The acceptance of smart home technology

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ABSTRACT,
Lately, the Internet of Things is gaining enormous attention. Especially the smart home area constitutes a big part of the Internet of Things' consumer applications. Although smart home technology is argued to be one of the most promising markets, diffusion is limited and companies struggle to exploit the market's opportunities. Therefore, it is crucial to understand why people refuse the use of smart home devices and which factors influence the acceptance of smart homes. This paper provides the variables effecting smart home use by taking the Technology Acceptance Model and resistance barriers as guidelines. Furthermore, it explains what is necessary in order to increase people's acceptance towards smart home use and how smart home companies can tackle the low diffusion rate.

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1. INTRODUCTION

The Internet is constantly evolving at a fast pace. The so-called Web 2.0 and Web 3.0 have revolutionized the internet and introduced huge technological advancements. However, the Internet of Things (IoT) is the area gaining huge attention lately (McKinsey & Company, 2015). The Internet of Things has made major advancements in the last couple of years and becomes more and more important (Lee & Lee, 2015). The term IoT was first introduced by Kevin Ashton in 1999 as the title of his presentation at Procter & Gamble (P&G). He was an assistant brand manager at P&G at that time and used the term IoT for explaining how computers and devices could decrease waste, loss and cost if they were able to generate and process data on their own, without data collected by people (Ashton, 2009).No single definition exists for the IoT yet (Balaji & Roy, 2017), although most scholars agree on the main aspects, defining the concept as "a paradigm where everyday objects can be equipped with identifying, sensing, networking and processing capabilities that will allow them to communicate with one another and with other devices and services over the Internet to accomplish some objective" (Whitmore, Agarwal & Xu, 2014, p. 261). Recognizing the increasing importance of IoT technology is inevitable nowadays. Around 127 IoT devices are connecting to the internet every second (McKinsey & Company, 2018). Furthermore, Gartner (2017) estimates that the number of IoT units will grow from around 6.4 billion in 2016 to almost 20.5 billion in 2020. Consumer applications will make up for more than 63% of the total units and are therefore a crucial area to focus on for companies producing IoT technology. One big part of consumer applications are smart home devices.

Smart home devices include products like "'wearables,' 'smart watch,' 'smart thermostat,' 'smart lock,'" (Hoffman & Novak, 2015). Even though the concept of smart homes is relatively new (Pal, Funilkul, Charoenkitkarn & Kanthamanon, 2018), intelligent housing using smart technology has been around for a while (McGrath, 2016). Nowadays, even broader society becomes aware of smart home technologies through products like Amazon's Alexa or Apple's Siri. Ma, Pogrebna and Ng (2014) underline that smart home services are considered to be one of the most promising potential markets. In general, "smart home refers to the use of ICT in home control, ranging from controlling appliances to automation of home features" (Stojkoska & Trivodaliev, 2016, p. 1). IoT-technologies can be introduced in many places in people's homes and therefore make smart homes a very challenging and promising topic to look at. Yet, especially smart home services are not as widespread as other technologies (Hofman & Novak, 2015). Certainly, several reasons exist for the rather low diffusion rate, however these have to be examined. Companies do not know consumers' expectations and wishes concerning smart devices (Nielsen, 2014). However, it is of big importance to understand people's motivation to use smart home technologies and their reasons not to do so. Nielsen (2014) states that the adoption of smart home technology will be inevitable in the future if companies deal with the challenges put in front of them. As "the characteristics of the system effect how motivated users are to use the system" (Davis, 1985, p. 11) it is crucial to understand advantages and disadvantages of smart home technologies and how they are perceived by users and potential users.

The goal of this study is to better understand people's motivation to use smart home technologies and devices. This includes providing information on what people consider advantages of these technologies and what the drawbacks or obstacles are according to them. As mentioned previously, IoT technology presents a huge opportunity in the smart home environment (Nielsen, 2014; Hofman & Novak, 2015) and its potential is far from being exploited yet (Nielsen, 2014; Gartner, 2017; McKinsey & Company, 2018). This study aims to examine why acceptance and adoption of smart home devices are rather low. Therefore, this research paper will be of great use in the marketing area. It will help individuals and companies to understand what people consider important in their decision making process concerning the purchase of smart home technology. Marketers can, based on this paper, develop marketing strategies emphasizing smart home devices' advantages and eliminate certain factors preventing people from purchasing these technologies. Furthermore, they will even be able to reconsider the production process of their products and change product features if necessary. Consequently, this study will provide knowledge which can help to further exploit the opportunities given in the market and to overcome the low diffusion rates of IoT technology in the smart home environment.

2. RESEARCH QUESTION

The previous section underlines the increasing importance of IoT technologies and especially the huge potential of the smart home market. Taking into account how promising the smart home market is, it is no surprise that several companies try to invest into the market. Google for instance hit the headlines when it acquired the smart home company Nest for $3.2 billion in 2014 (Kovach, 2018). Many companies will have an interest in knowing people's motivation for using smart home devices in order to be prepared for joining the smart home market or exploiting it further. In the case of this study, the focus will lie on the German smart home market. Therefore, the research question is formulated as follows:

Which factors influence the acceptance of smart home technologies in Germany?

In order to answer this research question further sub-questions have been developed:

1. *What are the advantages and disadvantages of smart home technologies?*
2. *Do Germans/people understand and comprehend the concept of smart homes and smart home devices?*
3. *What are Germans'/people's expectations concerning smart home technology?*

The previously mentioned sub-questions will help to better understand people's motivation to use smart home devices and consequently to answer the presented research question. First of all it is critical to know if people understand the idea of a smart home and smart home technologies. Only if this is the case they are able to assess whether they could profit from using such technologies. By knowing people's expectations it will be possible to analyze whether these expectations fit with the actual advantages and disadvantages of smart home technologies. People's expectations, advantages and disadvantages could be factors effecting the acceptance of smart home technologies. After answering all sub-questions it will be possible to detect and closer analyze the variables influencing the acceptance of smart home technologies in Germany.

3. SMART HOMES AND TECHNOLOGY ACCEPTANCE

3.1 Features of smart homes

Yet, scholars argue about a definition for smart homes and there is no single definition (Chan, Campo, Esteve & Fourniols, 2009). Next to the one presented in the introduction of this paper, Kadam, Mahamuni and Parikh (2015) define the concept precise and simple as "the integration of technology and services through home networking for a better quality of living" (p. 81). Smart

home devices can vary a lot and have a wide range of application areas in the setting of a home. Consequently, one can distinguish between different types of smart homes and smart home technology. First of all, smart home technology and components can either be autonomous, interact with each other, interact with a person or be very individualized (Hoffman & Novak, 2015). Autonomous components do not need other smart devices. A thermostat for instance could indicate or propose to the owner that the heating should be turned on. If the thermostat turned on the heating itself, it would be considered a smart device using interaction with other devices, the second type of smart components. The third type actively engages in interaction with a person. A coffee machine for instance could let the owner know when the coffee is finished by changing the intensity of the lights in the room the owner is in. The last type of smart components according to Hoffman and Novak (2015) uses very individualized coding. This means that the smart device is programmed in a way that fits the need of a specific individual. One can think of lights being turned on automatically in the morning, the exact time will differ from individual to individual depending on their preference when to wake up.

On the other hand, it is possible to differentiate between different types of smart home technology by looking at rather simple technological aspects. A classification can be made between wiring systems and wireless systems (Jiang, Liu & Yang, 2004). Some smart devices use and need physical wires in order to interact with one another. An advantage of these devices can be their reliability and the speed of the interaction. These devices fall into the category of using wiring systems. To the contrary, smart devices using wireless systems do not need any wires and work with a sending and receiving end. Wireless communication can be initiated by using Wi-Fi for example. The advantage of a wireless system is the ease of installation and also the comfort using it. However, devices exist using both wiring and wireless systems as well.

There is a numerous number of smart home applications as well as types of technology. De Silva, Morikawa and Petra (2012) for instance differentiate between smart technologies techniques like video-based, audio-based and multimodel techniques. Even the application areas differ from comfort, healthcare, safety, security to energy conservation to name a few (Alam, Ali & Reaz, 2012). It is impossible to grasp all types of smart homes and to categorize them appropriately. However, by knowing certain possible differences which have been explained previously in this section, it is easier to understand the concept of smart homes and its wide range of possible attributes.

3.2 Technology acceptance and adoption

An understanding of technology acceptance and adoption is critical in order to examine people's motivation to use smart home technologies. Two approaches have gained a lot of attention in by explaining technology and innovation adoption, which are the technology acceptance model (TAM) by Davis and the diffusion of innovation theory (DOI) by Rogers (Arts, Frambach & Bijmolt, 2011). Both models have different approaches to the adoption of either technology or innovations. Therefore, one model will certainly prove more useful than the other in explaining the acceptance of smart home technology. First of all, an explanation of the DOI is given.

Rogers (2003) defines innovation adoption as "a decision to make full use of an innovation as the best course of action available" (p. 21). Four different elements are claimed to make up the diffusion of an innovation. These are innovation, channel, time and social system. An innovation "is an idea, practice, or object that is perceived as new by an individual" (Rogers, 2003, p. 11). This innovation is communicated through a certain channel over a period of time. The members of a social system, which is "a set of interrelated units that are engaged in joint problem solving to accomplish a common goal" (Rogers, 2003, p. 24), are the recipients of the communicated message or innovation. This process consequently decides on how accepted and diffused a certain innovation is. Furthermore, one can distinguish between five adopter categories, which are innovators, early adopters, early majority, late majority and laggards. These categories differ in their pace of adopting an innovation and their size as well. Innovators are the people adopting an innovation first while laggards take the longest time. Innovators also make up the smallest group of people (2.5%) while early and late majority are the biggest groups of people (34% each). The DOI is certainly helpful in explaining how innovations diffuse overall. It helps to understand the process of an innovation being accepted in the market. However, it is a very broad theory and cannot explain collective adoption behaviors neither fits complex technologies (Zoysa & Wijayanayake, 2013; Lyytinen & Damsgaard, 2001). The DOI lacks the ability to concentrate on a specific technology as well, it does not examine system-related factors (Lundbald, 2003). The TAM therefore proves to be of more value for this research paper.

The most prominent approach to technology acceptance is the TAM developed by Fred Davis (Legris, Ingham & Collerette, 2003). Various studies have found the TAM to be the most appropriate framework for innovative and technological devices (Park, Baek, Ohm & Chang, 2013). Even though the first version has been developed in 1985, the TAM is still widely used today as well as being extended (e.g. "Internet-of-Things and Smart Homes for Elderly Healthcare: An End User Perspective", Pal et al., 2018; "Evaluation of Online Video Usage and Learning Satisfaction: An Extension of the Technology Acceptance Model", Nagy, 2018). The model argues that perceived usefulness of a technology, which is "the degree to which an individual believes that using a particular system would enhance his or her job performance" (Davis, 1985, p. 26), and ease of use, which is "the degree to which an individual believes that using a particular system would be free of physical and mental effort" (Davis, 1985, p. 26), determine people's attitude towards adopting technology. The attitude towards adoption in turn predicts the actual adoption of a certain technology. Perceived usefulness and ease of use are affected by certain external variables and ease of use affects perceived usefulness. Davis, Bagozzi and Warshav (1989) add the variable behavioral intention and explain that intention is mostly influenced by the attitude towards using technology and is the best predictor of the actual use (see Fig. 1).

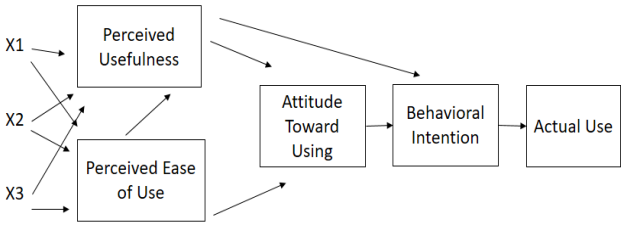

Figure 1 - Technology Acceptance Model (1989)

Even though the TAM proves to be helpful in explaining technology adoption, critics argue that more variables are needed (Legris et al., 2003). Indeed, next to other models, the so-called TAM2 has been developed by Venkatesh and Davis (2000). The TAM2 adds social influence processes (subjective norm, voluntariness, and image) and cognitive instrumental processes (job relevance, output quality, result demonstrability and perceived ease of use) to the original TAM (see Fig. 2). However, it does not include attitude towards using technology. It is able to

explain more than half of the variance in the factor perceived usefulness and emphasizes the substantial effect of subjective norm on usage intentions and attitude towards adopting technology.

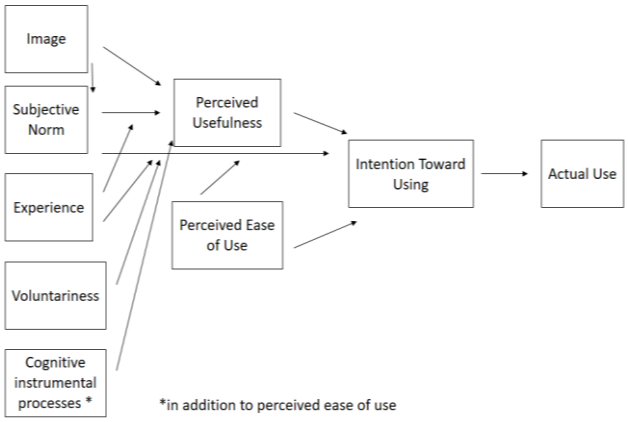

Figure 2 - TAM2

Despite the improvement of the original TAM, the TAM2 is not able to explain technology and innovation acceptance on its own as it is neglecting further crucial factors (Claudy, Garcia & O'Driscoll, 2014). Other versions and extensions of the TAM have not grasped these factors either. Various researchers argue that resisting factors should be examined instead of reasons for adoption (Kleijnen, Lee & Wetzels, 2009; Antioco & Kleijnen, 2010). Midgley and Dowling (1993) state that resisting factors are at least of the same importance as positive reasons for adoption. Innovation resistance can be defined as "the resistance offered by consumers to an innovation, either because it poses potential changes from a satisfactory status quo or because it conflicts with their belief structure" (Ram & Sheth, 1989, p. 6). In order to understand people's acceptance towards smart home technology resisting factors have to be taken into account.

Garcia, Bardhi and Friedrich (2007) refer to resistant innovations as products with competitive advantage but rather low consumer acceptance and use five barriers developed by Sundaresan Ram and Jagdish N. in 1989 in order to further study innovation resistance. The first barrier is the disruption of the status quo, involving the need to alter routines. The second barrier is not seeing the added value of an innovation. The third barrier is argued to be a psychological one which is considering the innovation as being too risky. Fourth, the innovation might deviate from social norms or traditions. The last barrier is a negative product image which can either be deserved or undeserved. With these barriers as starting point Garcia et al. (2007) propose two marketing strategies to overcome consumer's innovation resistance. These strategies are vertical cooperation and horizontal cooperation. The marketing strategies give a hint on how resistance concerning smart home technologies could potentially be tackled. Vertical cooperation is "the need to involve the supply or distribution chain in developing a marketing strategy that will address consumers' belief structure about innovation" (Garcia et al., 2007, p. 84). Cooperation with the supply chain is necessary until consumers accept the product, once they do the cooperation can decrease again. Horizontal cooperation on the other hand is "the need to involve competitors in developing a marketing strategy for the innovation" (Garcia et al., 2007, pp. 84-85). This strategy makes sense if competitors share similar goals. Which of the two strategies works best depends on the unique circumstances of each company and cannot be generalized.

In order to further categorize resistance barriers to technology and innovation acceptance, a distinction can be made between functional and psychological barriers (Ram & Sheth, 1989). Functional barriers on the one hand include usage, value and risk barriers to adopting to a new product (Claudy et al., 2014). Psychological barriers on the other hand deal with people's struggle to change their beliefs, traditions and norms when confronted with a new product (Antioco & Kleijnen, 2010). According to these classifications, the first three innovation adoption barriers mentioned in the previous section can be classified as functional barriers, even though Garcia et al. (2007) claim the third one to be a psychological barrier. The last two barriers fall into the category of psychological barriers. Overall, these barriers are argued to be the reasons people resist new technology. Furthermore, they might be factors slowing down the diffusion of smart home technology.

Overall, the TAM considered together with resisting factors is most appropriate when analyzing people's motivation to use smart home technology. The DOI is far too simple and does not prove useful in looking at such complex technologies (Zoysa & Wijayanayake, 2013; Lyytinen & Damsgaard, 2001). Neither is it appropriate when analyzing the details making people accept a certain technology, in this case smart homes. The TAM has proven most useful compared to other models in analyzing technology acceptance so far (Park et al., 2013) However, as the TAM fails to consider all relevant factors influencing the acceptance of technology (Claudy, Garcia & O'Driscoll, 2014), it is completed by resisting factors which are of equal importance (Ram & Sheth, 1989). By using the TAM and resisting factors as guideline for this study, the variables most likely to influence smart home adoption can be examined and further analyzed.

3.3 Motivation to use smart home technology

Current literature deals with smart home technology and its acceptance using the TAM as guideline. Researchers have examined varying factors influencing the adoption of smart home technologies so far (Taherdoost, Masrom & Ismail, 2009). The factors identified in this part of the paper and their corresponding definitions are summarized in Appendix 1 (or Table 2). The models presented in the following partly use the same or at least similar factors but all models are unique and have their own explanation for the acceptance rate of smart home technology. Two of the models are analyzing the acceptance of a specific smart home technology or smart home technology in a certain sector while the other paper analyzes smart home technology in general.

First of all, Pal et al. (2018) analyze the adoption of smart home solutions in the healthcare sector for elderlies using the TAM. The factors seen as relevant are performance expectancy, effort expectancy, social influence, facilitating conditions, technology anxiety, perceived trust, perceived cost and expert advice. These factors correlate with one another in various ways, but mostly effect behavioral intention (see Fig. 3). Apart from facilitating conditions and social influence, all factors show significant impacts. However, the non-significant results are argued to be due to the elderly population and are still important when examining people's motivation to use smart home technologies. While the study gives an overview of potential factors influencing the adoption rate of smart home technologies, one has to take into account that elderlies have unique characteristics and that the results cannot simply be generalized. Furthermore, the factor expert advice is specifically designed for the healthcare sector and cannot be used for studying general adoption of smart home devices. However, additional factors play an important part in explaining the acceptance of smart home devices. The factor behavioral intention as shown in Fig. 3 is part of the original TAM and does not present a new variable.

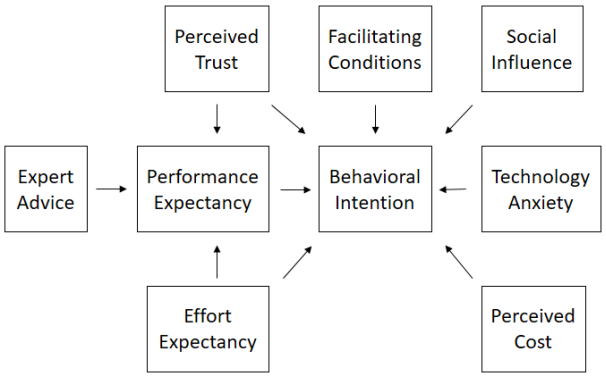

Figure 3 - Factors influencing acceptance of smart home healthcare solutions

In addition to the previously mentioned factors explaining people's motivation to use smart home technologies, new variables can be added. Park et al. (2017) consider additional factors as relevant in explaining consumers' acceptance of an electronic energy management system. In this case, the factors economic benefit (individual motivation), social contribution, environmental responsibility (social motivation) and innovativeness (personal characteristics) have been added. The former three factors influence the perceived usefulness in the TAM model. The latter one even affects both the perceived usefulness and the ease of use (see Fig. 4). As in the models before, some factors have more relevance than others and differ in their degree of affecting people's motivation to use smart home technology. Social contribution and environmental responsibility prove helpful in explaining people's acceptance of the electronic management system but are less important when considering the adoption of smart home devices in general.

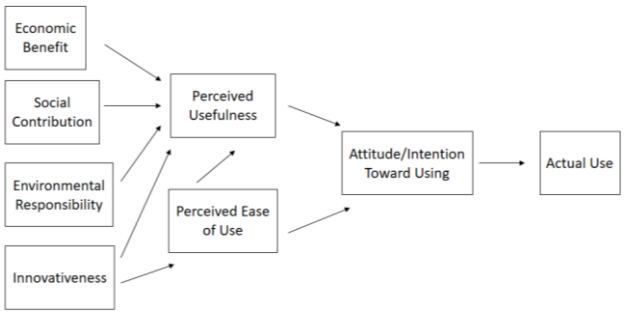

Figure 4 - TAM explaining acceptance of home energy management system

As stated before, numerous factors can potentially affect people's decisions to adapt to smart home technology. Park, Kim, Kim and Kwon (2017) propose that the factors security, cost, perceived control, enjoyment, system reliability, connectedness and compatibility are the main reasons for accepting smart home technologies. Indeed, the findings show that all factors except perceived security have significant impacts on the adoption process (see Fig. 5). Perceived usefulness, influenced by compatibility, control, system reliability and ease of use, is argued to be the most influential predictor of smart home technology acceptance. Perceived system reliability and enjoyment are rather weak factors in the model. The factors proposed by Park et al. (2017) vary from the ones mentioned in the previous section but certainly add to the understanding of people's motivation to use smart home devices, especially as they focus on smart home devices in general.

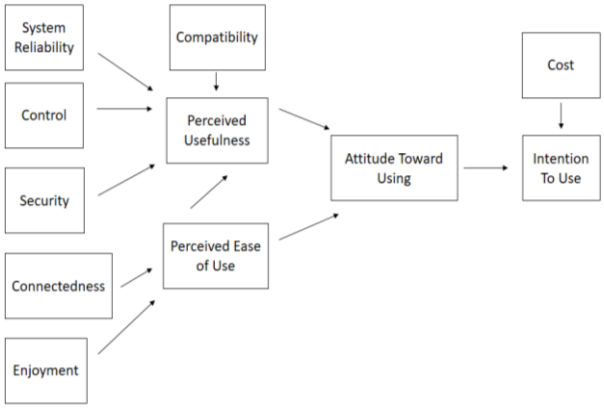

Figure 5 - TAM explaining smart home adoption

Overall, one can see that various researchers and studies have tried to identify the factors influencing the acceptance of smart home technology. However, these factors differ and one study itself is unlikely to identify all relevant variables. Furthermore, the impact of certain factors differs from one study to another and the correlations could not always be demonstrated. So far, research has mostly focused on positive reasons for adoption in the case of smart homes. Therefore, it is necessary to take into account resisting factors as well (Kleijnen, Lee & Wetzels, 2009). This study will look at further factors influencing the adoption of smart home technology and examine which resisting factors could be important in explaining the adoption rate.

4. METHODOLOGY

In order to answer the presented research question, a critical literature review was necessary. It is inevitable to review literature as "a review of prior, relevant literature is an essential feature of any academic project" (Webster & Watson, 2002, p. 13). Hart (2001) states that a literature review is "the selection of available documents (both published and unpublished) on the topic, which contain information, ideas, data and evidence written from a particular standpoint to fulfill certain aims or express certain views on the nature of the topic and how it is to be investigated, and the effective evaluation of these documents in relation to the research being proposed" (p. 13). Different databases have been used in order to find relevant information and reliable content, namely Web of Science, Scopus and Google Scholar. By using all three databases the ability to find as many relevant articles as possible was ensured. Furthermore, different keywords have been used in order to find appropriate information for this study. These keywords include 'smart home', 'internet of things', 'acceptance information technology', 'acceptance internet of things', 'acceptance smart homes', 'smart home technologies', 'adoption smart homes', 'adoption information technology' and 'innovation adoption'. Additionally, synonyms of these keywords, their respective singular or plural forms and further combinations of these keywords have been searched. Overall, the literature review has been conducted to find the most relevant theories that might help to explain people's motivation to use smart home technologies. Furthermore, it has been used to identify factors influencing the adoption of smart homes.

After having conducted secondary research, primary research helped to further identify factors influencing the acceptance of smart homes.

4.1 Data collection

Semi-structured interviews have been conducted with users and non-users of smart home technologies. Overall, ten German citizens have been interviewed. The only personal information retrieved and published are their gender, age, educational

background and nationality (list of respondents in Table 1). The interviews have been made fully anonymous to ensure confidentiality and the reliability of answers. All interviews were carried out face-to-face as preferred by most respondents over other methods (Groves, 1979). The length of an interview was typically between 10 and 15 minutes.

Table 1 – List of respondents

Case	Gender	Age	Education	Smart Home Use
1	Female	50	University Degree	No
2	Male	28	Undergraduate	Yes
3	Male	51	University Degree	Yes
4	Female	22	Vocational Baccalaureate Diploma	No
5	Male	19	Undergraduate	No
6	Male	23	Undergraduate	Yes
7	Male	22	High-school diploma	No
8	Female	21	High-school diploma	No
9	Male	64	Abitur (A-level)	No
10	Female	67	Secondary Modern School Qualification	No

4.2 Data analysis

The interviews included predefined questions regarding potential use of smart home technology, open questions regarding the motivation to use or not to use smart home technologies, the attitude towards (smart home) technology and follow-up questions. The first question was formulated as follows: "Have you heard of the term smart home technology before and do you know what it is". If the respondent was able to explain what smart home technology is, additional questions have been asked right away. If not, the term has been properly explained so that the respondents were able to answer further questions. The entire list of questions can be found in Appendix 2. The semi-structured interview has the advantage of being "well suited for the exploration of the perceptions and opinions of respondents regarding complex (…) issues and enable probing for more information and clarification of answers" (Barriball, 1994, p. 330) which proved helpful in engaging in a rather complex topic like smart homes. The goal of the semi-structured interviews was to identify factors affecting people's motivation to use smart home technologies which have not been found in the prior literature review and to clarify if factors previously identified are indeed relevant and accurate. In order to ensure the reliability and relevance of all factors found in the literature review, another research method has been used, namely a cross-sectional survey.

As opinions and factors are unlikely to change during the course of the study, the cross-sectional survey is the most convenient survey design. "The cross-sectional survey collects data at one point in time" (Dooley, 2001, p. 119). The survey has been given to the interview respondents three days after having participated in the interview to ensure independence and check the reliability of answers. Two respondents (case 9 and 10) have not been given the survey as their knowledge about smart homes was too narrow. The survey included forty-five statements that were answered using a Likert scale. The possible answers were "strongly disagree", "disagree", "neither agree nor disagree", "agree" and "strongly agree". A few questions could only be answered if the respondents owned a smart home device, the respondents were therefore told to choose the option "neither agree nor disagree" in the appropriate case. All statements correspond to a certain factor (see Appendix 4). The results have been scored in order to see whether the factors are indeed relevant to the interview respondents and have an effect on potential smart home users in Germany (see Appendix 5). The scores have been compared to the score of the factor behavioral intention as behavioral intention proves to be most useful in explaining actual smart home technology use.

The scales used in this research were validated in previous studies (see Table 2). The scale on factors explaining people's motivation to use a smart home technology was adapted from Pal et al. (2018). The statements have been adapted in order to fit general smart home use. Secondly, the scale on factors explaining people's motivation to use smart home application was adapted from a study by Park, Hwang, Ko and Kim (2017) due to their concentration on one certain smart home application. The third study, by Park, Kim, Kim and Kwon (2017), focused on general smart home devices and the scales have been used without adaptation. Some of the factors and concepts identified in the three studies overlap and are very similar so that they are only measured once in the survey. The entire survey can be found in Appendix 3, the results are summarized in Appendix 4. The additional factors found in the interviews have also been compared to the answers in the survey.

Table 2 – Scales measuring smart home acceptance (17 items)

Concept	Definition	Researcher
Performance Expectancy	The degree to which using a technology will provide benefits in performing certain activities	Venkatesh et al. (2003)
Effort Expectancy	The degree of ease associated with the use of any system	Venkatesh et al. (2003)
Social Influence	Influence by opinions and suggestions of friends, relatives and other social groups	Pal et al. (2017)
Facilitating Conditions	The degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system	Venkatesh et al. (2003)
Technological Anxiety	The fear, apprehension and hope that people feel when considering use or actually using certain technology	Meuter et al. (2003)
Perceived Trust	The state of mind of (…) people where they feel that their personal data will be safe, carefully protected, and anonymous	Pal et al. (2017)
Perceived Cost	The concerns related to the costs used in purchasing, maintaining, and repairing the essential	Bertrand, M., Bouchard, S. (2008)

	components in the services and systems	
Enjoyment	Degree of pleasure the user feels by using smart home service (internal and emotional benefits)	Reychav, I., & Wu, D. (2015)
Perceived Control	The ‘‘users’ perceptions on their capability, resources, and skills for naturally performing the behavior and usage of a particular service or system	Lu, Y., Zhou, T., Wang, B. (2009)
Perceived Connectedness	The degree to which users feel connected to smart home services	Park et al. (2017)
Perceived System Reliability	Users’ perceived level that smart home systems can present reliable services that make the users meet their expectations toward the system	Park, E., Kim, H., Ohm, J.Y. (2015)
Perceived Security	Users’ perspectives toward the protection level against the potential threats when using smart home services	Park et al. (2017)
Compatibility	The extent to which a unique innovation is consistent with the current and traditional values and needs	Rogers (2010)
Economic Benefit	The degree to which smart home services help the users economically	Park et al. (2017)
Innovativeness	The users perceptions and attitude towards new technology and new technological products	Park et al. (2017)
Behavioral Intention	Desire to use smart home services	Davis et al. (1989)
Perceived Usefulness	the degree to which an individual believes that using a particular system would enhance his or her job performance	Davis et al. (1985)

5. FINDINGS

5.1 Interview results

The conducted interviews showed that factors identified in prior research differ in their importance. Interview respondents have varying attitudes towards the concepts, however mostly agree on positive and negative features of smart home technology. The interviews did not consider every single potential factor as not all factors were mentioned or touched upon by the interviewees themselves and are therefore less relevant according to the interviews. In addition to analyzing previously identified factors, additional factors have been considered in the interviews.

Perceived Usefulness

The interviews showed that seven out of seven respondents not owning a smart device believe that it is simply not necessary to own a smart device. One respondent for example argued:

“I really don’t need any smart devices, I don’t see a reason to buy one”. (case 4)

While two respondents (case 1 and 5) considered buying a smart device once, a smart watch respectively, the others did not even consider buying one. All of them questioned the usefulness of smart home technology. The usefulness is also the biggest overlap between the individual interviews. Consequently, the interviews imply that perceived usefulness is the most relevant predictor of the intention to use smart home devices. Non-users did not see an advantage in using smart home technology, as another respondent formulated:

“If it doesn’t help me, why should I buy it”? (case 5)

According to the interview, low perceived usefulness is clearly the best predictor of smart home acceptance and more important than other identified variables, users of smart home devices indicated that smart devices are obviously of use to them.

Performance Expectancy

Performance expectancy is a concept with similarities to perceived usefulness and also likely to influence usefulness. The results are therefore not surprising, the non-users of smart home technology agreed that smart home technology is not helpful or were not sure if smart home technology might be of use. On the other hand users of smart devices argued that smart home technology is performing useful tasks for them.

Ease of use (effort expectancy)

Ease of use and effort expectancy are measured as one due to their similarity. Ease of use is not crucial in the case of smart home technology according to the interview respondents. Apart from the ones not knowing anything at all about smart home technology (case 9 and 10), most respondents did not consider smart services as complicated to use. This claim is also supported by the users of smart home technology, one of them states:

“Smart home devices are really simple to use, you get used to them very quickly as well”. (case 2)

The respondents did not consider the advantage of easy use of smart devices as critical in buying a smart device, they rather referred to the usefulness as more important. Few of the respondents (non-users) were not sure about the ease of use, however this issue did not matter to them as they did not consider a smart home technology as useful.

Perceived Trust (security)

Four (case 1, 3, 4, 5 and 7) out of seven non-users of smart devices addressed insufficient security as a problem of smart devices. For three out of these four, privacy and security issues are a reason not to buy certain types of smart home technology. They do not want companies or other institutions to own their data or know a lot about their private activities. The interviews suggest that security is critical in explaining smart home adoption. One respondent stated:

"I don't want anyone to have my data, they (companies/institutions) would know everything about me" (case 4)

As long as their data is not protected, four out of seven respondents would not consider buying a smart device.

Perceived cost
All respondents (except case 9 and 10 due to limited knowledge) agreed that smart home technology is expensive in general. However, for the users of smart home technology it is worth the money and they do not see the costs as big drawback. One respondent also stated:

"I personally ordered my smart light switch in China, it only cost me a few bucks, if I bought a product by Philips for example it would have cost me ten times more or so" (case 2)

The non-users' answers also imply that the cost might be less of a factor if they saw a bigger use in owing one of the smart home devices. One respondent answered:

"The high costs would be alright if the products were better". (case 8)

The costs seem to be of importance, however they might not be an obstacle if people consider smart devices more useful.

Perceived system reliability
Four respondents (case 1, 2, 5 and 8) brought up system reliability as a possible disadvantage. Two respondents (case 1 and 5) argued that the system might be hacked and not work accordingly anymore which is closely related to the concepts perceived trust and security. One smart home technology user (case 2) complained that the systems in use do not work anymore once the internet connection disappears. However, the respondent further argues that the devices can then be controlled manually, still the participant considers system reliability as a disadvantage of smart home technology.

Additional findings
The conducted interviews give rise to the assumption that further factors not previously identified influence the acceptance of smart home technology. The interviews show people with positive attitude and people with negative attitude towards smart home technology. However, a few respondents did not have an opinion about smart home devices due to limited knowledge on the matter. Two out of ten people (case 9 and 10) never heard of the term and were not familiar with any smart home technology. Two further respondents (case 7 and 8) have not heard of the term but knew about the existence of technology like smart heating systems or smart watches. Their knowledge was very limited so that basic product features were not known before the interview, neither costs, possible advantages nor disadvantages. Therefore, they did not have the intention to buy a smart home product.

In the case of one respondent (case 2), the exceptional knowledge about smart home technology and its functions supports his smart home use. Even knowing potential risks in detail does not impose a barrier to purchasing smart home devices. The respondent for example stated

"I personally don't take security and privacy issues too serious, smart home just makes things easier for me". (case 2)

This respondent also uses smart home technology daily, including a smart thermostat, smart heating system, smart switch (light switch) and smart socket which is all controlled via Amazon's Alexa or optionally via smartphone applications. Knowing and using all these devices, their simplicity is the main advantage according to this respondent.

Overall, the results also imply that age and educational background affect the acceptance and awareness of smart home devices. The oldest participants in the interviews (case 9 and 10) did not know about the existence of smart home technology while younger respondents were more familiar with this type of technology. Furthermore, the more educated the participants were the more likely they were to know about smart homes, especially undergraduates showed exceptional knowledge.

5.2 Survey results

First of all, the individual survey results fit and correspond well to the answers given in the interview (see Appendix 5). Respondents show the same attitude towards smart home technology at the two different points in time. It can therefore be concluded that both interview and survey answers are reliable. Although not all concepts included in the survey have been discussed in the interviews, most of them have been touched upon. Especially the intention to use smart home technology has been compared from the interview to the survey and has not changed at all considering the respondents' answers. In this part, only the striking results are being discussed in detail.

Four (non-users of smart devices) of eight respondents believe that a rather high level of facilitating conditions exists. These respondents do not have the intention to use smart devices. It is striking that one respondent (case 2), who is using several smart devices, claims a low level of support according to the survey score and still intends to and actual uses smart home technology. Looking only at the survey results one can conclude that facilitating conditions is not a factor influencing smart home use in Germany at all. As two further smart home users claim a high degree of support, there is no reason to conclude a negative impact of facilitating conditions on smart home use.

Another factor that should be looked at is technological anxiety. Technological anxiety does not seem to hinder nor support the use of smart home devices according to the survey. One respondent (case 3) uses smart home technology regardless of scoring positive on technological anxiety while other respondents score negative and still do not use any smart home devices. The results are not as explicit as the ones concerning facilitating conditions. However, the factor technological anxiety does not have a considerable effect on smart home use according to the survey answers.

Overall, the relevance of factors found in the literature review is proven and underlined by the survey results. Even the factor social influence, which is non-significant considering an elderly population, shows a positive correlation to the intention to use smart home devices. While half of the respondents show a neutral opinion towards the factors compatibility and enjoyment, other factors link more clearly to the behavioral intention. The factors found mostly significant to influence behavioral intention and consequently smart home use are performance expectancy, effort expectancy, social influence, perceived trust, perceived cost and perceived system reliability. This means that the survey clearly supports six out of the twelve measured concepts while two of them (facilitating conditions and technological anxiety) are considered to be of very low importance if at all. The remaining concepts cannot clearly be categorized as respondents possess limited knowledge or answers to the survey are too split.

6. CONCLUSION AND DISCUSSION

The purpose of this paper was to discover the factors which influence smart home technology acceptance in Germany. The TAM and resisting factors have been used as guidelines in order to identify the appropriate factors. Pal et al. (2017) claim six variables to influence the behavioral intention to use a certain smart home technology. The most significant ones are perceived effort and perceived cost. Park et al. (2017) on the other hand, studying the acceptance of a home energy management system, identify four additional factors next to ease of use, usefulness and behavioral intention. However, only economic benefit and innovativeness can be seen as relevant for smart home technology in general. In a different study, Park et al. (2017) examine seven additional variables next to the typical TAM variables and claim six of them to have a significant impact on smart home use. Compatibility and perceived control show the biggest impacts.

The interviews with users and non-users of smart home technology give further results and implications regarding people's motivation to use smart home technology. The most important result certainly being that knowledge is a crucial factor in determining one's intention to use smart home devices. Knowledge is a factor missing in all present models. Furthermore, knowledge directly influences the intention to buy smart home technology, as also supported by the survey results discussed earlier. Looking at the TAM, this means that the level knowledge potentially influences all variables, including the ones found in the literature review (perceived cost, performance expectancy etc.). A big lack of knowledge will influence the intention to buy smart home technology negatively while having hardly any knowledge at all equals no actual smart home technology use. On the other hand a lot of knowledge means assessing advantages and disadvantages more precisely, it can affect the TAM variables influencing ease of use and perceived usefulness positively and negatively (see Fig. 6 for proposed model).

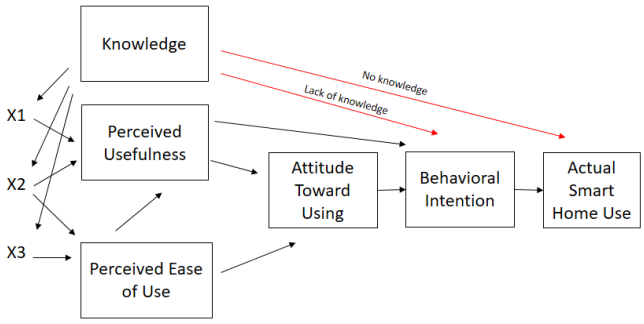

Figure 6 – New proposed TAM explaining smart home adoption

Limited knowledge about smart home technology's characteristics and attributes prevents people from developing a desire to buy or use smart home technology. People will not have a positive attitude towards smart homes without having certain knowledge.

Rather than seeing knowledge as a factor in the TAM, it is possible to view it as an additional resistance barrier to technology and innovation adoption. Looking at resistance factors is argued to be even more appropriate (Kleijnen et al., 2009; Antioco & Kleijnen, 2010). According to the interviews especially a lack of knowledge can be seen as further resistance barrier. It neither fits the definition of a functional barrier nor psychological barrier as introduced by Ram and Sheth in 1989. It should therefore be classified as knowledge barrier. The knowledge barrier is not a typical resistance barrier as people do not purposely resist the new technology. Although not typical, the knowledge barrier is crucial in explaining smart home adoption. The low level of knowledge might even explain a great deal of the smart homes' low diffusion rate. Furthermore, the knowledge barrier has to be seen as the first barrier to overcome, functional and psychological barriers will only exist if certain knowledge is possessed by an individual and therefore have to be tackled in the next step. With no knowledge on the matter at all, there will not be any smart home technology adoption. The interviews show that as long as only little is known about smart home devices, people do not have the motivation to use any smart devices and resistance barriers identified in the literature review are irrelevant thus far.

Additionally, the interviews showed that perceived usefulness is the best predictor of the intention to use smart home devices. This claim is also supported by the results from the literature review. People value usefulness more than any other factor. They will not use smart home technology as long as they do not consider it as useful. Perceived security is another factor with big importance according to the interview respondents. It is also striking that Park et al. (2017) find perceived security non-significant in explaining perceived usefulness in the TAM. Security is certainly important when considering smart home adoption rates, it can be a crucial factor in the TAM or a resisting factor illustrating a functional barrier to smart home use. Interview respondents clearly stated that security is important to them when considering buying or using smart home technology. As this factor is argued to be influencing perceived usefulness, it contributes to the big impact perceived usefulness proves to have.

The conducted survey shows further results with implications regarding smart home acceptance in Germany. It emphasizes the non-significance of the factor facilitating conditions. The majority of non-users of smart devices believe that a rather high level of "an organizational and technical infrastructure exists to support the use of the (smart) system" (Venkatesh, V., Morris, M. G., Gordon, B. & Davis, F. D., 2003, p. 453). Furthermore, the survey implies that technological anxiety is not important in determining people's motivation to use smart home devices. "The fear, apprehension and hope that people feel when considering use or actually using certain technology" (Cambre & Cook 1985; Meuter, M. L., Ostrom, A. L., Bitner, M. J. & Roundtree, R., 2003, p. 900) does not have an effect on smart home use according to the survey. However, the entire survey mostly underlines the importance of variables found in the literature review. It proves six factors to be indeed relevant while only two factors are found to be irrelevant.

The results from this study can be of use for companies producing and selling smart home technology. Additionally, the results can be especially of use for marketing purposes. By knowing the relevant factors explaining the motivation to use smart home devices, companies can market their products precisely and also change product features that are not valued by customers. As knowledge about smart devices is crucial, however limited yet, companies have to increase customer awareness of smart home products. By simply increasing awareness, new potential customers will be addressed and a bigger part of the potential market can be exploited. Furthermore, companies have to develop good relationships with customers and build more trust. Customers should have better perceptions towards privacy and security issues. Building smart technology that ensures privacy and security is also crucial if not inevitable in order to exploit the whole potential market which is enormous and might even grow (McKinsey & Company, 2015).

This study extends the TAM by adding the variable knowledge and proves that certain factors like perceived usefulness have more importance than others. It furthermore adds the knowledge barrier to the already existing barriers, classifying the knowledge barrier as most crucial one to overcome smart home technology resistance. This paper contributes an improved understanding and comprehension of the TAMs developed so far and combines them in order to discover the most relevant factors influencing smart home acceptance.

7. LIMITATIONS AND FURTHER RESEARCH

This research paper has been developed with due diligence. However, few limitations should be considered. First of all, this paper has clearly been written in order to explain German citizens' motivations to use smart home technology. Interview and survey respondents are exclusively German. The results should therefore be taken carefully when considering different nationalities. Furthermore, not all age groups are included in the interviews and survey due to a limited number of respondents. More respondents including all age groups might give other results and implications. The effect of age and educational background on smart home adoption has to be further analyzed in order to be validated. The participants do not necessarily represent a sample of overall society in Germany.

Furthermore, the statements included in the survey might have been interpreted in different ways due to people's varying understanding. Some statements have also been translated into German for a few respondents as the English level varied between all participants. All participants have been part of the closer or wider environment of the researcher which might have a slight influence on the results as well. However, overall the interview and survey give an appropriate estimate and are a good sample for this study.

This paper can be seen as starting point for further research into the acceptance of smart home technology. The proposed factor knowledge has to be further investigated in order to prove its relevance and estimate its importance more precisely. Additionally, more representative data is necessary in future studies in order to make more general assumptions. Based on this paper researchers can investigate the correlation and overlap between resisting factors and the TAM variables in order to see which theory proves more useful.

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10. APPENDIX

10.1 Appendix 1 – Scales measuring smart home acceptance (17 items)

Concept	Definition	Researcher
Performance Expectancy	The degree to which using a technology will provide benefits in performing certain activities	Venkatesh et al. (2003)
Effort Expectancy	The degree of ease associated with the use of any system	Venkatesh et al. (2003)
Social Influence	Influence by opinions and suggestions of friends, relatives and other social groups	Pal et al. (2017)
Facilitating Conditions	The degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system	Venkatesh et al. (2003)
Technological Anxiety	The fear, apprehension and hope that people feel when considering use or actually using certain technology	Meuter et al. (2003)
Perceived Trust	The state of mind of (…) people where they feel that their personal data will be safe, carefully protected, and anonymous	Pal et al. (2017)
Perceived Cost	The concerns related to the costs used in purchasing, maintaining, and repairing the essential components in the services and systems	Bertrand, M., Bouchard, S. (2008)
Enjoyment	Degree of pleasure the user feels by using smart home service (internal and emotional benefits)	Reychav, I., & Wu, D. (2015)
Perceived Control	The ‘‘users’ perceptions on their capability, resources, and skills for naturally performing the behavior and usage of a particular service or system	Lu, Y., Zhou, T., Wang, B. (2009)
Perceived Connectedness	The degree to which users feel connected to smart home services	Park et al. (2017)
Perceived System Reliability	Users’ perceived level that smart home systems can present reliable services that make the users meet their expectations toward the system	Park, E., Kim, H., Ohm, J.Y. (2015)
Perceived Security	Users’ perspectives toward the protection level against the potential threats when using smart home services	Park et al. (2017)
Compatibility	The extent to which a unique innovation is consistent with the current and traditional values and needs	Rogers (2010)
Economic Benefit	The degree to which smart home services help the users economically	Park et al. (2017)
Innovativeness	The users perceptions and attitude towards new technology and new technological products	Park et al. (2017)
Behavioral Intention	Desire to use smart home services	Davis et al. (1989)
Perceived Usefulness	the degree to which an individual believes that using a particular system would enhance his or her job performance	Davis et al. (1985)

10.2 Appendix 2 – Interview questions

1. Have you heard of the term smart home technology before (do you know what it is)? If not the term will be explained and clarified
2. Do you own a device you consider a smart device (if yes which)?

If yes

1. What was your reason to buy it?
2. Did you have any concerns buying it (if yes, which?)
3. What exactly do you like?
4. What don't you like about it?
5. How (how often) do you use it?

Additional questions that stem from interviewees' answers (also focusing on survey scales)

If no

1. Did you ever consider buying a smart device (why didn't you?)
2. Do you see any advantages of smart home technology?
3. Do you see any disadvantages?

Additional questions that stem from interviewees' answers (also focusing on survey scales)

10.3 Appendix 3 – Survey

For each of the statements below, circle the response that best characterizes how you feel about the statement, where: 1= Strongly disagree, 2= Disagree, 3= Neither agree nor disagree, 4= Agree, And 5= Strongly agree.

		Strongly agree	Disagree	Neither agree nor disagree	Agree	Strongly agree
1.	I find using smart home technology helpful in my daily life.	1	2	3	4	5
2.	Smart home technology makes my life easier.	1	2	3	4	5
3.	I find smart home technology extremely useful.	1	2	3	4	5
4.	It is easy and clear for me to use various smart devices present in my home.	1	2	3	4	5
5.	Using features of smart homes is easy to learn.	1	2	3	4	5
6.	I can operate the smart home devices by myself.	1	2	3	4	5
7.	It is not difficult for me to use smart devices present in my home.	1	2	3	4	5
8.	Overall, I think that using smart devices is convenient.	1	2	3	4	5
9.	I will use smart devices in my home if my family members and friends do so.	1	2	3	4	5
10.	I will use smart home devices if media/government encourages it.	1	2	3	4	5
11.	People who are important to me will support my use of smart home technology.	1	2	3	4	5
12.	I believe proper guidance will be available when using smart home technology.	1	2	3	4	5
13.	All my smart home devices can inter-operate with each other.	1	2	3	4	5

14.	I believe proper service is available when I have difficulties using my smart devices.	1	2	3	4	5
15.	I have sufficient knowledge and the ability to use smart home devices by myself.	1	2	3	4	5
16.	The sophisticated technology behind smart homes makes me feel worried.	1	2	3	4	5
17.	I am very enthusiastic to learn about computers and new technology.	1	2	3	4	5
18.	I hesitate using computers and other ICT technology for the fear of mistakes.	1	2	3	4	5
19.	I fear using smart home technology because of privacy issues.	1	2	3	4	5
20.	The internet offers a secure medium which ensures confidentiality.	1	2	3	4	5
21.	I find it risk-free to disclose my personal information so smart home providers.	1	2	3	4	5
22.	The costs of investing into several smart home products are too expensive.	1	2	3	4	5
23.	Smart home devices will help me economically.	1	2	3	4	5
24.	I can satisfy my needs paying lower prices.	1	2	3	4	5
25.	Purchasing and maintaining smart home is a burden for me.	1	2	3	4	5
26.	I prefer products that are based on the latest technology	1	2	3	4	5
27.	I try to gather up-to-date information about new products or new technologies.	1	2	3	4	5
28.	I prefer to bring improvements in life or work through new	1	2	3	4	5

	products or new technologies.					
29.	I hope to be the first to buy a new product.	1	2	3	4	5
30.	I like new products or products with new technology more favorably than products without new ones.	1	2	3	4	5
31.	Using smart home services is compatible with my life.	1	2	3	4	5
32.	Using smart home services fits well with the way I like to manage my house.	1	2	3	4	5
33.	Using smart home services fits well with the way I want to interact with the components in my house.	1	2	3	4	5
34.	Using smart home services is fun.	1	2	3	4	5
35.	It is so interesting to use smart home services.	1	2	3	4	5
36.	Using smart home services is exciting and pleasant.	1	2	3	4	5
37.	Smart home services perform their functions rapidly.	1	2	3	4	5
38.	Smart home services are reliable without errors	1	2	3	4	5
39.	Smart home services are being immediately responsive to my request	1	2	3	4	5
40.	I feel good because I can access smart home services anytime.	1	2	3	4	5
41.	I feel comforted because I can interact with the components in my house via smart home services	1	2	3	4	5
42.	I feel like being connected to the smart home services because I can take any information on the services' components that I want.	1	2	3	4	5

43. I will definitely use smart home devices in the near future.	1	2	3	4	5
44. Given I have access to smart home devices, I will use them.	1	2	3	4	5
45. I intend to invest and use smart home services as much as possible.	1	2	3	4	5

10.4 Appendix 4 – Survey answers

	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree		
1			1 4 5 6 7 8	3	2		Performance Expectancy
2		1	4 5 6 7 8	3	2		
3		1 3 5 6	4 7 8		2		
4		6	1 3 4 5 7 8		2		Effort Expectancy
5			1 4 5 7 8	3 6	2		
6			4 5 7 8	1 6	2 3		
7		8	1 4 5 7	3 6	2		
8	5	1 4	6 7	3 8	2		
9	2 4 5	1 8	3 6 7				Social Influence
10	2 4 5 7	1	6 8	3			
11	2	4 8	1 3 5 6 7				
12		1	6	2 3 4 5 8	7		Facilitating Conditions
13		2	1 3 4 5 6 7 8				
14		2	1 3 5 6 8	4 7			
15		3	4 7 8	1 6	2 5		Technological Anxiety
16	2	6	8	1 3 7	4 5		
17		7	1 3 8	4 5 6	2		
18	2	1 4 6 7 8	3	5			
19	2	6 7 8	1	3 5	4		Perceived Trust
20	2 4 5	1 3	6 7 8				
21	4 5 7	1 3	6	2 8			
22		5	3 4 7 8	1 3 6	2		Perceived Cost
23	5	4	1 3 7 8	6	2		
24		1 6	7 8	3 4 5	2		
25	2	5	3 4 6 8	1 7			
26		4	3 7 8	1 6	2 5		Innovativenss
27		3 7 8		1 4 6	2 5		
28		6	3 7 8	1 4 5	2		
29	2 3 4 5 7 8	1 6					
30	2	3	4 8	1 5 6 7			
31		1	4 5 6 7 8	2 3			Compatibility
32		1 3	4 5 6 7 8		2		
33		1 3 5	4 6 7 8		2		
34		1	3 4 5 6 7 8		2		Enjoment
35		1 5	3 4 7 8	6	2		
36		1 5	3 4 6 7 8		2		
37		5	1 3 4 7 8	2 6			Perceived System Reliability
38		1 2 5 8	3 4 6 7				
39			1 4 5 6 7 8	2 3			
40			1 3 4 5 6 7 8		2		Perceived Connectedness
41			1 4 5 7 8	3 6	2		
42		2	1 4 5 6 7 8	3			
43	4 5	1 7 8	6		2 3		Behavioral Intention
44	4	1 5	7	3 6 8	2		
45	4 5	1 7 8	3 6	2			

10.5 Appendix 5 – Scores survey compared to interview results

The scores have been calculated by averaging the score for each statement of each scale using the Likert scale numbers. Numbers in Likert scale for 'technological anxiety', 'perceived trust/security' and 'perceived cost' have been adapted due to both negative and positive statements used in the scale. Numbers above 3 mean rather low technological anxiety, high perceived trust/security and high perceived cost.

P= fit between survey and interview; **F**= Misfit between survey and interview; **X**= not addressed in interview

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Performance expectancy	2.33/P	5/P	3.33/P	3/F	2.66/P	2.66/P	3/F	3/F
Effort expectancy	3/X	5/P	4/P	2.8/P	2.6/X	3.4/P	3/X	3/X
Social influence	2.33/X	1/X	3.33/X	1.3/X	1.6/X	3/X	2.33/X	2.33/X
Facilitating conditions	2.66/X	2.66/X	3.33/X	3.6/X	3.33/X	3/X	4/X	3.33/X
Technological anxiety	3.25/P	5/P	2.5/F	3/P	3/P	4/X	2.75/P	3.25/P
Perceived trust/security	2.33/P	3/P	2/P	1/P	1.3/P	3.33/P	2.66/P	3.66/P
Perceived cost	3.25/P	3/P	3.5/P	3.5/P	3.25/P	2.75/F	3.25/P	3/F
Innovativeness	3.2/X	3.4/X	2.2/X	2.8/X	3.8/X	3.2/X	2.6/X	2.4/X
Compatibility	2/X	4.33/P	2.6/F	3/X	2.66/X	3/X	3/X	3/X
Enjoyment	2/X	5/P	3/P	3/X	2.33/X	3.33/P	3/X	3/X
Perceived system reliability	2.66/P	3.33/F	3.33/P	3/X	2.33/P	3.33/P	3/X	2.66/P
Perceived connectedness	3/X	4/P	3.6/X	3/X	3/X	3.33/X	3/X	3/X
Behavioral intention	2/P	4.33/P	4/P	1/P	1.33/P	3.33/P	2.33/P	2.66/P