seen in a market where consumers are already happy to use quite advanced technological products.

Consumer behaviour drastically changed when the Covid-19 viral pandemic hit the world in February 2020 (Panetta, 2020). All over the world people were recommended to work from home, to practice social distancing, to wash their hands thoroughly, to wear a face mask in public places, not to touch any unnecessary surfaces and to stay home as much as possible. This led to a change in online and offline shopping behaviour as well as in a newfound interest in voice-controlled devices (Weintraub, 2020; Kalsi, 2020; Zanuldin & Webster, 2020). Warc (2018) points out that voice interactions can clearly add value to the consumer by providing immediate convenience, and that this is something businesses and brands need to consider tapping into as soon as possible.

Tackling this technical research topic means understanding how to combine online sources containing new information and research with already existing behavioural

theories. There are several behavioural theories related to adoption of technology that can be used to support the findings and opinions voiced in different sources. When browsing through online sources, the author found that most contained research data from the United States or Asian markets where the voice technology is more widely used. A large part of the data mainly focused on voice assistants and not purely on voice search. For this reason, the author decided to use the broader term voice technology, that contains both voice search as well as voice commands, when discussing the topic in this study.

1.2 The objective

Finland is considered a highly technologically developed country, ranking first on the European DESI scoreboard (European Commission, 2020). Finland was also ranked number one most Hi-Tech country in the world by Margasoft (2020), before US, Japan, South Korea, and Germany, so the factors hindering and driving adoption of voice technology on the Finnish consumers are interesting to find out. Factors driving the adoption will be investigated and discussed as well. The study is conducted through online focus groups, providing a small but rich sample of data of Finnish consumers adoption behaviour. The objective of the study is to identify and find drivers and barriers to adoption of voice technology amongst Finnish consumers. The research question is stated as follows:

> "What are the drivers and barriers to adoption of voice technology amongst Finnish consumers?"

1.3 The structure

In chapter two previous literature regarding voice technology, consumer adoption behaviour theories as well as potential business value and previous use cases are being presented. The methods and interviews conducted are explained in chapter three, followed by the results that are analysed in chapter four. In the fifth chapter the author discusses the findings and brings forward potential future research questions, followed by the sixth and last chapter consisting of conclusions.

2 LITTERATURE REVIEW

2.1 Defining voice technology

To shed light on how different voice technology and voice search can be perceived the author brought forward the following quotes.

> "Voice search is a form of speech recognition technology that allows users to perform searches via spoken commands" (Lucy, 2019).
>
> "Voice search or voice-enabled search refer to the search systems that allow users to input search queries in a spoken language and then retrieve the relevant entries based on system generated transcriptions of the voice queries" (Jiang et al. 2013).
>
> "[..] voice input has the potential to be the most efficient form of computing: Humans can speak 150 words per minute on average but can only type 40. Now is the time for voice recognition to take over, too, since the technology is a logical fit with Internet of Things-connected devices, such as Amazon Echo or the Apple Watch" (Ryan, 2016).

With all these statements pointing towards an easy integration of voice technology in the society, why is it not happening? Boyd (2019) argues that voice search or voice technology development goes against the traditional evolution curve; online, we learn to write, read, and now speak and listen, as traditionally offline the evolution has been to first learn to listen and speak. Is this reversed pattern the reason why voice technology adoption is slow?

Rios (2019) points out that as voice technology develops, and more people are starting to use it, there is a high risk for those that do not embrace it to be left on the side-lines of future society and business. Similar trends can be seen in the banking industry; fewer banks offer offline services and are pushing customers to use their online services and apps (Ghani et al., 2017; Sharif & Raza, 2017; Laukkanen, 2016). Rajan Anandan, VP, Southeast Asia & India of Google predicts that India with its advanced interest in technological solutions will be "the world's first voice-driven Internet market, where voice will be both the primary input & output" (Mishra, 2018). Voice search is already statistically more used in Asia than anywhere else, even though the English-speaking youth (16-24-year-olds) is not far behind (Griffin, 2020).

There is no way of knowing if voice technology development and adaption will follow a previously seen behavioural curve, but considering previous data and research, a rising trend in voice search and voice technology usage can be seen, especially in the smart

speaker category, which according to Engberg (2018) is being adopted almost as fast as the smartphone was around ten years ago. The reason why this quick change could be commercially fatal for some businesses is simply because they are not prepared for it, and according to Enge (2018) within the next decade less than a quarter of all devices connected to internet will be the traditional PC, tablet, or smartphone, that is used today. Enge (2018) brings forward a theory that at some point even search fields in the browsers might be removed, which would significantly change consumer behaviour and the demand put on business owners to adapt. The change from offline to online is still taking place in some companies, while others already have been selling online for years. Osman (2020) estimates that 95% of all purchases will be made online by 2040. Gartner predicted in 2017 that by 2021, the early adopter companies who have made their website easy to use for both voice- and visual search could increase their digital commerce revenue by more than 30% compared to those that have not done this adaption (Panetta, 2017; Boyd, 2018).

According to Ray (2021) a little over 50% of all household would own a smart speaker device by the end of 2022. In the US, 31% of the households already did own a smart speaker back in 2019 (Statista, 2019b). There is no mentioning of how actively this smart speaker is predicted to be used, or for which market Ray's prediction was done, but if already more than every second household is expected to own one, it shows significant positive trend and is a clear sign of consumer readiness for adoption of new technology. Rolfe (2019) points out that the smart speaker category is seeing the fastest tech device adoption since the smartphone.

Ray (2021) explains that the behaviour when using voice technologies for search is quite different from the typed search. According to Ray only around 25 keywords are used for nearly 20% of all voice searches, and these mainly consist of action driven words like "how" or "what", as well as descriptive words like "best" or "easy" (seoClarity, 2020). This list shine light on for the purposes of voice search and in what kind of situations voice technology is used - and might also indicate where one would expect it to be used, but it is not. Gartner (2016) predicted that "by 2021, 30% of web browsing will be screenless" (Ray, 2021). Webb (2019) estimates that the number will be over 50%. This is believed to happen with increased preciseness of voice search and ever developing artificial intelligence (AI), giving a better user experience with less friction areas. Living in a time of radical digitalization is a landmark in history. Digitalization is changing everything in

our daily lives, just as industrialization was changing people's lives 70 years ago (Fitzgerald, 2020). Panetta (2020) predicts that the current traditional computing technologies will hit a wall within five years and be forced into more neuromorphic computing, where the computer brain thinks and acts like a human brain.

2.2 The difference between voice search and web search

Shortly put, voice search is natural sentences and therefore longer searches, while typed web searches tend to be shorter, using fewer keywords (Bensaid, 2020). The advantage of voice search is that it reveals more of the intention for the search than regular web searches. The type of searches also differs; Griffin (2020) says that voice searches tend to be action queries, and that the estimate is that typing creates up to thirty times fewer action queries compared to voice searches. From this one can conclude that voice searchers are more ready to act on the results of their search than type searches, which can be more of browsing nature.

On Google, voice search only renders one result (the most accurate one), while traditional web search gives you several options to choose from (Gandhi, 2017). Surati (2019) points out that while the Google assistant and Apple's Siri both use Google search, Amazon's Alexa and Microsoft's Cortana use Bing as their search engines. This means that up to half of the future and current voice search user could be using Bing instead of Google, and that businesses should not forget to optimize their webpages for Bing alongside Google. If the whispers of Apple possibly creating their own search engine are true (Waters, 2020), this could further complicate the search landscape in the future, as different types of search optimization would need to be done on different browsers. Adding to this mix the giant Amazon and their massive marketplace with different optimization requirements for internal searches, and we begin to understand the issue and potential of search optimization. More than half of US consumers already go directly on Amazon to search for their products instead of performing a Google search (AMZ Insight, 2022). Seeing this change happen is witnessing a transformation in consumer behaviour.

Oziemblo (2019) points out that if you are not ahead of competition with voice search, you might be entirely out of the competition, as the search results only display one relevant result. This is similar to Amazons buy box, where you need to meet certain criteria

to win it and be highly visible to consumers. If the estimated consumer usage of voice search is correct and 50% of all searches will be done by voice in less than two years, it is easy to understand that businesses who do not optimize for voice search could potentially face huge issues and see a big drop in visibility on vital search engines, which in most cases will lead to lost revenue by missed sales opportunities.

2.3 Potential business value

It has been estimated that the value of US and UK voice commerce markets will increase from two billion dollars today to up to forty billion dollars already in 2022 (Perez, 2018; Carufel, 2018; Rolfe, 2019; Osman, 2020). Regarding voice commerce, Carufel (2018) commented that "the new channel may well be the next major disruptive force in retail". They also said that purchases made with voice search tend to be small amounts and products of lower value. This statistic is provided by them for the top-ranking categories for voice purchases: grocery (20%), entertainment (19%), electronics (17%), clothing (8%). John Franklin, Associate Partner at OC&C commented:

> "Voice commerce represents the next major disruption in the retail industry, and just as e-commerce and mobile commerce changed the retail landscape, shopping through smart speaker promises to do the same. The speed with which consumers are adopting smart speakers will translate into a number of opportunities and even more challenges for traditional retailers and consumer products companies." (Carufel, 2018).

Webb (2019) supports this by stating that "by the end of the next decade, the vast majority of shopping purchases will be made by voice". It is fascinating to envision how technology will shape our shopping behaviour in the future, be it via mobile, smart speaker or even through robot shop staff.

Robots are making an entrance and giving another interesting layer to traditional shopping (Petro, 2020). Coombs (2018) envisions the potential of voice-controlled AI by lifting examples from the daily life:

> "It may start out with "I think you've left the lights on, would you like me to turn them off?", but think of how this technology could be applied to other scenarios such as care for the elderly. Being informed when "normal" routines are broken, such as the kettle not being switched on in the morning or the lights not being turned on, could be used as an indicator that something is wrong."

This kind of potential would bring real value to the whole society. Singh (2019) brings forward the potential of voice recognition as biometric measure and says that the bank Uniphore, based in Bengaluru, strongly believes that the voice apps will be used by

consumers to check their account balance, transfer funds and for paying bills. As consumers would perceive this as a benefit that would make their lives easier, it could serve as a driver for consumers to adopt voice technology. The vice president of Amazon Pay, Paul Gauthier, believes voice payments could revolutionize the whole commerce industry, if, and when consumers start paying for goods with the sound of their voice (Rolfe, 2019).

2.4 Apple and Google applications

Voice search has been investigated for years, going as far back as 1877, but with the breakthrough happening in 1952 with Audrey, Bell Labs' Speech Recognition System (Annadurai, 2019). This system only understood numbers, but IBM managed to create a system that could understand words in 1962 (Annadurai, 2019). Many do not even realise how early products with voice recognition technology entered the homes of people; according to Annadurai (2019) this happened already in 1987 with dolls created for children that could understand speech commands. Many connects the voice technology breakthrough to the time around 2011 when Apple's Siri revolutionized the markets by being the first smart device, with which you could have a conversation (Annadurai, 2019). Google was a little slower but made a great attempt with their Google Duplex technology to change how simple online reservations are done (Annadurai, 2019). Google Duplex is an AI technology, that used in combination with Google voice assistant can call and make for example a restaurant reservation, book a hairdresser appointment, or buy movie tickets in the United States (Callaham, 2019). Garun (2019) comments that when Google Duplex was announced in 2018, the expectations were sky high, but a year later businesses, and consumers alike, are still confused about how the technology is supposed to work. This might be a sign, that the market is not yet ready for functions like Google Duplex, or that the technology (although ground-breaking) is not simple enough for consumers to see the value and being able to or wanting to adopt it.

2.5 Prior studies on consumer adoption of voice technology

Demographics and gender play an interesting factor in the voice adoption process. Rios (2019) comments that generally voice technology is more popular amongst the younger

generations. Stevanovic (2020) has found statistics pointing to that a little over 40% of the world's population performed at least one voice search during the first three months of 2019, and mainly on mobile phones, even if smart assistants also were gaining popularity. This is an interesting aspect to consider when looking into factors creating the resistance to voice search adoption. According to Yle (2018a) mobile searches and especially "near me"-searches increased on Google by 50% in Finland 2018 compared to 2017.

McCaffrey, Hayes, Wagner, and Hobbs (PWC, 2018) conducted research on voice technology and stated that consumers in the ages 18-24 are adopting voice technology faster than the older generations, the older generations (25-49) are however using them more often. PWC (2018) found similar facts in research that they conducted into consumer intelligence services and found that the younger consumers drive the adoption of voice technology, together with households with children and medium income. PWC (2018) also bring forward an explanation for lower use in the younger age groups; people in their survey said that they prefer to use their voice assistants at home, in private, and the younger age groups tend to spend more time outside the home.

2.5.1 Hindering factors for voice technology adoption

PWC (2018) points out three major hindering factors of voice technology adoption from their research study: limited knowledge of the full capability of a device, lack of trust, and hesitation due to price or complexity. If one would generalize these findings, it could be said that the end users seem to be missing information on functionalities to be able to fully use their devices and technology.

Storm (2020) claims that businesses that invest in voice search now could gain a significant advantage in the future if Gartner's prediction 30% of all searches are made by voice without a screen in 2020 (Garner 2016; Storm 2020). Anderson (2020) states that "By looking at these numbers, one can safely say that the voice search option is currently commonplace", meaning it is time for businesses to start optimizing for voice search.

Jiang et al. (2013) investigated user responses to errors in voice input in voice search. They found that a voice search user might have to repeat his or her search multiple times before getting the desired results, which in many cases leads to frustration. Boyd (2019)

explains that for humans to adopt a new behaviour they need time and incentive, and since many consumers still are more comfortable with writing than speaking online, this will take time before becoming the new normal.

Consumer privacy has been questioned a lot in connection with increased online presence; everything from Google taping conversations, Facebook listening in on its users (Kleinman, 2017) to Alexa performing actions without being told to do so (Lynskey, 2019). Ray (2019) conducted research where 79% of the respondents replied that they were concerned or somewhat concerned about their privacy when using voice commands.

In a study conducted by Tsukamoto et al. (2021) the main reasons for Japanese not using voice technology were found to be that it was embarrassing to use, the technology did not understand the query, the responses were inaccurate and that it was easier to type.

Laricchia (2022) published the statistics from 2020, which can be seen in figure 1 below, regarding barriers to voice technology worldwide. The top two reasons here are accuracy and language issues related to accent or dialogue.

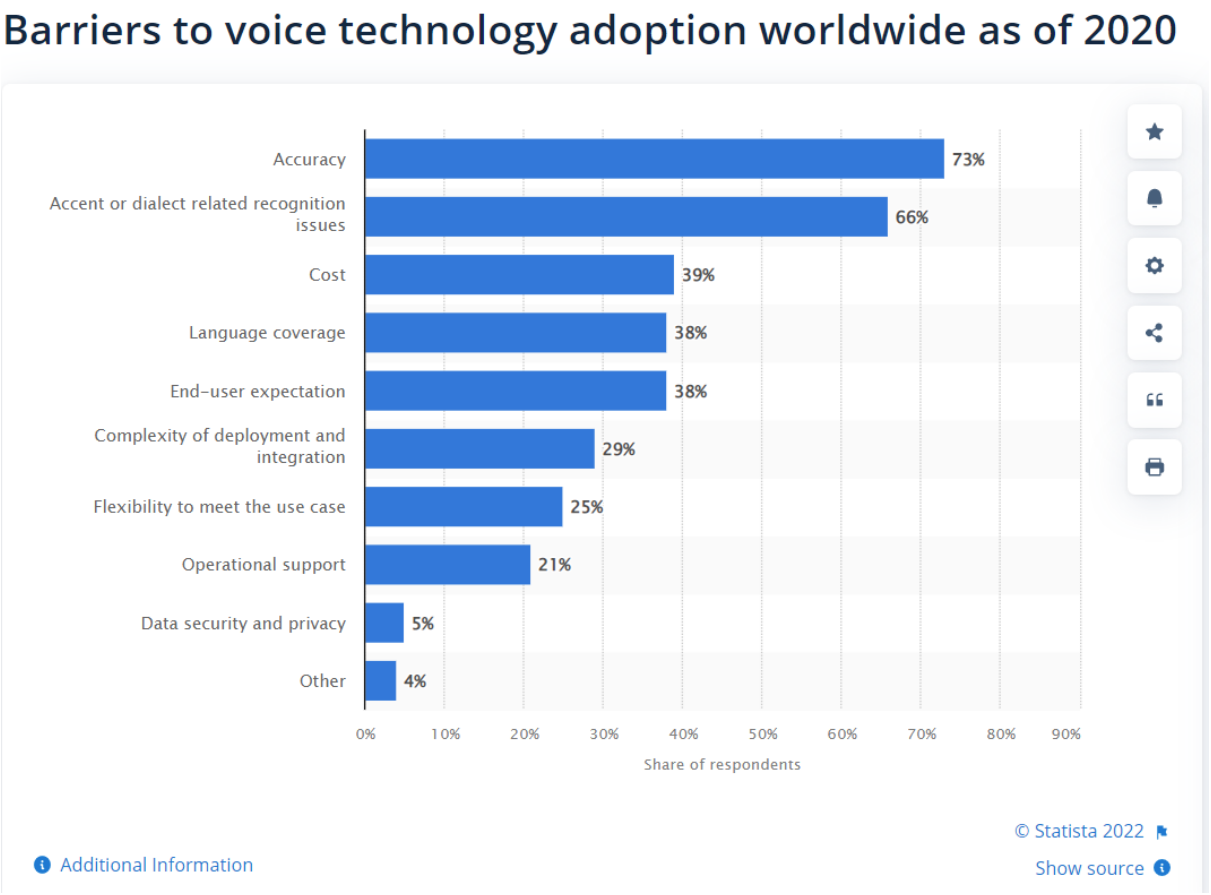

Figure 1 Barriers to voice technology adoption worldwide as of 2020 (Laricchia, 2022)

2.5.2 Driving factors for voice technology adoption

New trends could also mean new ways to enjoy voice search experiences. Sharma (2022) says that "voice technology has become the most disruptive force to hit the world ever since the internet became a visual medium" and Thompson (2019) points out that for marketers, this channel is a possibility for "building immersive consumer experiences". Thompson even goes as far as to say that the digital interaction can feel almost human-like. Haberin (2018) adds that "Consumers will be more inclined to try voice search when it's built into items they already use regularly". He even goes as far as saying "A voice-first world is no longer a fantasy – it's an inevitability" (Haberin, 2018). Pratt (2019) brings forward the advantage's smartphones have by saying stating that smartphone users prefer voice searches as they are faster and easier than traditional typed searches. Smartphone and voice assistant penetration can be said to help increase the use of voice technology. Currently, 20% of the searches on mobile are voice searches (Georgiev, 2022). In the US, the penetration for home assistants or smart devices was 33% in 2019

but was predicted to rise to 55% in 2022; in 2021 around 43% of the households in the US had a smart home device (Statista, 2022). Globally the use of smartphone penetration has reached its all-time high in 2020, with 41,5% of the global population using a smartphone (O'Dea, 2020). According to Georgiev (2022) 56% of adults feel tech-savvy when using functions such as voice search on their mobile and voice commands on their home assistants.

Singh (2019) brings forward the potential of biometric voice recognition by explaining how banks are experimenting with voice biometrics. According to Singh (2019) the banks intend to use the consumers voice as authentication when the customer reaches out to customer service or wants to complete a transaction, and he brings forward the benefit of not having to remember multiple passwords. Other biometrics such as fingerprints, facial recognition and eye scan are already used for biometric authentication around the world (Kaiwartya et al., 2017). An experiment to question the security of voice biometric authentication was performed by twins in the US in 2017, where the non-identical twin managed to get into his brothers account by using voice recognition biometrics (Simmons, 2017). This proofs that voice biometrics is still a work in progress, and according to Kaiwartya et al. (2017) the voice of humans is ever evolving, affected by factors such as age, sicknesses, different moods, the person you are speaking to or with or noise from the environment, and it can change over time.

The messaging app WhatsApp is a good example of technology using voice driven actions. With more than two billion users in 180 countries and 65 billion messages every day, two billion minutes' worth of voice and video messages are sent every day over the app (Andjelic, 2020; Iqbal, 2020). The voice technology can also have a great impact on people who are illiterate (Hudson, 2013) or people, who are visually challenged or blind (Kuharana & Pruthi, 2017), by giving them access to an online world that has been out of their reach due to the requirement of reading and writing to properly be able to use the internet functions. Singh (2019) comments that the current level of interaction with different devices has never been as easy as now.

2.6 Technology adoption theory

When talking about human-computer interaction, affect and emotion have been identified as important influences (Peter & Beale, 2008) but it has also been pointed out that it might be better to focus on the interaction instead of the emotion (Palen & Bodker, 2008). To shed some light on factors impacting and either speeding up or slowing down adoption of new technology it is beneficial to use several behavioural theories and models to properly explain consumer behaviour and the reasons behind it. According to Lai (2017) the constant technological change that we are experiencing both creates threats to the existing business models, and at the same time offers huge potential opportunities for new technologies and business models. Tao et al. (2010) points out that a users' adoption of a technology might not only be depending on the level of technology but also on the perceived usefulness for the user specific task. Technology acceptance has been researched for a long time and can be considered a mature research field (Alomary & Wollard, 2015). In the following sub-chapters, the author will go through some of the most widely used behavioural theories that can be used in connection with consumer technology adoption or acceptance. In this study the author will focus on the Diffusion of Innovations theory and the Resistance of Innovation theory. Voice technology can be perceived as a relatively new innovation and therefore these two models work well for the intended use purpose and analysis of the results.

2.6.1 Different behavioural theories and models

Theory of Reasoned Action (TRA) and Theory of Planned Behaviour (TPB)

Fishbein and Azjen's Theory of Reasoned Action (TRA) from 1975 has been extensively used to predict and understand motivational influences on an individual's behaviour. According to Taherdoost's (2018) analysis of this model, this predicts an individual's attitude towards a behaviour, which is based on emotions and the persons own beliefs system and is affected by the surroundings attitude towards a certain behaviour. Hagger (2019) expresses that the Theory of Reasoned Action has demonstrated effectiveness in predicting how people's behaviour might change and vary within different contexts.

The Theory of Planned Behaviour (TPB) was developed by I. Azjen in 1985 from the Theory of Reasoned Action (TRA) by expanding the factors affecting intention from two

to three factors. (Kumphong et al., 2017) The added factor was the Perceived Behavioural Control (PBC), which reflects on the individual's perception of control, which in turn has proven to add significantly to the prediction and variability of intentions and actions (Azjen & Madden, 1986; Azjen 2002). According to Hsu & Chiu (2007) the Theory of planned behaviour has previously been successfully used to predict users' acceptance of information technology (IT).

From these theories the Model of PC Utilization (MPCU) by Thompson et al. (1991) was born. According to Alomary & Wollard (2015, p. 2) this theory consists of "six determinants to technology acceptance [..]: job fit, complexity, long-term consequences, affect toward use, the social factor, and the facilitating conditions". Understanding factors impacting PC utilization can help understand consumer behaviour related to voice technology usage.

Technology Acceptance Model (TAM)

Lai (2017, pp. 21-38) describes the Technology Acceptance Model (TAM) as "an adaptation of Theory of Reasonable Action [..] specifically tailored for modelling users' acceptance of information systems or technologies". The Technology Acceptance Model was introduced by Fred Davis in 1986 and has been widely used in research (Hu et al. 1999; Lu et al. 2003; Dishaw et al. 1999; Pavlou, 2003; Pikkarainen, 2004; Legris et al., 2003). Venkatesh and Davis further developed the Technology Acceptance Model 2 (TAM 2) in 2000 and Venkatesh and Bala took it one step further with the Technology Acceptance Model 3 (TAM 3) in 2008 (Lai, 2017). Each step added new factors impacting the acceptance of technology as can be seen in figure 2.

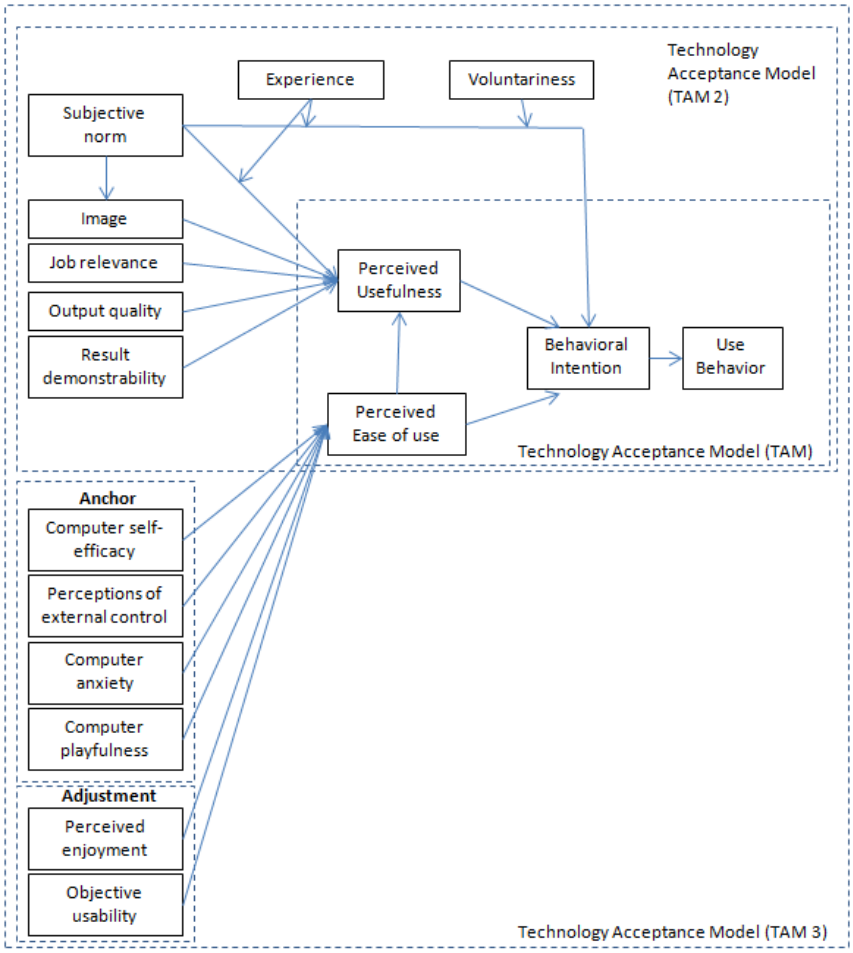

Figure 2 Technology Acceptance Model (TAM) by Davis, 1986, Technology Acceptance Model 2 (TAM 2) by Venkatesh & Davis, 2000,, and Technology Acceptance Model 3 (TAM 3) by Venkatesh & Bala, 2008. (Figure: Boughzala, 2014, p.169).

The original TAM model put to test the Perceived Usefulness and the Perceived Ease of Use. These are defined as "the potential user's subjective likelihood that the use of a certain technology will improve his/her action and [..] the degree to which the potential user expects the target system to be effortless" (Lai, 2017, pp. 21-38). Taylor & Todd (1995) suggested that people with prior experiences, good or bad, already have an attitude towards the object or innovation and that this affects their behaviour more strongly. They also point out that those without experience might focus more on ease of use and be more affected by the perceived social norm, while the experienced ones focus on perceived usefulness. Azjen & Madden (1986) suggested that past experience might help shape intention and Taylor & Todd (1995) added to this by suggesting that the way information is communicated to inexperienced users can have a strong effect on intention, but still might not become a behaviour. One implication that this research might have according

to Taylor & Todd (1995) is that the TAM model might better predict technology adoption for experienced users.

Consumer adoption by Kotler

This model has mostly been used to describe how a consumer adopts a product and what factors affect this behaviour. Voice assistants, smartphones and other smart gadgets with voice technology are products that consumers purchase with the existing feature of voice technology. Voice assistants main use is actions based on different voice commands, while smartphones have a wider use purpose. Penz & Hogg (2011) brought forward the role mixed emotions play in both consumer behaviour and in the person's intent to purchase. The five stages of consumer adoption described by Kotler et al. (2014) are product awareness, product interest, product evolution, product trial and product adoption. Voice technology is not directly a product, but the consumer still needs to own a device able to understand voice commands in order to be able to use the technology.

Unified Theory of Acceptance and Use of Technology (UTAUT)

To predict intention to accept and adopt technology, Venkatesh et al. (2003) developed the Unified Theory of Acceptance and Use of Technology (UTAUT) model (Alomary & Wollard, 2015; Attuquayefio & Addo, 2014; Taherdoost, 2018) from combined elements of previous technology acceptance models and theories (TRA, TAM, the motivational model, TPB, combined TAM-TPB, the model of PC utilization, innovation diffusion theory and social cognitive theory).

The central parts of this theory are effort expectancy, performance expectancy, social influence and facilitating conditions. These are in turn affected by experience, age, and voluntariness of use, as can be seen below in figure 3 (Taherdoost, 2018; Alomary & Wollard, 2015). According to Alomary & Wollard (2015, p. 3) Venkatesh et al.'s model "is considered to be more robust than other technology acceptance models in evaluating and predicting technology acceptance".

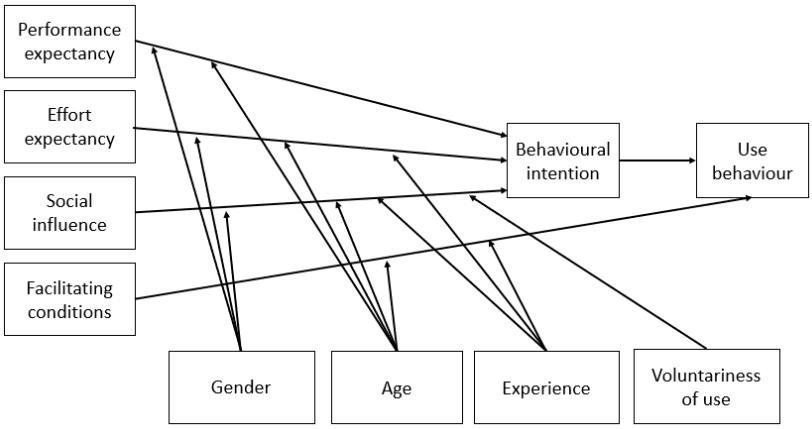

Figure 3 Unified Theory of Acceptance and Use of Technology (UTAUT) by Venkatesh et al., 2003. (Figure: Al-Imarah et al. 2013)

Task Technology Fit (TFF)

The adoption process of technology can be described with the task technology fit (TFF) model. This model, shown below in figure 4, explains that how well the technology fit in combination with the intended use purpose or task has an impact on the adoption. A technology might be perceived as advanced and even beneficial, but the consumer might not adopt it if it does not fit the consumers task requirements (Tao et al., 2010). There have been several studies investigating the task-technology fit relationship (Strong et al., 2006; Tao et al., 2010; Suk et al., 2013; Shahreki, 2016; Lai, 2017).

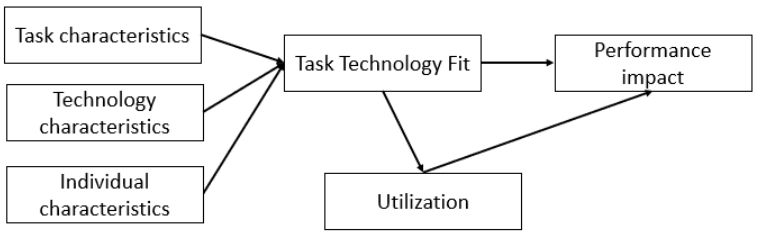

Figure 4 Task Technology Fit (TFF) by Goodhue & Thompson, 1995. (Schlagwein et al., 2012)

2.6.2 Consumer resistance model

Ram & Sheth (1989) introduced the consumer resistance model, which they used to explain how consumer would be inclined to use a specific service, technology, or tool, and why they would reject it. The initial resistance reaction may appear when an innovation creates a big change in the consumers daily life or conflicts with previous beliefs of the consumer. The adopters of innovation were divided into five groups Innovators, Early Adopters, Early Majority, Late Majority and Laggards (see Rogers Diffusion Theory

1971). Ram & Sheth (1989) further divided the barriers affecting consumer adoption into functional and psychological barriers. In the resistance model presented by Ram and Sheth (1989) the five barriers are usage barrier, value barrier, risk barrier, tradition barrier and image barrier. These can exist on spectrum from active to passive resistance and are affected by timing as well as the level or amount of change the innovation brings with it. Amongst the functional barriers are the listed patterns for product usage, value of product, and risks associated with the use of the product, while the psychological barriers focus on consumer's traditions and norms, and the perceived product image.

Functional barriers

The usage barrier causes resistance to an innovation when it collides with a consumers existing habit or workflow, forcing a change into a comfortable existing routine (Ram & Sheth, 1989). The value barrier causes resistance to an innovation when the perceived benefit of said innovation is not strong enough; there is no incentive for change. The risk barrier consists of four types of risk factors that cause resistance to an innovation: physical, economical, functional, and social risk. Physical risk is related to for example new medicine or foods. Economical risk is perceived when the investment in the unknown innovation is high, and therefore the risk of disappointment also higher. Functional risk is uncertainty regarding functionality of an innovation – what if the new product does not function properly? Social risk creates resistance when the consumer is afraid to face ridicule from peers or social exclusion (Ram & Sheth, 1989).

Psychological barriers

The tradition barrier creates resistance when the innovation causes a cultural change in the consumers life – the bigger the change, the greater the resistance. Typical for this barrier is that the attitudes might well change, but it takes time. The image barrier creates resistance when trying to break a stereotype – the origin of the innovation has a certain identity that we associate with product class (quality), country ("Asian tools are lower quality than American") or some other factor (Ram & Sheth, 1989).

The initial stimuli for resistance or adoption might come from an external or internal source and will instigate a spontaneous response within the consumer – either resistance or openness to the innovation in question (Bagozzi & Lee, 1999). They also point out that

some initial resistance can occur passively due to old habits, or existing strong attitudes towards the object. Bagozzi & Lee (1999, p. 218-225) bring forward the positive and negative emotions related to acceptance of innovation:

> "Emotional acceptance of innovations comes from positive emotions such as joy, pride, hope, love or liking. [..] Emotional resistance to innovations comes from negative emotions such as anger, fear, sadness and disgust, guilt, shame, contempt, and envy and jealousy."

Bagozzi & Lee (1999) also speak about the need for further research – current adoption models often end with the decision to adopt or not, and they point out that the adoption process continues after that, and that the implementation part of the process also should be taken into consideration. The consumer might decide to resist adoption and feel comfortable with this decision, until stronger arguments or better incentives are brought forward.

Laukkanen et al. (2008) looked deeper into the reasons of non-adopters (postponers, opponents and rejectors) of internet banking. They defined the groups as follows; the postponers who have the intention to adopt a given innovation within a year; the opponents who see it as possible and have the intention to adopt the innovation, but have not yet decided when, but surely not within a year; the rejectors who have no intention to adopt the innovation. It is important to keep in mind, that this only concerns non-adopters. Donahole (2019) said that augmented reality (AR), virtual reality (VR), and voice search already have passed the threshold of early adopters. This might be true for the US, but perhaps not yet for Europe. Antioco & Kleijnen (2010) looked closer at adoption barriers that were characterized by either high incompatibility and high uncertainty or by low incompatibility and low uncertainty. By choosing a communication strategy that fits the type of barrier the consumer is faced with, businesses can help consumers overcome these barriers and facilitate adoption.

2.6.3 Diffusion of Innovations Theory (DOI)

The main concepts of voice search adoption have been defined within the diffusion of innovation theory; explaining how the (1) innovators, the (2) early adopters, the (3) late majority and the (4) laggards (see figure 5) adopt new technology (Kaminski, 2011; Rogers, 1971), as well as which factors are driving each of these segments. Rogers (1962, 1983, 1995, 2003) originally brought forward the Diffusion of Innovation Theory (DOI)

to help researchers understand how new innovations are accepted by and spread amongst people. In practice this means that there are a few individuals that are open to a new idea / innovation and decide to adopt it and start using it. These are called the early innovators and they then spread the word to some more who also open up to the adoption, and this creates early majority adoption, which over time reaches a saturation point where most of the population or late majority, have adopted the new idea. These are followed by the laggards who do not adopt the innovation before it becomes absolutely needed. According to Kaminski (2011) a sixth group can sometimes be added – the non-adopters.

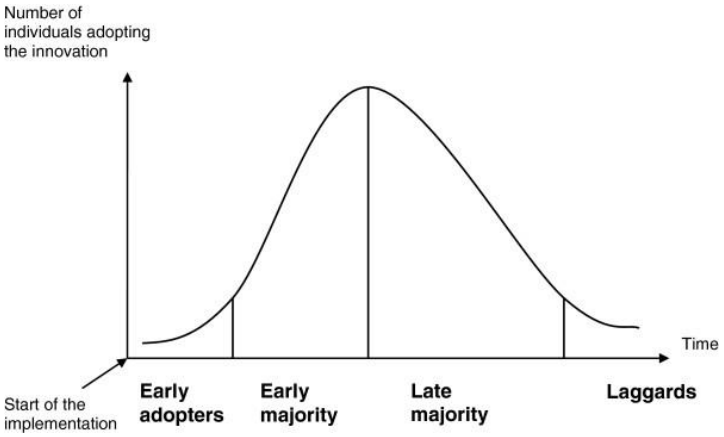

Figure 5 Diffusion of Innovation Theory by Rogers, 1962. (Figure: Vedel et al. 2013)

For the topic of this thesis the curious aspect is to understand where in the development curve the current state of voice technology can be placed. Rogers (1962) identified five general characteristics, or attributes, that can be seen as driving or hindering factors for the adoption of an innovation. These are shown below in figure 6.

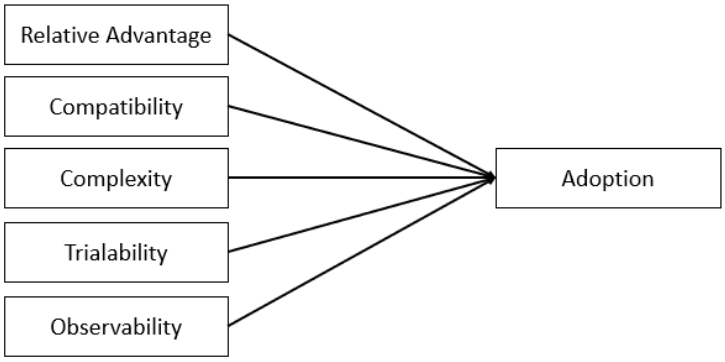

Figure 6 Characteristics affecting the Innovation of Diffusion (Rogers, 1962)

1. relative advantage, where a product or service can be perceived as superior to an existing one.

2. compatibility, where the innovation matches the individual's values and experiences.
3. complexity, where if a product is perceived as complex, it can slow down the adoption, while a product perceived as easy can speed up the adoption.
4. trialability or divisibility, where the adoption process is sped up by a sample or test as well as an individual's willingness to try it.
5. observability or communicability, where the benefits of the innovation can easily be described and the results can be faster seen, leading to speeding up the adoption.

According to a McKinsey survey (2020) the Covid-19 crisis has pushed the acceptance of voice technology amongst consumers forward by years, as the benefits brought forward could easily be identified by the wider audience when governments recommended against touching surfaces in public. The adoption process is ongoing, and most consumers can still be found between the early adoption phase and the early majority adoption phase in the adoption curve (under 50% of the population are using it on a regular basis). Park & Jun (2003) point out that consumers from cultures with high likelihood to avoid uncertainty are less likely to be early adopters.

Sahin (2006, p. 14) brings forward four key elements affecting Rogers' Diffusion of Innovation model.

1. The innovation. Rogers (2003) described innovation as an idea that the individual perceives as new, and Sahin (2006) added to this by saying that the innovation does not necessarily have to be new, as long as the individual perceives it as new, it can still be an innovation for them. The innovation adoption also depends on how much uncertainty there is. Being aware of advantages and disadvantages may make the decision easier (Rogers, 2003).
2. The communication channels. Sahin (2006) puts forward mass media channels as the most efficient way to inform a larger group of potential adopters about the innovation and interpersonal channels, like face-to-face discussions with peers or friends, as the best when it comes to advance the adoption process of an individual.
3. Time. Time is present throughout the adoption process and helps define "the relative earliness or lateness of the adoption of an innovation" (Sahin, 2006).

4. The social system. This element consists of individuals, groups (family and friends) or even organizations that together engage in problem solving to reach a common goal (Rogers, 2003).

The Technology Readiness (TR) model was brought forward by Parasuraman and Colby in 2001 (Taherdoost, 2018). TR focuses on the likelihood of people adopting and using new technologies, both in private and at work. It uses similar segmentation as Rogers' adoption model, with five classes of technology consumers: explorers, pioneers, sceptics, paranoids, and laggards.

Perceived Characteristics of Innovating Theory (PCIT)

The Perceived Characteristics of Innovating Theory (PCIT) is based on Rogers' Theory of Diffusion and was developed by Moore and Benbasat in 1991 to better predict the perception of using an innovation by the potential adopters, by not focusing only on the characteristics of the innovation (Yaacob & Yusoffa, 2014). They identified the following eight factors that influence the diffusion of an innovation as pictured in figure 7.

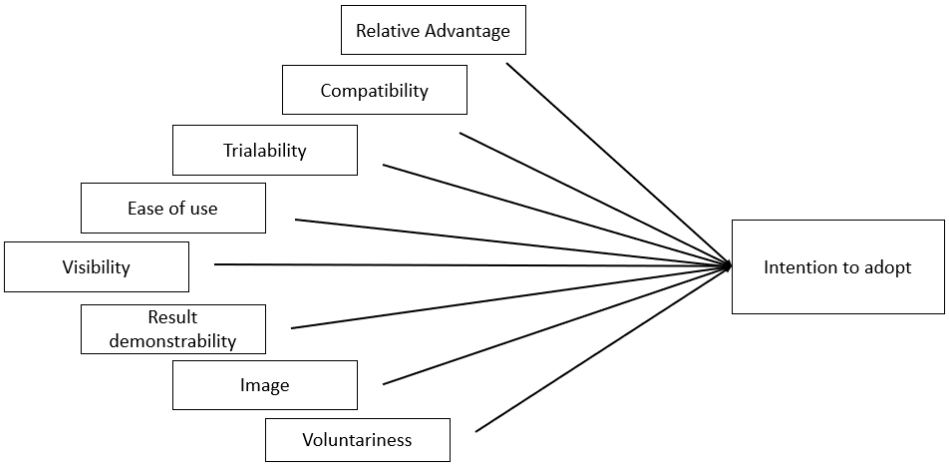

Figure 7 Perceived Characteristics of Innovation Theory by Moore & Benbasat, 1991. (Figure: Dahlberg & Öörni, 2006)

2.7 Voice technology in Finland

Voice search and voice technology has not been utilized much in Finland, but the reason for this is unclear. Hindsberg (2019) questions if the Finnish language is too hard for machines to learn, and Hallamaa (2018) suggests that the public interest would be much higher if the voice technology understood Finnish properly. Ruokonen (2019) brings forward voice technology as one of the biggest trends of 2019 and says that Finns, who are

used to using different technological applications in their daily life, should have an easy transition to adopting voice technology. According to Ruokonen (2019) and Yle (2018a) the biggest use areas for voice technology is entertainment (Spotify, games), information search (news, weather, Google) and life management (calendar, reminders, alarms). Hindsberg (2019) is convinced that many more Finns will be talking to their smartphones, cars, and smart speakers in a not very distant future.

Savolainen (2012) digs into the process of creating the Finnish voice search; Google needed at least 300 volunteers who recorded Finnish sentences, after that they started programming and creating language rules. According to Savolainen (2012) Finnish is a relatively easy Nordic language and only needed 150 Google rules, while Swedish for example was so complicated that it was not worth creating any rules for it, and Danish could not be added in August 2012 along with the other Nordic languages because it was too difficult for Google. Kammonen (2012) also tested the voice search function on Google and found that 16 out of his 30 searches produced the correct Finnish result. According to Jäntti (2017) the voice search results are already acceptable, but there are still limitations; Alexa, for example, does not yet understand or speak Finnish. Jäntti (2017) goes as far as saying that at the moment "[..]Alexa is just a glorified egg timer" for Finnish consumers.

Teknologiateollisuus (2019) found that a major hindering factor for the development of voice technology has been juridical. According to them, the development of voice technology has been significantly delayed by the GDPR regulation in EU, which has required a lot of investigation and new agreements, as voice data is considered personal data until anonymized. According to Yle (2018a) the biggest hindering factor in the smart speaker category development in Finland is that the home smart devices like Alexa are not yet available in Finnish, and that Finns still feel awkward talking English to them. However, Yle (2018b) predicts a transition from touch to voice very soon, as the younger generation has already begun using English voice commands on their smart devices instead of waiting for the Finnish version to be available. The Finnish government body Vake has kicked off a, even by international standards, exceptional project in June 2020 called "Lahjoita puhetta" ["Donate your speech", free translation] (Kallio et al, 2020). The goal with this project is to collect speech data from different aged Finns and foreigners speaking

Finnish, to be able to keep the Finnish language involved in the technological development and services of the future (Kallio et al, 2020). 10 000 hours of speech was set as the goal for the campaign, and since June 2020 around 3000 hours of speech data has been donated, but at least 2000 hours more is needed according to linguist Mietta Lennes for the creation of an accurate speech model for the Finnish language (Kallio et al, 2020). Kallio et al. (2020) points out that the richer and more diverse the material (gender, age, local dialects, etc.), the better the smart devices will understand the speech of as many Finns as possible in the future, and the better the understanding, the more people will use it and benefit from it.

Linnake (2017) comments that he has been using voice technology for writing text messages but has not seen anyone in his surroundings using voice technology. According to him, the technology works surprisingly well, and the results are surprisingly good. Liila (2017) brings forward the issues voice technology has with understanding the spoken words and says that this naturally has a negative impact on usage. Liila (2017) also comments that even though Google said that they managed to get voice technology to understand 95% of human speech correctly, this does not mean that it covers all languages, and that Finnish seems to still be tricky, but she also points out that companies who do not put effort into optimizing voice search will without a doubt be left on the side-lines in the future. Jäntti (2017) says that the worst thing about voice technology not understanding your command is the sound of error as “this broadcasts to everyone around you that you made a mistake of some kind”, which ties back to Lee (2017) who also implied that one of the reasons voice technology is not used more is that it is embarrassing to use in public.

3 METHOD

The research question is to find drivers and barriers to adoption of voice technology amongst Finnish consumers and the aim is to find the reasons behind slow voice technology adoption in Finland, making qualitative research the more appropriate research method. The qualitative research method brings forward the emotions and emotional drivers of behaviour of the consumer. A quantitative study would also have been possible, but the qualitative allows for more freely elaborated answers and brainstorming, which is needed when trying to find undiscovered reasons why people are not using this technology more. For data collection for this thesis, the method of semi-structured focus group interviews was chosen.

3.1 Qualitative research and focus groups

Bryman (2012) describes qualitative research as "[..] theory is supposed to be an outcome of an investigation rather than something that precedes it" (p.378). He also says that "the qualitative researcher seeks close involvement with the people being investigated, so that he or she can genuinely understand the world through their eyes" (p. 401). This is a very good way to describe qualitative research. The most important thing in a qualitative research study according to Ngulube (2015) is the qualitative data analysis, since this is the step that help the researcher make sense of the qualitative data that was collected and reach a conclusion.

Focus group discussions allow free conversation, group interaction and possibly discovery of new ideas why the voice technology is not more used and the main barriers preventing people from using it, as well as reason for using it or considering using it. Kolb (2008, p. 30) defined the focus groups as a group of individuals who are brought together and encouraged to share their point of view on a specific topic. He also pointed out that bringing the interview objects together can awaken new thoughts and create a deeper response to the questions, as they get influenced by and react to the comments of the others in the group.

3.1.1 Online focus groups

As we are living in exceptional times with the Covid-19 virus turning our worlds upside down, the easiest way to currently manage focus group discussions is online. Research performed by Woodyatt et al. (2016) showed that online focus group interviews can lead to a larger word count, shorter interview, but more honest information revelations. Woodyatt et al. (2016) was comparing face-to-face interviews with online focus groups and concluded that even though the format of data collected was different, the content was very similar.

3.2 Data collection

The plan for this research was to have two focus groups, each with three to eight participants, but in the end three focus group interviews were held, each with two to five participants. More participants than that per group would have made discussions hard. The author functioned as the facilitator and moderator of the focus group interviews. The participants did not know each other or the moderator from before. As pointed out by Kiuru (2014), the ideal participants would be average users, not experts, but also not novices. These participants were recruited through Facebook groups and can therefore be assumed to have some level of technical knowledge. The author of this thesis posted in several different Facebook groups in search of participants and these eight were the ones that expressed interest in the topic and had time to participate. The author chose to not be selective or picky with the participants participated, as this would result in more objectiveness and a more random sample, which could potentially give a more heterogenic view of Finnish consumers' opinions. The Facebook groups used were "Hae töitä - verkostoidu - ilmoita työpaikoista – somerekry [Find jobs-connect-post jobs-social media recruitment]", "Nuorille töitä [Jobs for youth]" as well as "Suomenkieliset työpaikat maailmalla [Finnish jobs around the world]".

The focus group interviews were held on Microsoft Teams and recorded. The duration of the interview sessions was between 30 minutes and one hour. The participants were given access to the questions before the interview and asked to fill in an informed consent form (see appendix 1 and 2) online before participating. The author collected inspiration for the interview questions by researching the US market, where voice-controlled features

(home assistants and voice search) have grown exponentially in the last years (Donnelly, 2020; Guy, 2018). The interview consisted of ten questions targeting both negative and positive aspects of voice search as well as possible use cases. The participants were asked questions regarding use scenarios, possible security concerns, motivational drivers and stoppers as well as encouraged to open discussion around the theme. The full interview guide can be found in appendix 1.

The interviews took place during the first quarter of 2022 (January-March). The interviews were held in Finnish, as it made more sense when researching Finnish consumer habits and it was the common language for the participants and the interviewer, and it helped to avoid creating a language barrier and allowed the interviewees to freely express themselves in their mother tongue. The transcription and translations of the interviews were made by the author. Before the interview started, the moderator repeated the same information that was sent out to the interviewees before the interview, this being the reason of the interview, that the interview will be recorded and that all answers will be treated confidentially, and the interviewees' identity will be kept anonymous (see appendix for interview invitation and interview guide). After the interviews, the data collected needed to be transcribed, analysed, and coded.

3.3 Sample

There were eight participants in total, three male and five female, aged between 18 and 62, giving the author a good, but rather small, sample of the Finnish population. Figure 8 below shows the division of participants in the interviews.

Focus group interview nr 1	(F)=female, (M)=male		
Age	24	18	
Code letter + gender	B (F)	A (F)	

Focus group interview nr 2	(F)=female, (M)=male		
Age	40	36	62
Code letter + gender	D (M)	C (F)	E (M)

Focus group interview nr 3	(F)=female, (M)=male		
Age	52	42	18
Code letter + gender	H (F)	G (F)	F (M)

Figure 8 Focus groups: age and gender

3.4 Data analysis

The interviews were transcribed (in Finnish) within a week of the interview. As the interviews were recorded, there was no hurry to transcribe them, but made sense to do it as soon as possible with the discussion fresh in mind. The transcripts ended up being between six and nine pages per focus group interview.

The aim of the analysis was to discover possible barriers and drivers to voice technology adoption amongst Finnish consumers. The analysis was based on a partly inductive, or a "bottom-up", approach, as the purpose was to analyse data, focusing on understanding individual behaviour and finding a pattern (Lodico et al., 2010). However, instead of creating a theory, these results were matched with categories based on the Resistance of innovation theory (Ram & Sheth, 1989) and the Diffusion of innovation theory (Rogers, 1962), adding a deductive approach to the analysis. This helped keep the focus on the research question and created a sounder qualitative analysis (Bingham & Witkowsky, 2022).

As described in chapter 2, the Diffusion of Innovation theory contains five categories that explains how consumers adopt new technology consisting of the innovators, the early adopters, the late majority, and the laggards. The characteristics impacting these categories have been divided into five subcategories (relative advantage, compatibility, complexity, trialability and observability) by Rogers (1962). These subcategories relate quite well to the barriers presented by Ram & Sheth in the Resistance of Innovation theory (1989) (see appendix 3). This allowed the author to visualize the perceived benefit and perceived obstacles in specific categories. For these reasons these two theories were selected. In the next chapter the drivers and barriers found are presented.

The author started the analysis by dividing the comments into two, first level codes with characteristics perceived as positive or advantageous characteristics, hereafter drivers, and negative or disadvantageous characteristics, hereafter barriers (see appendix 4). These were in turn matched against the ten categories that emerged from the two theories and labelled accordingly, creating the second line of coding (see appendix 5). For the drivers the diffusion of innovation theory was used and for the barriers, the resistance of

innovation theory. These results will be analyzed in the next chapter. See figures 9, 10 and 11 for the coding schemes for the data analysis.

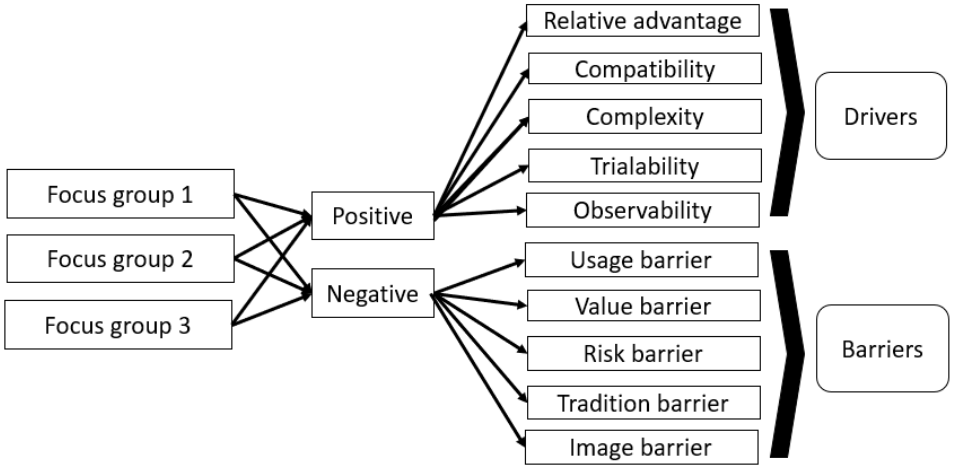

Figure 9 Code lines used for data labelling

3.5 Trustworthiness

The interviewer as an outsider, with no prior connections to the interviewees, was aiming to not share any personal opinions during the interviews or let them impact the wording of the interview questions.

When the sample size is small, as is the case in this study, each interviewee's answer becomes more important and has a greater effect on the result than it would have if the sample size was bigger. Even with a small sample size the data seemed to reach fair saturation, meaning that some of the themes in all three focus groups started to repeat themselves. According to Hennink et al. (2022) reaching saturation indicates that an acceptable sample size was used for the research topic and that the data collected through the focus interviews captured enough diversity and distinctions of the theme to demonstrate validity. In this study several themes were repeated in the different focus group interviews, identifying the most important drivers and barriers.

The interviewees were assured that their answers would be handled in a way so that their identity could never be directly linked with the answers given. They were encouraged to

voice their honest opinions, but there is always a little risk that the interviewees were not completely honest in their answers and may have given answers that they felt would be more appropriate or appreciated by the others in the group discussion (Freitas et al., 1998). The participants did not know each other or the moderator from before, which helps in avoiding biased opinions.

4 RESULTS

The data analysis identified both drivers and barriers of voice technology adoption. These are more closely presented in the following chapters. The participants quotes are marked by letter only, ensuring the interviewees' anonymity. The translations from Finnish to English were made freely by the author.

4.1 Drivers

Based on the interviews the author found drivers from the relative advantage, compatibility, complexity, trialability and observability categories. Three reasons for each category are presented in figure 10 below. The first column shows in which of the three focus groups this comment was made; the number after the comment shows how many times the comment was made by a different participant.

Focus group in which the comment was made	Comment (X = times mentioned by different participant)
1,2,3	Convenient for setting alarms (6)
1,2,3	Is safer driving and talking than driving and texting (5)
2,3	Time saved compared to traditional typing (4)
1,2,3	Leaves hands free, allows typing without using hands (5)
1,2	Convenient at home, can be connected to smart home setting (3)
1	Helpful for elderly, that can have a hard time using the small buttons or seing the screen (1)
1,2,3	Assists (dyslectics) with spelling (5)
2,3	Simple to use for easy tasks like setting alarms and changing music (3)
2,3	Saves time when needing to write while on the move (5)
1,2,3	Fast to use (6)
1,2,3	Convenient for playing videos & changing songs (5)
1,3	Autocorrect helps writing correclty in multiple languages (3)
2,3	Fun to play with technology (3)
1,2	Family member uses it (2)
2,3	Smartphones already have the technology, low effort to test it (2)

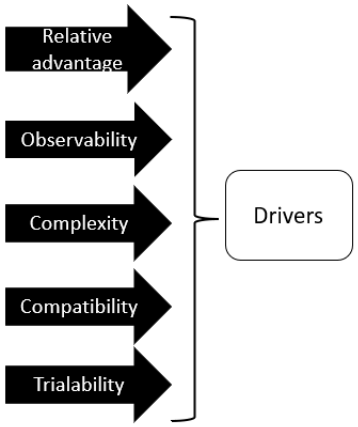

Figure 10 Drivers to voice technology adoption

4.1.1 Relative advantages

The relative advantages found related convenience, especially **saving time** or when performing another task simultaneously. Adding to **driving safety** and being **convenient for setting alarms** for example while cooking was also mentioned.

> “If you want to find something in another language and you know how it’s pronounced by not written, or then if you have some kind of reading disorder, or your hands are busy or you don’t have hands, then it can be convenient.” (Interviewee B)

> ”If you want to take a nap or you’re cooking or baking something and boiling eggs for example, then you can just shout at your phone and tell it to alarm you in seven minutes so that you don’t forget your eggs on the stove.” (Interviewee C)

4.1.2 Observability

The interviewees brought forward the use of voice technology while driving as a generally more accepted, and safer, option to typing. The main benefits that were brought forward was that using voice technology **leaves the hands free** and **allows you to type without using your hands**, that it is **convenient at home as it can be connected to a smart home setting**. One interviewee also brought forward t**he benefit for the elderly, as it helps the ones who have a hard time using the small buttons or trouble seeing the screen**.

> ”No one should be using their phone, but [..] I would say that all of us use it more or less when we are driving, so this [voice search, authors note] is a good thing, it brings a little bit of security because you don’t have to look at the screen while typing.” (Interviewee C)

> ”For elderly people this could be very helpful [..] when they have a hard time writing on the small screen.” (Interviewee H)

> “My grandmothers and grandfather all almost exclusively use voice search after I’ve connected it to their phones.” (Interviewee A)

> ”I could use my son as a reference, he is now in his thirties. And he he has this Alexa and, yeah okay, he works in tech support for a phone company and is a half nerd, and well he has everything working through Alexa, starting from his robot vacuum cleaner.” (Interviewee E)

4.1.3 Complexity

The complexity of the innovation has a big impact on the adoption decision. The **helping (dyslectics) with spellcheck** and autocorrection of typing were perceived as very easy to use and helpful qualities of voice technology. **Simple tasks like setting alarms** and **changing songs** when listening to music were mentioned by several interviewees as a convenient feature. Voice technology also was perceived to **save time when needing to write while on the move**. The interviewees also brought forward laziness as a

fundamental reason for using voice technology, suggesting that the innovation can be perceived as easy.

> "When you get lazy or when you're heading to bed in the evening and want to put an alarm or a calendar reminder [..] it works surprisingly well." (Interviewee D)

> "I use voice search quite a lot. I would even say several times a day, because it's easier for me since I have a little bit of dyslexia so it's easier for me than typing myself." (Interviewee A)

> "I could use it when it's freezing outside and I want to find some information, then the fingers don't have to freeze while writing, I'm sure it would be very convenient in that kind of situation." (Interviewee F)

> "[..] in months or on a yearly level I probably save a couple of hours [by using voice search, authors comment]." (Interviewee D)

4.1.4 Compatibility

Themes brought forward by the interviewees relating to compatibility were related to using voice technology being **fast to use**, that it works **conveniently for playing music on the TV or changing songs**, as well as helping to make life easier by **helping to write correctly in multiple languages.**

> "[..] When you're lazy and don't feel like moving [..] it's convenient to change the channel with the voice." (Interviewee G)

> "[..] then it's easier to talk to the phone and then it writes it correctly, and sometimes it can be a problem if it doesn't understand properly. I really use it in Finnish, English, and Russian, sometimes in Swedish if I don't know how to spell it. The thing is if I know how to say it but not spell it then it's much easier like this.". (Interviewee B)

> "Well of course when it works it is super quick to use for search or different commands [..]." (Interviewee C)

4.1.1 Trialability

The willingness to try voice technology was higher when it came to **fun things** to do with it; for example, testing how well it understood or if it was able to beatbox or change songs. The fact that this **technology already exists in smart phones** also makes it easier and requires less of an effort for consumers to try it out. **Family members who already use** voice technology for something makes it more appealing to try it, or at least stir some curiosity for it.

”[..] I recently realised that I, on my Android, I have a Xperia Android phone, uhm so I realised that I could try this google voice search thing on it and I thought I would give it a shot. Ever since I’ve used it every now and then.” (Interviewee C)

”It’s great for this kind of everyday silliness, then you don’t have to worry [about security, authors comment].” (Interviewee C)

”Well I’ve only tried it [voice search] a couple of times and I noticed it works really well and understands me very well, and I tried it in Finnish. I study languages every day through an app on my phone, so I speak to my phone every day, but for some reason I just haven’t used this, I have no reasons for it, it just hasn’t been used. So, I’ve used it very little, only really tested it.” (Interviewee F)

“I use it surprisingly much [on the phone, authors comment]. My girlfriend speaks Thai and she uses it on our TV. I didn’t even know that we had that feature in our TV, but she has started using it. So she speaks Thai to it and YouTube finds her all the music and whatever show she watches.” (Interviewee D)

4.2 Barriers

The barriers were divided into five barrier categories that can be found under the functional and psychological barriers. The functional barriers relate to three areas: product usage patterns, product value, and risks associated with product usage. These barriers are more likely to arise if consumers perceive significant changes from adopting the innovation. The psychological barriers arise from two factors: traditions and norms of the consumer, and perceived product image. These barriers are more often created through conflict with consumers prior beliefs. Among possible barriers for adopting voice search the hesitancy to change habits, to try something new were mentioned, as well as frustration for technology misunderstanding the intent or words of the user.

Three reasons for each category are presented in figure 11 below. The first column shows in which of the three focus groups this comment was made; the number after the comment shows how many times the comment was made by different participants.

Focus group in which the comment was made	Comment (X = times mentioned by different participant)
1,2,3	I'm not comfortable sharing my private / sensitive search topic (4)
2,3	In many situations speaking might not be possible, not all situations are appropriate for usage (3)
1,3	I type faster and get results quicker by typing (2)
1,2,3	Voice technology is not very well known (6)
1,3	Mothertounge [Finnish] not well enough supported (3)
2,3	It is frustrating not being able to use voice technology for writing and having to write manually anyways after several attempts (2)
1,2,3	Friends are not using it, lacking word of mouth praise, leaves me insecure about it (6)
1,2,3	It's frustrating having to try many times before being able to perform wanted action (5)
1,3	I would not use it in a public place (5)
2	"Apple is safer than Android for IT topics like voice technology" (1)
1	I'm not a fan of smarthomes so this voice technology is not so interesting for me (2)
2	Security concerns limits use areas (3)
2, 3	Finns are silent people, not very talkative, maybe prefer writing (2)
1, 3	People need time for deciding whether or not to use it. (2)
2, 3	Seen as strange as it isn't "normal" yet

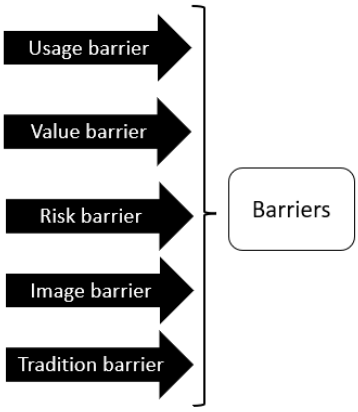

Figure 11 Barriers to voice technology adoption

4.2.1 Usage barrier

Under the topic of usage barriers presented by the interviewees were **not wanting share the private or sensitive search topic**s, finding it difficult to find proper situations to use voice search as **not all situations are appropriate for usage**, and being able to **performing the same action faster by typing**.

> ”If you live with a family, do you really want everyone to hear what you are looking for in the browser.” (Interviewee E)

> “There are people like me [..] if I’m out on town I don’t like that other hear what I’m searching for, or if I’m home I just like for me to know what I’m looking for online.” (Interviewee H)”

4.2.2 Value barrier

Amongst the value barriers mentioned were **the inconvenience of not being able to use the interviewees mother tongue** (Finnish), not getting the wanted results and **having to redo the search or action manually** anyways as well as finding that **voice technology is not very well known**, leading to the interviewees not perceiving a good enough benefit to drive change and adoption of the innovation.

> “I’ve only really heard negative stuff about using voice search before this interview, that the device hadn’t understood what was intended and the search had to be done multiple times and finally just write it anyways.” (Interviewee B)

”I’ve tested the Siri functionality every now and then just to see [..] but it’s been clumsy so I don’t use it very often.” (Interviewee H)

“In the end it’s not a big deal to just write what you want to know.” (Interviewee H)

“[..] you always have to translate to English first and then back to Finnish. If you use Finnish it won’t work properly.” (Interviewee D)

4.2.3 Risk barrier

The interviewees brought forward several social and functional risk barriers, amongst others that misunderstandings were frequent, **having to redo the same action created frustration** and since their **friends were not actively using voice technology**, they also felt a social barrier blocking them from using it. Many interviewees also said that they **would not want to use it in a public place**, partly due to not wanting people overhearing search queries, partly because they did not want to disturb others in public by talking unnecessarily.

“[..] I’m not more worried about [security, authors comment] when speaking compared to writing, but of course if people around hear it or gets disturbed by whatever I say then it is of course a whole different story.” (Interviewee G)

“[..] I’ve only heard negative things about using it from before this interview, that it has not understood, and one has had to try again and again and finally give up and write anyways.” (Interviewee A)

4.2.4 Tradition barrier

The interviewees pointed out that voice technology security is not clear to them, that **voice technology is seen as strange,** without clear use purpose, and that **Finns in general are less talkative** than other nationalities, which might have an impact on use, as they might prefer writing. A couple of interviewees also brought forward that **people need time for deciding** whether or not they want to use it.

“[..] I just know that I have friends who live abroad and they might even be using it a bit more. Pretty little I’ve heard that anyone in my circles would be using it, I only know of a few.” (Interviewee C)

“And we are one of the most silent people. [..] Not very talkative.” (Interviewee C)

“For a lot of people the term voice search is probably quite foreign.” (Interviewee D)

> "I have to say, I've only every once seen someone use voice search in my entire life." (Interviewee F)

> "[..] I would be annoyed, if I'm forced to use it, that I'm not allowed to get to know it [voice technology, authors comment] at my own speed." (Interviewee A)

4.2.5 Image barrier

Regarding voice technology the stereotypes brought forward related to security, that specific brands would be more secure than others, for example that **Apple is safer than Android**, and that as **the whole idea of a smart home is not appealing**, **therefore also voice technology is not so interesting**. Some interviewees also expressed **concerns regarding security** aspects, which then in turn limits the use area.

> "I'm not a big fan of the idea of a smart home, so that's probably one reason why I'm not too excited about this voice search either." (Interviewee B)

> "[…] for safety reasons, Apple is so much safer than Android, so there are no viruses or other things, maybe it's just because in my company I've always had Apple since it's so much harder to hack [..]. " (Interviewee D)

> "[…]I would not say anything like any sensitive data or like social security numbers or similar thing, I would not be comfortable speaking that." (Interviewee C)

5 DISCUSSION

The research question was “What are the drivers and barriers to adoption of voice technology amongst Finnish consumers?”. The interviews shed light on which areas served as drivers and which areas as barriers regarding voice technology adoption of a small group of Finnish consumers. The consumers seemed to be quite decided on either liking it or hating it, and for this reason it made sense to start analysing the results by dividing the comments made into positive and negative experiences related to voice technology. Interviewees who did not particularly like voice technology still brought forward useful use cases and suggestions, while interviewees who already were actively using voice technology had a hard time seeing any negative aspects of it.

Abramovich (2018) and Ruokonen (2019) suggested that the use cases for voice technology were mainly asking for the weather forecast, changing the music on a smart device, life management (calendar, reminders, alarms), or finding directions while driving without having to type, all of which were confirmed by the interviewees when questioning them about their use areas. They also brought forward the point of it being fun entertainment because it was not always working as intended. This suggests that instead of being perceived as a useful, functional tool, voice technology is viewed as entertaining rather than helpful. It can be argued that voice search is not more used because it has not really worked as it should (Lee, 2017), it has not been easy enough or user-friendly enough, and because it is potentially embarrassing to use in public. This was confirmed by several of the interview participants who also brought forward concerns regarding privacy and user issues.

The author had expected the Finnish language to be a bigger barrier, but most of the interviewees were quite okay with using voice technology in English. The ones who tried it in Finnish found that it either worked as expected or that it did not work at all. Therefore, the language barrier cannot be seen as a major barrier to adoption. However, the cultural aspect of Finns being perceived as less talkative, and this having an impact on the willingness to talk to a smartphone or home assistant was brought forward by interviewees in different focus groups. In table 1 a summary of drivers and barriers can be found. After this, the drivers and barriers are discussed further.

Drivers

Relative advantages

- Convenient for setting alarms
- Safer driving (typing without looking at screen)
- Time saved compared to typing

Observability

- Leaves hands free of phone, allowing multitasking
- Convenient at home, can be connected to smart home setting
- Helpful for elderly, who can have a hard time using the small buttons or seeing the screen

Complexity

- Simple to use for easy tasks like setting alarms and changing songs when listening to music
- Assists (dyslectics) with spelling
- Saves time when needing to write while on the move

Compatibility

- Fast to use
- Convenient for playing videos and changing songs
- Autocorrect helps writing correctly in multiple languages

Trialability

- Fun to play with technology, using it for entertainment purposes
- As this technology already exists in smart phones it is easy to try it
- Family members using voice technology creates curiosity towards it

Barriers

Usage barriers

- Not feeling comfortable sharing a private / sensitive search topic
- Not all situations are appropriate for voice technology usage
- Performing the same action faster by typing

Value barriers

- Voice technology is not very well known
- Not being able to use the mother tongue (Finnish)
- Frustration caused by trying to use voice technology but it’s not working as expected and having to manually type anyways after several attempts.

Risk barriers

- Friends are not actively using voice technology, lack of word of mouth creates insecurity towards it
- Having to redo the same action creates frustration
- “I would not use it in a public place”

Image barriers

- Apple is safer than Android for IT topics like voice technology
- I'm not a fan of smart homes so this voice technology is not so interesting for me
- Security concerns limits use areas

Tradition barriers

- Finns are in general are less talkative than other nationalities, maybe even prefer writing if given the choice
- People need time for deciding whether to use it or not
- Seen as a strange technology as it isn't "normal" yet

Table 1 Drivers and barriers

5.1 Drivers

Rogers (1962) five characteristics (relative advantage, compatibility, complexity, trialability, observability) of factors impacting the adoption of an innovation helped to put the findings into perspective. The interview results suggest that the Finnish consumers have yet to find the relative advantage of voice search compared to existing tools. For specific use cases, such as setting an alarm, it has been found to be very convenient at times, but not good enough to completely replace the previous method of setting alarms.

The majority of the drivers found from the focus group interviews were related to speed, time saved, hands freed up for performing multitasking and using voice technology for entertainment. Kibbe (Kinsella, 2021) commented that he thinks that 2022 will be the year when voice technology will be optimized "for what users are using voice for, not what they could be using voice for". Kibbe lists use cases (media, smart home, quick news, and simple Q&A), which match the ones that surfaced in the focus group interviews. This implicates the adoption is on its way, but certain barriers are slowing the process. A curious trait that could be seen in all interviews were the listing of possible future use cases, but not necessarily use cases that were already included in the consumers daily lives right now. This points to the Finnish consumers being able to see the value of the innovation, but still not being ready or able to adopt it.

The findings also suggest that the complexity is perceived as high; the consumers are lacking proper incentive and find the tool to be useful only for more simple tasks. The consumer trialability is surprisingly low, considering that Finnish consumers are happy to use technology in their daily lives and voice technology is incorporated in smartphones, which as many as 96% of Finns own (Clausnitzer, 2021). It has also been stated that consumers would be more likely to try out voice search when it's built into items they already use (Haberin, 2018), however this does not seem to be entirely the case, as most consumers were confused as of how it was supposed to work and how it could be accessed. The interviews showed that participants whose family or friends were using voice technology were more inclined to try it.

One might conclude that it is the observability or communicability that is lacking and failing to in a simple manner describe the benefits of voice technology to the end user.

Sahin (2006) suggested that mass media would be the most efficient way to inform a larger group of potential adopters about the innovation as well as through face-to-face discussions with peers or friends. This was also something that was brought forward by the interviewees; they lacked knowledge about the benefits with voice technology and felt that no one was using it. However, some of the use cases brought forward by the interviewees connected to convenience of being able to use voice technology around the house, especially the fact that the hands were free to multitask was a popular feature. When younger generations had helped older generations set up voice technology and connect it with their devices, they were happy to use it, as it helped them solve the issue of having a hard time typing and seeing what was written on a small screen. When it comes to compatibility, the innovation seemed to match the interviewees expectations when the task at hand was a simple one, like changing songs when listening to music or helping to spell in a foreign language.

Convenience has been found to be a strong driver in other research related to technology (De Bellis & Johar, 2020; Wu, 2018). In this research the strongest drivers found related to convenience – the user wanted the innovation to make their life easier, simpler, faster and help solve a problem they are currently facing. De Keyser (2019) expressed the importance of convenience by saying "What matters to consumers is the time and effort they have to expend – the less, the better". Sankar (2020) points out that we all strive to make our lives as easy as possible and says that "the dictionary definition of convenience implies increasing comfort or decreasing work, modern society often translates this into the idea of saving time". The current use cases brought forward by the interviewees were linked to time saving, entertainment and security in multitask situations. Examples of these are for example playing videos on a device or texting while driving. Using voice technology in the car seems to be more widely accepted than using voice technology outside of the car. As a conclusion it can be said that the convenience and entertaining aspects of voice technology are the strongest drivers amongst Finnish consumers.

5.2 Barriers

The majority of the barriers found from the focus group interviews were functional barriers, primarily in the risk barrier category. These include barriers like technology issues

(misunderstandings, errors in results), language not supported, unwillingness to use voice technology in public, and general lack of knowledge regarding the possibilities voice technology holds. From the sample, several individuals expressed that they had no issue using voice technology in English and even preferred it as the results were better; a few mentioned that Finnish had worked well for them. A couple said that it would be nice to use in their mother tongue (Finnish), but this did not seem like a deal breaker to any of the participants. As predicted, the transition from touch to voice has already started (in English) as the younger generation use English instead of Finnish for their voice commands (Yle, 2018b).

The interviews clarified that voice search is currently used on a smaller scale, but still not perceived as "normal" in a wider (social) setting. As it has been suggested that our social groups, family, and friends are the ones that help us determine what should be perceived as "normal" (Salonen & Helne, 2012), it appears that this social risk barrier is still being processed by the majority of the population but has been accepted by a smaller part of the population.

Amongst the usage barriers the topics of privacy and use location were mentioned several times. The interviewees expressed discomfort sharing what they were looking for online vocally and also pointed out that some situations, for example at work or when someone is sleeping, makes using voice technology a little inappropriate. Lancelot Miltgen et. al (2016) and Mani et. al (2019) found that any kind of privacy concerns was having a negative effect on the consumers' intention to accept an IT innovation, which also was true in this case. Perceiving something as uncertain can work as an effective blocker of change (Salonen & Helne, 2012); several interviewees brought forward frustration with not being able to trust that the technology would work as expected when they wanted to use it. These experiences, good or bad, in turn creates an attitude towards the innovation, which then in turn has a stronger impact on their behaviour (Taylor & Todd, 1995). In the case of voice technology, interviewees who previously had had challenges with misunderstandings also seemed less interested in trying it again. Frustration caused by the technology not working as expected lead to many of the interviewees not wanting to use it, as they often had to redo the action by manually typing anyways. Processing frustration has proven to "significantly reduce the probability of commitment to a technology" (Strebel

et al., 2004). The definition of "not working as expected" is quite wide-ranging and can have a different meaning for every individual. The specific cases mentioned by the interviewees were related to misunderstandings of intention, misspelling of words, and not reacting to the person's voice. More experienced users of voice technology often took this as a funny error, but the novices who had just wanted to try the innovation, found this to be more annoying.

Several participants brought forward the social settings as a restriction for how they use voice technology. For fun and non-serious topics no one had an issue using it, but as soon as something a little more private would need to be approached, the participants expressed their discomfort. This could be a simple thing as just wanting to look something up and not wanting to share that with anyone around. Location also played a role in this; some were comfortable using voice search freely at home, while others even at home felt worried about who might overhear the topic of their search query. The task technology fit model, which explains how the intended use purpose has an impact on the technology adoption (Goodhue & Thompson, 1995) could be used to describe how this might be a reason why the utilization grade of voice technology is seemingly low amongst Finnish consumers. Treumann (2014) pointed out that we simply need to hear more success stories about successful adoptions in order to be more open to adoption ourselves. This was also pointed out by multiple interviewees; the lack of positive word of mouth does create a barrier to adoption.

Among the strongest factors causing inconvenience to the consumers were misunderstandings, too many errors and not adding value to the consumers daily life, as they experienced that they either type faster anyways or would often have to redo the search because of misunderstandings. De Bellis & Johar (2020) comment that "convenience [..] has the ability to make other options unthinkable", which is why it is a key barrier blocking adoption. Several of the interviewees struggled to see how voice technology could be incorporated into work life due to privacy issues, and for this reason viewed it more as a fun tool for private purposes.

Pratt (2019) argued that voice searches should be the preferred way for searches for smartphone users as it is faster and easier; this did not seem to be the case amongst the

Finnish consumers. The ones who had tried it experienced different levels of misunderstandings, misspellings and wrong results, no matter the language used (Finnish or English). Some seemed to prefer using it in English, as the results were somewhat better. The interviewees who had used voice technology preferred using it for simpler tasks like changing the song when listening to music or setting alarms on their smartphones.

Technological barriers to adoption have been researched a lot in the past (Bhatt, 2011; Treumann, 2014; Ram & Sheth, 1989; Naselli, 2021). Clear technological barriers that the interviewees brought forward were lack of knowledge related to characteristics and use areas of voice technology and not working as intended (not reacting to the voice, misunderstanding intent). Technology can also be hard to grasp for the end consumer, which adds to slowing down adoption. SimplifyChange (2020) points out that "a lot of reluctance to adopt new technology lies in a misunderstanding of what technology can actually include" explaining that too often people envision futuristic machines or robotics instead of easy tools that can help make your daily life easier. Most barriers found related to inconveniences caused by technology not functioning as expected or social settings making it awkward to use the innovation. This is however not only a Finnish phenomenon; Laricchia (2022) found that accuracy was a leading barrier worldwide to voice technology adoption (see appendix).

6 CONCLUSIONS

The aim of this thesis was to find drivers and barriers to adoption of voice technology amongst Finnish consumers. The result suggest that the consumers have found their specific use area for voice technology or have chosen not to adopt it due to certain barriers. Both barriers and drivers were found, but the real reason behind slow consumer adoption of voice technology is still not crystal clear. The main barriers found related to privacy concerns, inconvenience to use it in certain places, social barriers as not many are using this technology and frustration with technology when it was not working as expected. The main drivers found related to convenience, time saved, entertainment and creating safer ways to perform daily tasks.

6.1 Managerial implications

When considering how and when to start adapting business processes to meet voice technology requirements, businesses should carefully consider the barriers that were found. As mentioned before, the consumer might not adopt the technology if it does not fit the task requirement set by the consumer. Consider current active use cases and areas and build on those instead of imposing your own idea of how it should be used. Several consumers mentioned that increased, positive marketing, creating more knowledge regarding voice technology functions would get them to use the technology more. As the voice technology develops and becomes better, companies should already be taking actions to make sure they are not left on the side-lines. By action in this context the author means for example optimizing web shops and content for voice search results and preparing for voice commerce. There is a lot for businesses to benefit from being prepared before adoption really takes off.

6.2 Limitations and suggestions for future research

As voice technology still is a "new" technology, there is limited amount of previous research on this topic, which created a clear need for this study. However, this research also only represents a limited view on the subject as a small sample of Finnish consumers were studied. Moreover, the subject in question was clearly difficult for some of the participants. Some questions were asked by the participants seeking confirmation to their previous knowledge regarding functionalities of voice technology or names of voice assistants. Some of the participants found new use cases from the other participants answers. As the use cases differed from person to person, future studies could more strictly recruit different types of users.

The barrier and drivers found in these focus group interviews should be tested through quantitative research to confirm validity for a larger part of the population. There are several interesting topics related to this research. Digging deeper into markets where voice technology is more used (Asia, US, Germany) might be able to present interesting precedent for a pattern of adoption. Investigating how robotics are driving voice technology could also be an interesting angle for future research, especially in Japan, where

robotics is more widely used and accepted. Gender bias when it comes to technology adoption would also be an interesting topic to look closer at.

The deductive method chosen to analyse the results has the potential of distorting the results as the interviewees answers are matched with the ten categories that emerged from the resistance to innovation (Ram & Sheth, 1989) and the diffusion of innovations theory (Rogers 1962), instead of freely creating categories based on themes that emerged in the interviews. However, most of the answers fit well within the given categories. The deductive approach helped the author stay focused on the topic at hand. Even if there are other possibilities for analysing the data, this analysis does, provide a reasonable view of Finnish consumers opinions regarding voice technology and their reasons for adopting it or not adopting it.

The last few years we have lived through exceptional times with Covid-19 and it would be curious to see how voice technology adoption has been impacted by the general move to more online business and distance working. The way the popularity of voice assistants and the role smart homes plays in the adoption process would be interesting to dig deeper into. As with all new technology, voice technology also brings with it some concerns regarding biometric security and the possibilities of using voice as a unique biometric identifier for official business. Having said this, it could be interesting to find out if such cases of misuse could be found. One interviewee brought forward their interest in finding out whether or not there is a difference in functionalities between voice search for IOS and for Android. This would absolutely be interesting to look into.

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APPENDICES

Appendix 1

Interview guide

Interview questions

1. Have you used voice search on your mobile / home assistant / wearable device? If yes, on which device and in what language?
2. In what situation could you see yourself using voice commands / searches? Give an example. Shopping? Searching for a route? Are the replies most of the time correct and easy to understand?
3. In your opinion, what are the main advantages for consumers to use voice technology? Are there any relative advantages compared to traditional online search?
4. What are the possible risks with using voice search (if any)? Are you worried about who is handling your online data and/ or biometrical identification points like voice?
5. What do you believe are the main drivers for consumers to start using voice search more in their daily lives? Availability? Improved technology?
6. What population group (age/profession) do you think uses voice technology the most in Finland?
7. Is voice search easier to use than traditional typed in search? How would you react if the search bar would be removed from browsers in 5 years?
8. How could voice technology improve to become more user friendly / for more people to start using it?
9. How would your life change (or would it) if you started using voice technology more?
10. Anything else you would like to add?

Appendix 2

Informed consent

Informed Consent for Online Interview Research

Master thesis: Adoption of voice technology - a qualitative study of Finnish consumers

Purpose
You have been invited to participate in a focus group interview regarding voice technology adoption amongst Finnish consumers under the direction of Fredrica Brenner, master student at Arcada University of Applied Sciences. The purpose of this focus group is to investigate to which extent voice technology is used amongst Finnish consumers. The information learned in this focus group will be used to clarify factors helping or hindering the adoption of voice technology in Finland.

Procedure
Participation in this study is completely voluntary. If you decide not to participate there will not be any negative consequences. As part of this study, you will be placed in a group of 3 – 7 individuals. A moderator will ask you several questions while facilitating the discussion. This focus group interview will be recorded.

Please note that there are no right or wrong answers to focus group questions. The intention is to hear many varying viewpoints and for everyone to contribute their thoughts and experiences. Out of respect, please refrain from interrupting others. However, feel free to be honest even when your responses counter those of other group members.

The interview will be held in English, but the participants can choose to answer also in Finnish or Swedish. The estimated duration is 30-45 min.

Confidentiality
Your responses will remain confidential, and no names will be included in the final report. You can choose whether or not to participate in the focus group, and you may stop at any time during the course of the study. Should you choose to participate, you will be asked to respect the privacy of other focus group members by not disclosing any content discussed during the study. Researchers within Arcada University of Applied Sciences will analyze the data, but as stated above your responses will remain confidential, and no names will be included in any reports. The recordings will be deleted after the conclusion of the thesis.

Contact Information
If you have any further questions or concerns about this study, please contact:

Researcher
Fredrica Brenner
Tel: +358 40 664 1776
E-mail: brennerf@arcada.fi

You can also contact Fredrica's thesis supervisor:
Niklas Eriksson
Tel: +358 29428 2620
E-mail: niklas.eriksson@arcada.fi

Arcada University of Applied Sciences,
Jan-Magnus Janssons plats 1
00560 Helsingfors
Finland

Thank you in advance for your participation!

Fredrica Brenner
Master student at Arcada University of Applied Sciences

1. I agree to participate in the research study. I understand the purpose and nature of this study and I am participating voluntarily. I understand that I can withdraw from the study at any time, without any penalty or consequences. 🗩 o

- ◯ Yes
- ◯ No

2. I grant permission for the data generated from this interview to be used in the researcher's publications on this topic. 🗩 o

- ◯ Yes
- ◯ No
- ◯ I grant permission under the following conditions

3. I grant permission for the interview session to be recorded and saved for purpose of review by the researcher and if needed by the thesis supervisor or other research personnel at Arcada University of Applied Sciences. 🗩 o

- ◯ Yes
- ◯ No

4. Choose one of the following options: 🗩 o

- ◯ I grant permission for the researcher to use direct, attributed quotations from my interview.
- ◯ I grant permission for the researcher to use my responses in aggregate or anonymous statements, but I prefer to maintain confidentiality and request that any comments are presented without attribution to me.

5. Please type your full name in the box below to indicate that you have you have read and understood the description of the study, are over the age of 18, and that you agree to the terms as described. 🗩 o

1. I agree to participate in the research study. I understand the purpose and nature of this study and I am participating voluntarily. I understand that I can withdraw from the study at any time, without any penalty or consequences. o

- ○ Yes
- ○ No

2. I grant permission for the data generated from this interview to be used in the researcher's publications on this topic. o

- ○ Yes
- ○ No
- ○ I grant permission under the following conditions

3. I grant permission for the interview session to be recorded and saved for purpose of review by the researcher and if needed by the thesis supervisor or other research personnel at Arcada University of Applied Sciences. o

- ○ Yes
- ○ No

4. Choose one of the following options: o

- ○ I grant permission for the researcher to use direct, attributed quotations from my interview.
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5. Please type your full name in the box below to indicate that you have you have read and understood the description of the study, are over the age of 18, and that you agree to the terms as described. o

Appendix 3

Colour coding used for barriers and drivers, for the barriers based on the resistance model (Ram & Sheth, 1989) and respectively based on the Diffusion of Innovation (Rogers, 1962) for the drivers.

Based on the resistance model (Ram and Sheth, 1989)	Barriers	Based on the diffussion of innovation theory (Rogers, 1962)	Drivers
Usage barrier	The usage barrier causes resistance to an innovation when it collides with a consumers existing habit or workflow, forcing a change into a comfortable existing routine	Relative advantage	where a product or service can be perceived as superior to an existing one.
Value barrier	The value barrier causes resistance to an innovation when the perceived benefit of said innovation is not strong enough; there is no incentive for change.	Compatibility	where the innovation matches the individual's values and experiences.
Risk barrier	The risk barrier consists of four types of risk factors that cause resistance to an innovation: physical, economical, functional, and social risk. Physical risk is related to for example new medicine or foods. Economical risk is perceived when the investment in the unknown innovation is high, and therefore the risk of disappointment also higher. Functional risk is uncertainty regarding functionality of an innovation – what if the new product does not function properly? Social risk creates resistance when the consumer is afraid to face ridicule from peers or social exclusion	Complexity	where if a product is perceived as complex it can slow down the adoption, while a product perceived as easy can speed up the adoption.
Tradition barrier	The tradition barrier creates resistance when the innovation causes a cultural change in the consumers life – the bigger the change, the greater the resistance. Typical for this barrier is that the attitudes might well change, but it takes time.	Trialability	where the adoption process is sped up by a sample or test as well as an individual's willingness to try it.
Image barrier	The image barrier creates resistance when trying to break a stereotype – the origin of the innovation has a certain identity that we associate with product class (quality), country ("Asian tools are lower quality than American") or some other factor	Observability	where the benefits of the innovation can easily be described and the results can be faster seen, leading to speeding up the adoption.

Appendix 4

First line of coding, grouping the (not yet translated) comments into positive and negative.

Advantages	Disadvantages
on mulle helpompaa, kun jos on lukuhäiriö niin on hankalampi kirjoittaa	voi olla joskus ongelmia et se ei oikein ymmärrä
jos mä tiedän miten se sanotaan mutten tiedä miten sitä kirjoitetaan, niin se on helpompi niin	Jossain bussissa sekin voisi olla sinänsä aika hankala käyttää kun kuuluu muittenkin hälinät, että ottaisiko se siitä häiriöö
et jos tulisi joku rasitusvamma käteen tai jotain tämmöistä mikä esim pakoittaisi siihen	se puhelin sit alkais kuunnella niin kun kaikkea muutakin
jos haluaa löytää jotain toisella kielellä ja tietää miten se lausutaan muttei tiedä miten se kirjoitetaan, jos on joku esim. lukuhäiriö tai sitten on just jotain käsissä tai ei ole edes käsiä.	pystyisikö se vaikka käyttämään sun ääntä niinkun vääriin. just muokkaamaan mitä sä oot sanonut ja sit käyttää sitä tyyliin pankkeihin kun soittaa. Että sillä äänellä puhuu ja jos on jotain omia tietoja niin kukaan ei edes ajattelisi mitään
jos on jotain aistiyliherkkyyttä, että ei tykkää vaikka koskee siihen puhelimen näyttöön hirveesti, et semmoisessa tilanteessa varmastikin joillekin voisi olla tosi hyvä.	
ust jos on vaikka jossain julkisella paikalla tai sitten on vaikka kylässä niin sitten vois käyttää tätä ääni.	monikohan youtubettaja on tota miettinyt kun lataa niin kun omalla äänellä sit noita videoita
muutkin lähipiirissä alkaisi niin kun käyttämään sitä ja että että niin kun se normaalisoituisi	sitä parannettaisi sillai ettei tulisi niitä virheitä
huomaisi että heillä olisi ollut jotain hyötyä siitä niin sitten ehkä itekin.	Että kun monesti on kuullut niitä käyttökokemuksia että sit se on kumminkin kirjoittanut sen jotenkin hassusti
oiskohan Singaporessa kun sairaalassa esimerkiksi kun pitäisi tietää että mihin oireet voi viitata niin sun ei tarvii kattoo mistään netistä tai näin vaan sä voit,	ettei se olekaan ymmärtänyt että mitä sä sanot niin
mulle helpompi koska mä puhun niin monella eri kielellä, yhdeksällä	Helpommaksi öh just se että se kirjoittaisi oikein ja että se reagoisi paremmin ääneen koska mulla on ollut se ongelma että se ei joskus vaan reagoi mun ääneen, vaikka kuinka mä puhun niin se ei ns kuule mua.
nythän on jo, nythän on jo esimerkiksi Google Alexa, eli kaiutin mihin voi yhdistää haun ja silt on kiva ihan että mikä on sää, tai siin voi kysyä että miten mun pitää pukeutua, ja sit se vastaa että laita takki tai tälleen. Sit olisi kiva jos sen pystyisi	: Jo no siis suomeksi sen on hankalaa kirjoittaa jos on ä,ö kirjaimia tai jos on ruotsalaista å:ta, niin tietenkin se kirjoittaa o:n kun ei se

Appendix 5

Second line of coding. The comments have been translated and colour coded according to the colour coding map seen above (e.g., the functional barrier representing usage is yellow, the value barrier blue, and so forth). The numbers in the first column show in which focus group interview (1-3) the comment was made and the number in the third column show how many times each theme was mentioned by different participants.

Focus group in which the comment was made	Barrier	Times mentioned	Comment
1, 2	Tradition	2	Fear of phone tapping into conversations or sensitive data
2, 3	Tradition	2	Finns are silent people, not very talkative, maybe prefer writing
3	Tradition	2	Does not work in multiple languages, Finnish works best
1, 3	Tradition	2	People need time for deciding whether or not to use it.
2, 3	Tradition	2	Seen as strange as it isn't "normal" yet
1	Tradition	1	This technology feels futuristic and distant from my everyday life
1	Tradition	1	I prefer to not use it and don't want to be forced to use it
1	Tradition	1	The use area is quite narrow
1,2,3	Usage	4	I'm not comfortable sharing my private / sensitive search topic
2,3	Usage	4	In many situations speaking might not be possible, not all situations are appropriate for usage
2,3	Usage	3	People will overhear what I'm searching for and I dont like it
1,3	Usage	2	I type faster and get results quicker by typing
1	Usage	1	Technology is too hard to figure out alone
3	Usage	1	I fear loosing the ability to write and spell
3	Usage	1	Would not work at my work place
1	Image	2	I'm not a fan of smarthomes so this voice technology is not so interesting for me
2	Image	1	"Apple is safer than Android for IT topics like voice technology"
2	Image	3	Security concerns limits use areas
2,3	Risk functiona	6	It doesn't work in Finnish, use English, it works best
1,2,3	Risk functiona	6	Friends are not using it, lacking word of mouth praise, leaves me insecure about it
1,3	Risk functiona	5	I would not use it in a public place
1,2,3	Risk functiona	5	Voice technology often misundertands me regarding intent
1,2,3	Risk social	4	There is a general lack of knowledge / understanding of the technology
1,2,3	Risk social	3	Voice technology keeps misunderstanding my words
2,3	Risk social	3	Vulnerable to attacks - more users, more attractive target. Where does my data go? Feeling more vulnerable when using voice technolo
1,2,3	Risk physical	5	It's frustrating having to try many times before being able to perform wanted action
1,3	Risk functiona	3	Not reliable enough to be counted on
1,3	Risk functiona	2	Does not react to my voice
2,3	Risk social	2	Lacking confidentiality assurance
3	Risk social	2	I dont want to disturbe other people with my searches
3	Risk functiona	2	I think the technology is missing important language / words for daily use
2,3	Risk functiona	2	Not optimized for, or taking enough into consideration, people with speaking difficulties or disabilities
1,3	Risk social	2	Fear of unknown behaviour / having to change my own habits
3	Risk social	1	Voice technology is easily disturbed by surrounding noises
2	Risk functiona	1	Older generations dont use it
3	Risk functiona	1	I speak to my phone every day learning new languages through apps but for some reason never started using voice search
1	Risk functiona	1	Wrongful use of biometrics
1	Risk functiona	1	Often results in spelling errors
2	Risk functiona	1	More for foreigners than Finnish people
3	Risk functiona	1	Inconvenient to use, I can't be both on a call and use phones search functionality at the same time
1,2,3	Value	6	Voice technology is not very well known
1,3	Value	3	Mothertounge [Finnish] not well enough supported
2,3	Value	2	It is frustrating not being able to use voice technology for writing and having to write manually anyways after several attempts
1,3	Value	2	Past negative experiences creates barrier for my interest in using it in the future
3	Value	1	Inconvenient to search for example number series or mixed languages

Focus group in which the comment was made	Driver	Times mentioned	Comment
1,2,3	Complexity	5	Texting while driving
1,2,3	Complexity	3	For injured
1,2	Complexity	3	Time saved
2,3	Complexity	3	Easy to use
2,3	Complexity	3	While cooking
1,2,3	Complexity	5	For dyslectics
1,2,3	Relative advantage	6	Setting alarms
2,3	Relative advantage	4	Faster than typing
1,2,3	Relative advantage	4	Convenient when lazy
2,3	Relative advantage	3	Easier than TV remote
1	Relative advantage	1	Convenient when typing is not possible
3	Relative advantage	1	Safer than walking and typing
1,2,3	Relative advantage	5	Safer than driving and typing
1,2,3	Compatability	6	Fast to use
1	Compatability	1	Makes life easier
2,3	Compatability	2	Works exactly as expected
1,2,3	Compatability	5	Convenient for playing music
2,3	Compatability	4	Convenient for watching videos
1,3	Compatability	3	Spell check
2	Compatability	2	No added security issues
3	Trialability	1	Observing younger generations using it creates curiosity
2,3	Trialability	3	Entertainment, fun to play with technology or use for playing media
3	Trialability	1	Smartphones already have the technology, ready to be tested
1,2,3	Observability	5	Handsfree
1,2,3	Observability	5	Multiple use areas at home
1,2	Observability	3	Connection to smart home
2,3	Observability	2	Convenient for cold weather use of phone
1	Observability	1	No need for touching
1	Observability	1	Helps elderly
1	Observability	1	Helps medical staff