Do I Really Have to Accept Smart Fridges?

An empirical study

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Abstract— **Smart fridges have not taken off as rapidly as their creators would have wished. This raises questions about user attitudes towards the smart fridge. A small-scale empirical study, comprising 17 individual semi-structured interviews, results in identification key factors influencing user acceptance of the smart fridge. This leads to a new smart fridge acceptance model (SFAM). The SFAM modifies the well-known Technology Acceptance Model (TAM) by adding social influence, technology anxiety and cost to the factors included in the original Technology Acceptance Model. The findings indicate that participants are willing to use such an innovation if it already exists.**

Keywords-technology acceptance model; smart fridge; ubiqioutus computing; acceptance factors

I. INTRODUCTION

Ethnographic studies show that a huge part of people's social life occurs in the kitchen [19]. The kitchen is a place where you can combine vital communication and social purposes [30], a vast amount of time is spent there and many people regularly attach notes and other information to the fridge. Consequently, researchers from all over the world are working to enhance nutrition and dietary support [12], cooking, recipe planning [14] and communications [4].

This study is part of a three-year PhD project. The aim of this paper is to identify factors that will influence smart fridge acceptance based on the Technology Acceptance Model (TAM) [8] and provides useful services to users in the household. To do this, we performed the following:

- Reviewed the literature on technology acceptance.
- Identified the factors influencing the smart fridge based on reviewing the literature review and empirical investigation.
- Extended the Technology Acceptance Model based on the empirical findings and therefore proposed associated the factors with related variables.

New factors that influence the acceptance of the smart fridge have been identified empirically by following these three steps. This results in an improved acceptance model.

This paper is organised as follows. Section II presents an overview of the smart fridge and technology acceptance. In Section III, we empirically investigated set of factors influencing smart fridge acceptance. In Section IV and V, the results of interviews and discussion are presented, and finally, Section VI summarises the conclusions and future work.

II. LITERATURE REVIEW

A. Smart Fridges

The smart Fridge is a smart home appliance that senses items placed inside the fridge and keeps track of stock through bar code or Radio-Frequency Identification (RFID) tags [26]; it also provides users with extra information about their products, their nutritional facts and consumption history.

The smart fridge has frequently been used as a prototypical instance of the Internet of Things. The smart fridge is a new concept; it consists of a large, flat surface that is fitted with a touch screen to allow interaction with users.

One function of the smart fridge is to offer a shopping assistant that helps the household to decide what food needs to be purchased. It, also, offers a meal planner that plans meals to be consumed and determines the necessary grocery items necessary for the preparation of those meals [13]. Lundberg [17] designed "the Snatcher Catcher", an interactive fridge that keeps track of the items in it using a camera. The results indicated that people showed a desire to own this fridge.

Today, the fridge also offers a facility to save energy; The Department of Energy and Climate Change in the UK published a report saying that using a smart fridge could save around 2 million tons of carbon dioxide every year and £222 million in energy savings [1]. Bigler [5] integrated a smart fridge into a Demand Site Management (DSM) network to reduce power peaks by more than 25% and to average out the overall energy consumption in order to improve grid utilization. Moreover, smart fridge specialists in "RLtec" have revealed that they are planning to install their demand management smart grid technology in smart fridges. This technology can be used to balance the power supply and demand [24].

According to Kuniavsky [16], "the fridge favoured technological unification over the user experience in three ways": lack of functional focus, value for money and ignorance of differences between the life cycles of consumer electronics and those of appliances. He argued that the reason behind lack of commercial success for the smart

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fridge is that multiplying functions, such as support for general household management, distracts from the fridge's main purpose of keeping food fresh and offers no clear advantage over, for example, buying a tablet computer. In other words, the smart fridge should perform something that a regular fridge combined with a current computer cannot perform.

B. *Technology Acceptance*

User acceptance is crucial to the success of new technologies, but it is difficult to predict. Information system researchers have established numerous theoretical frameworks to understand why and how people accept a new technology. Some frameworks emphasize user acceptance of technology by using dependent variables such as intention or usage, while other frameworks emphasize implementation success at the organizational level. User acceptance refers to "the willingness of the user group to employ information technology for tasks the technology is designed to support" [9].

The Technology Acceptance Model (TAM) has gained a lot of attention from researchers and experts for many years. Hence, it is the most commonly adopted and effective model at determining the reasons future users accept or reject a specific information technology; it is also capable of adaptation to all attitudes in different contexts [11]. TAM assumes that primary determinants are perceived usefulness and perceived ease of use for attitudes towards using a particular technology [8]. Figure 1 shows the original TAM.

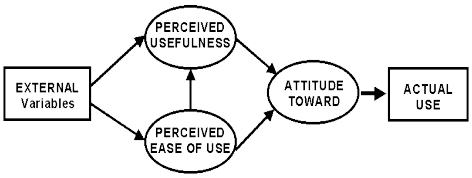

Figure 1. The original Technology Acceptance Model (TAM) [8].

Several empirical assessments of TAM recommend that perceived usefulness has constantly been the most important determinant of intention to use. Perceived usefulness is also affected by perceived ease of use.

The purpose of TAM is to clarify and investigate users' perception of a given system and to facilitate design changes before users have experienced a particular system. Moreover, the aim is to find out the effect of external variables on attitudes and intentions. TAM is an improvement on the Theory of Reasoned Action (TRA) model [2][10], which is influenced by beliefs, behavioral intentions and actual behavior.

The TAM proposed a set of factors that are important in determining user attitude towards accepting a technological innovation [8][18]. The Technology Acceptance Model factors are perceived usefulness, perceived ease of use, attitudes towards use are defined as "the user's desirability of his or her using the system" [18], actual use (AU) and external variables, such as demographic variables.

Venkatesh and Davis [32] proposed an extended TAM called TAM2, which involves social influence and cognitive instrumental variables into the original TAM. The social influence variable includes subjective norm and image, whereas cognitive includes job relevance, output quality and result demonstrability.

Venkatesh [33] extended TAM and proposed the Unified Theory of Acceptance and Use of Technology (UTAUT), which attempt to explain user intentions to use and usage behavior towards a new technology. UTAUT consists of seven constructs: performance expectancy, effort expectancy, social influence, facilitating conditions, moderating factors, behavioral intention and use behavior. The moderating factors are gender, age, experience, and voluntariness.

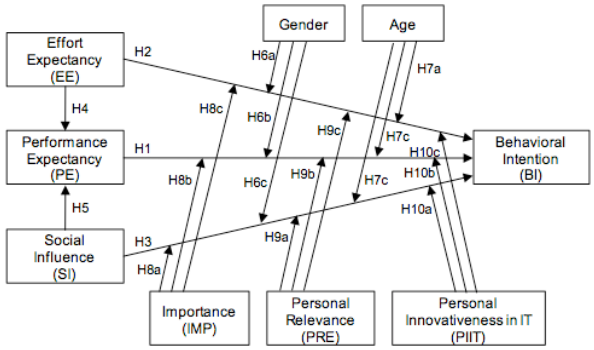

Figure 2. Smart kitchen acceptance model [21].

In a similar study, Rothensee [26] found that smart fridges are useful, easy to use and users will buy them if they are available on the market. He modified the TAM model with three main factors: perceived usefulness (PU), perceived ease of use (PEU) and affective attitude (A) towards behavioral intention. Also, moderators (gender, technological competence and sense of presence) have, according to the author, no significant impact on the model. Mayer [21] adopted the UTAUT model to analyze the user acceptance of smart products in smart home environment. Figure 2 shows the smart kitchen acceptance model.

TABLE I. FACTORS INFLUENCING SMART FRIDGE ACCEPTANCE BASED ON THE LITERATURE REVIEW.

Factors	TAM	UTAUT	Rotheness	Mayer et al.
SI	No	Yes	No	Yes
BI	Yes	Yes	Yes	Yes
PEU	Yes	Yes	Yes	No
PU	Yes	No	Yes	No
DF	Yes	No	No	No
A	No	No	Yes	No
E	No	Yes	No	No
PE	No	Yes	No	No
FC	No	Yes	No	No

User acceptance researchers think that more factors should be added to the TAM model or integrated with other acceptance models in order to improve its explanatory effect [20]. On the other hand, it has been found that TAM is the best model to explain users' attitudes toward new technology [3].

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III. EMPIRICAL INVESTIGATION

The aim of this section is to present an empirical analysis that identifies the set of factors influencing the smart fridge.

A. Procedure

The initial literature review focused on acceptance models used in fields related to new technology, smart kitchens and smart homes. Based on those models, as well as semi-structured individual interviews, user acceptance factors in the smart fridge were identified using the Technology Acceptance Model because it is applicable in the context of innovative technology.

As the aim of the investigation was to gain a better understanding of the factors influencing acceptance of smart fridges rather than to test hypotheses, we adopted a qualitative approach.

The individual interviews were all semi-structured, consisting of mainly open-ended questions. According to Yin [35], "interviews are one of the most important sources of case study information."

The interviews took about 30 minutes. Topics for discussion emphasized evaluation of the smart fridge system. In addition, quota-sampling technique used to identify willingness to participate.

The interviews conducted for this study consisted of questions about the interviewees' technology background and demography, their attitudes towards the smart fridge as well as their attitudes towards smart kitchens in general. Also, the interviewees were asked about their lifestyle, eating habits, experiences and opinions regarding online shopping.

After obtaining ethical approval, email invitations were sent to the subjects to solicit voluntary participants. A link of a YouTube video about smart fridges and its features was sent with the invitation email. Participants watched the YouTube video before attending the interviews, which took place in a quiet environment to aid audio recording.

B. Participants

Subjects were students and staff members from different departments in Aberystwyth University. Altogether, 17 interviews were carried out from June 2013 until July 2013. Participants were restricted to over the age of 18 (females = 9) in order to cover and involve very diverse age groups in the study. Participants were recruited via courses and mailing lists at Aberystwyth University. Of our participants, 12 were students and 5 were self-employed. Table II provides a summary of the participants. In interview studies, the number of interviews included is normally recommended to be between 5 and 25 [31]. However, the number depends on the available time and resources for a particular study.

C. Data Analysis

All of the interviews were audio-recorded using a digital recorder and then transcribed for data analysis according to Grounded Theory [29]. These transcripts were imported into Dedoose web-based data analysis software for coding and analysis. We started with codes that had already been identified by previous literature and then added new codes from the interviews.

The code list included: attitude towards the smart fridge, risk, cost, performance risk, complex, enjoyment, privacy, social influence, memory loss, independence, usefulness and ease of use. This final code list covers two categories that are thought to impact users' attitudes to smart fridge: Technical factors and social factors.

The second step of the interview analysis was identifying attitudes towards the smart fridge, which were either positive or negative. Out of the 17 volunteer interviewees, only 4 could be described as negative, 12 could be described as positive and the final interviewee could be described as moderate.

The final step of data analysis was to focus on and analyze participants with either positive or negative attitudes. The participant with moderate attitude was not selected for further analysis.

TABLE II. OVERVIEW OF THE INTERVIEWEES.

No.	Sex	Occupation	Age	Social Status
1	F	Postgraduate Student	25	Single
2	F	Lecturer	46	Married
3	M	Undergraduate student	20	Single
4	M	Postgraduate Student	26	Single
5	M	Postgraduate Student	27	Single
6	F	Secretary	47	Married
7	F	Postgraduate Student	35	Married
8	F	Postgraduate Student	27	Single
9	F	Postgraduate Student	26	Single
10	M	Lecturer	49	Married
11	F	Postgraduate Student	25	Single
12	M	Postgraduate Student	25	Single
13	F	Postgraduate Student	26	Single
14	M	Postgraduate Student	28	Single
15	F	Postgraduate Student	25	Single
16	M	Lecturer	45	Married
17	M	Lecturer	47	Married

IV. RESULTS

The qualitative analysis suggested that users' intention to accept the smart fridge is affected by many factors. Based on the data analyses, we grouped these factors into two categories: technological and social factors.

Results were analyzed with selected quotations and not all of the participants are quoted for each part. The findings are based on our analysis of all of the interviews according to common practice in qualitative studies.

None of the participants had any experience with either smart fridges or smart kitchens. However, it appears that participants accepted the idea of smart fridges and showed a high willingness to use them. On the other hand, there were numerous aspects identified that make the implementation and acceptance of smart fridge measures more difficult.

The factors mentioned by the participants are described below. All names of participants have been changed.

A. Social Factors

1) Cost

Participants agreed that the cost of a smart fridge would prevent them from using it; the current cost of a smart fridge is around £3000 [25]. Kuniavsky [16] argued that the market

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price for each of these smart fridges was more expensive than the combination of its technologies. Prices this high belong to luxury goods, where the price of the goods is not based on the functionality. Thus, the price of the smart fridge should be based on its functionality and its ability to deliver a better user experience.

From individual interviews, there were mixed reactions towards the smart fridge price, 83% of the participants were willing to spend up to £600 on the smart fridge. Some participants agreed that the price would reduce in the future, just like other smart gadgets have, and that every household would own a smart fridge in the future because *"you have got to have it"*. (Mark)

John compared smart fridges with LED TVs: *"At the moment I think it is going to be a significant issue. However, years ago an LED TV cost around £3000-4000; now it is for £300. So, what we have to assume at some point is that the price will reduce. Because the benefits are less for me than for the next 20 years I won't spend so much money."*

Moreover, participants argued about the risk if the smart fridge system goes wrong; they will end up with a basic fridge costing much less than the smart one. Thus, it is relative to the perceived usefulness of the system. Kate explained: *"Price is a serious factor. It is a big investment, you know, if part of it goes wrong, if the computer part goes wrong, you basically just have a standard fridge again which you can get for a couple of quid."*

2) Technology Anxiety

Technology anxiety is defined as "the fear and apprehension people feel when considering use of or actually using technology-related tools" [7][22][28].

Most university students and staff members are comfortable with using computers and technology. The results show that all of the participants have a good knowledge of using computers. However, even when participants can see the benefits of using the smart fridge, they may avoid it if they are not comfortable with using such a new technology.

Other participants argued that they feel anxious using new technology, especially when initially interacting with it, but the anxiety disappeared as they familiarized themselves with the functionality, for example, as David explains: *"I don't have any problems using new technology but I feel anxious maybe for the first 10 minutes; after that I think I get used to it. I don't give up that easily; I just try to work it out."*

3) Social Influence

Moore and Benbasat [23] defined it as "the extent to which use of an innovation is perceived as enhancement of one's status in a social system". Davis [8] believed that, in some cases, people might use a system to comply with others' mandates rather than their own feeling and beliefs. Mark explains: *"I think at some point in the future everybody will buy it because everybody has to own it. Like the smart phone - nowadays everyone owns one because everybody does!"*

In addition, some participants indicate that that behavioral intention to use a smart fridge is influenced by their friends, colleagues and the community. For example, as Susanne explains: *"If I heard any good reviews about the smart fridge from friends I will definitely buy it."*

B. Technical Factors

1) Perceived Usefulness

Davis [8] in his original TAM defined it as "the degree to which an individual believes that using a particular system would enhance his/her job performance."

The results of the interviews indicate that participants all acknowledged the system's usefulness in terms of its potential benefits to save food and make their life much easier. For example, most participants said that they think the smart fridge is *"very useful."*

The smart fridge is useful for elderly people as they experience a decrease in memory capacity. Memory loss for older adults plays an important role in their preference for the smart fridge. Smart fridges will help them to generate shopping lists automatically, as well as know what is cooling inside the fridge without depending on their memory. Steve explains: *"I think that very often we forget what we have in the fridge we go shopping and then you buy the same thing again."*

Also, Steve added: *"I have aging parents so we recognize that at some point it is going to be difficult to remember everything in the fridge, so I see that the smart fridge is quite a useful facility, as we get older."*

The smart fridge may increase the effectiveness and efficiency of the participant's life by offering many features such as grocery shopping and recipe suggestions. Rose explains: "*It will help me when I am shopping for food. The fridge will help me to not buy unnecessary food.*"

2) Perceived Ease of Use

This is defined as "the degree to which an individual believes that using a particular system would be free of physical and mental efforts." [8]

The majority of participants spoke about the level of user-friendliness of the smart fridge. Since most of the participants have good experience with computers, it was expected that they would be comfortable with using a smart fridge in the future to track items and check consumption history; however, they think that interacting with this technology will be easy. If things are not perceived as easy, participants will simply not use them. Hannah explains: *"If it's complicated I don't think I'm going to enjoy using it."*

Good interface design will also increase perceived ease of use, thereby attracting more users to the smart fridge *"I think the GUI itself will be important. Also, it has to be easy to control"* (David). Moreover, the convenience of the smart fridge and its ability to make grocery orders and deliver them to the household reduces travelling, thus increasing the well-being and independence as well as increasing the ease of everyday activities. For example, Lauren explains: *"I needed it the most when my children were young and it was not easy to take the baby to the store."*

It is, therefore, assumed that when participants perceive the smart fridge as easy to use, they will be more likely to accept it.

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V. DISCUSSION

The findings suggest that motivation for accepting the smart fridge is affected by numerous factors that have been categorized as follows: social and technological factors. Five main factors have been identified as important for smart fridge technology acceptance: perceived usefulness, perceived ease of use, social influence, technology anxiety and cost.

The interviews confirmed the major elements such as perceived usefulness and perceived ease of use in affecting users' motivation to accept the smart fridge. Combing the findings from the literature review and the results of the interviews, an enriched research model, the Smart Fridge Acceptance Model (SFAM), is proposed with three additional constructs added: social influence, technology anxiety and cost (Figure 3).

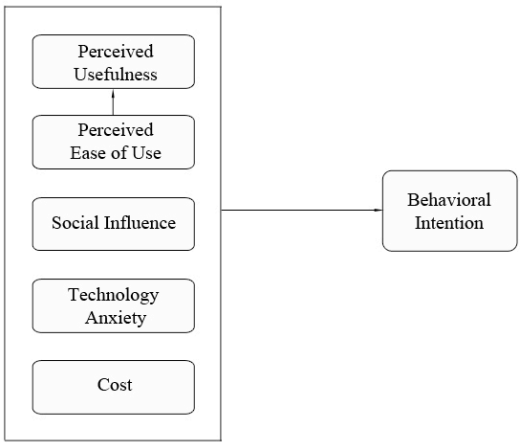

Figure 3. Smart Fridge Acceptance Model (SFAM).

Perceived usefulness and ease of use are considered the most important factors in smart fridge acceptance. The easier the system is to use, the more users will find it helpful, which leads to an increased intention to use a smart fridge in the future.

In terms of perceived usefulness, participants consider particularly useful tracking items and expiry dates. This can also be very useful for elderly people as they experience decrease in memory capacity.

In the area of perceived ease of use, the results reveal that participants think that the smart fridge will be easy to use, which confirms findings from existing technology acceptance literature. Each participant indicated familiarity with computers therefore makes smart fridge easy to use.

Participants with satisfying computer experience and low technology anxiety were more likely to use the smart fridge in the future and more likely to spread positive word-of-mouth. Therefore, increasing computer experience will reduce technology anxiety.

Participants are generally uncomfortable with uncertainty and therefore consult friends, family members and the social network on their adoption decisions [6]. Moreover, participants regard this kind of new technology as symbolic of wealth to enhance their sense of self-importance [27].

The only limitation observed from the interviews was that participants are not willing to own a smart fridge because of its high price. That is in line with the existing research of Kim [15] and Wu [34], who found a negative impact of the cost on technology acceptance. Participants also expressed willingness to try out the smart fridge if it was readily available.

Overall, the majority of the findings support the findings from existing literature and related technology acceptance research.

VI. CONCLUSION AND FUTURE WORK

This paper investigated the factors influencing the acceptance of the smart fridge. We studied existing Technology Acceptance Models and extended a set of factors that could influence smart fridge acceptance. These factors were identified by studying the literature reviews and then validated the qualitative interviews. The original TAM was the best user acceptance model to analyze smart fridge acceptance; however, the TAM needs to be extended to identify smart fridge factors. The results show that perceived usefulness, perceived ease of use, social influence, technology anxiety and cost are the most important factors for smart fridge acceptance.

The advantage of this research is that its focus is on the user, who is the key to acceptance of a new technology; it was also based on the original Technology Acceptance Model, which has been validated in several studies. The main contribution of this study is the domestication theory that was used for proposing the SFAM.

Future research will involve measuring each factor using multi-item scales, as well as further empirical investigation of the model using a smart fridge prototype.

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REFERENCES

[1] J. Adetunji, "UK set to trial 'smart fridges'", The Guardian, Available online at www.theguardian.com, 2008.

[2] I. Ajzen, and M. Fishbein, Understanding attitudes and predicting social behaviour, Englewood Cliffs, NJ: Prentice-Hall, 1989.

[3] K. Alshare, E. Grandon, and D. Miller, Antecedents of computer technology usage: considerations of the technology acceptance model in the academic environment, Journal of Computing Sciences in Colleges, vol. 19, April 2004, pp.164-180.

[4] J. Bauer, K. Streefkerk, and R. R. Varick, Fridgets: digital refrigerator magnets, In: CHI 2005 Student Design Competition, Portland, 2005, pp. 2060–2064.

[5] T. Bigler, G. Gaderer, P. Loschmidt, and T. Sauter, SmartFridge: Demand Side Management for the device level, Emerging Technologies & Factory Automation (ETFA), 2011 IEEE 16th Conference on IEEE. Toulouse, pp. 1-8, 2011.

[6] M. E. Burkhardt, and D. J. Brass, Changing patterns or patterns of change: The effects of a change in technology on

 ISBN: 978-1-61208-325-4

social network structure and power, Administrative science quarterly, vol. 35, no. 1, March 1990, pp. 104-127.

[7] M. A. Cambre, and D. L. Cook, Computer anxiety: Definition, measurement, and correlates, Journal of Educational Computing Research, vol. 1, 1985, pp. 37-54.

[8] F. D. Davis, Perceived usefulness, perceived ease of use, and user acceptance of information technology, MIS quarterly, 1989, pp. 319-340.

[9] A. Dillon, and M. G. Morris, User acceptance of new information technology: theories and models, Annual review of information science and technology, vol. 31, 1996, pp. 3-32.

[10] M. Fishbein, and I. Ajzen, Belief, attitude, intention and behavior: An introduction to theory and research. Reading, MA: Addison-Wesley, 1975.

[11] L. Gentry, and R. Calantone, A comparison of three models to explain shopbot use on the web, Psychology & Marketing, vol. 19, pp. 945-956, November 2002.

[12] V. Hanson-Smith, D. Wimalasuriya, and A. Fortier, NutriStat: tracking young child nutrition. CHI'06 extended abstracts on Human factors in computing systems. ACM, 2006, pp. 1831-1836.

[13] M. Janzen, and Y. Xiang, Probabilistic reasoning for meal planning in intelligent fridges, Advances in Artificial Intelligence. Springer, 2003.

[14] W. Ju, R. Hurwitz, T. Judd, and B. Lee, CounterActive: an interactive cookbook for the kitchen counter, CHI'01 extended abstracts on Human factors in computing systems, ACM, 2001, pp. 269-270.

[15] H. W. Kim, H. C. Chan, and S. Gupta, Value-based adoption of mobile internet: an empirical investigation, Decision Support Systems, vol. 43, February 2007, pp. 111-126.

[16] M. Kuniavsky, Smart things: ubiquitous computing user experience design, Morgan Kaufmann, 2010.

[17] J. Lundberg, A. Ibrahim, D. Jönsson, S. Lindquist, and P. Qvarfordt, The snatcher catcher: an interactive refrigerator, Proceedings of the second Nordic conference on Human-computer interaction. ACM, 2002, pp. 209-212.

[18] Y. Malhotra, D. F. Galletta, Extending the technology acceptance model to account for social influence: theoretical bases and empirical validation. System Sciences, 1999. HICSS-32, Proceedings of the 32nd Annual Hawaii International Conference on IEEE, 1999, pp. 14.

[19] M. Mateas, T. Salvador, J. Scholtz, and D. Sorensen, Engineering ethnography in the home, Conference companion on Human factors in computing systems, ACM, 1996, pp. 283-284.

[20] K. Mathieson, Predicting user intentions: comparing the technology acceptance model with the theory of planned behavior, Information systems research, vol. 2, September 1991, pp. 173-191.

[21] P. Mayer, D. Volland, F. Thiesse, and E. Fleisch, User Acceptance of 'Smart Products': An Empirical Investigation, In WI 2011 Proceedings, vol. 2, 2011, pp. 1063 – 1072.

[22] M. L. Meuter, A. L. Ostrom, M. J. Bitner, and R. Roundtree, The influence of technology anxiety on consumer use and experiences with self-service technologies, Journal of Business Research, vol. 56, 2003, pp. 899-906.

[23] G. C. Moore, and I. Benbasat, Development of an instrument to measure the perceptions of adopting an information technology innovation. Information systems research, vol. 2, 1991, pp. 192-222.

[24] J. Murray, Smart fridge specialist sets sights on supermarket chillers. Business Green, April 2010.

[25] Reuters. Samsung's T9000 smart refrigerator runs on Android, includes apps like Evernote and Epicurious. NDTV Gadgets, January 2013.

[26] M. Rothensee, User acceptance of the intelligent fridge: empirical results from a simulation, The Internet of Things, 2008, pp. 123-139.

[27] S. Sarker, and J. D. Wells, Understanding mobile handheld device use and adoption, Communications of the ACM, vol. 46, 2003, pp. 35-40.

[28] C. R. Scott, and S. C. Rockwell, The effect of communication, writing, and technology apprehension on likelihood to use new communication technologies, Communication education, vol. 46, 1997, pp. 44-62.

[29] A.L. Strauss, J. Corbin, and S. Niewiarra, Grounded theory: Grundlagen qualitativer sozialforschung, Beltz, PsychologieVerlagsUnion Weinheim, 1996.

[30] L. Swan, and A. S. Taylor, Notes on fridge surfaces, ACM, 2005, pp. 1813-1816.

[31] J. Vaivio, Interviews–Learning the Craft of Qualitative Research Interviewing. European Accounting Review, vol. 21, 2012, pp. 186-189.

[32] V. Venkatesh, and F. D. Davis, A theoretical extension of the technology acceptance model: four longitudinal field studies, Management science, vol. 46, 2000, pp. 186-204.

[33] V. Venkatesh, M. G. Morris, G. B. Davis, and F. D. Davis, User acceptance of information technology: Toward a unified view, MIS quarterly, 2003, pp. 425-478.

[34] C. S. Wu, F. F. Cheng, D. C. Yen, and Y. W. Huang, User acceptance of wireless technology in organizations: a comparison of alternative models, Computer Standards & Interfaces, vol. 33, 2011, pp. 50-58.

[35] R. K. Yin, Applications of case study research (applied social research methods series volume 34). London: Sage, 1993.

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