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DIGITAL NATIVES' AND IMMIGRANTS' SWITCHING BEHAVIOR IN SMART HOME ENVIRONMENT – A COMPARATIVE STUDY

ABSTRACT

This Master's thesis examined the switching behavior of theoretical digital immigrants' and theoretical digital natives' in the context of switching from a traditional living environment to a smart technology assisted one, in other words a smart home environment. Switching behavior was examined in both groups individually and the determinants were mapped based on former theories and research on push-pull-mooring (PPM) model. The results were compared between the groups in order to generate new information on switching behavior when switching from traditional living environments to smart technology implemented ones. The emerged information is useful in future research with similar contexts and in designing smart living environments for various consumers. A Partial goal was to bring new information to the discussion on digital natives and immigrants which has remained unsolved for some time. Previous research on this topic was examined via a literature review and the empirical part was conducted as qualitative semi-structured thematic interviews. The subjects were categorized by their year of birth. 11 digital immigrants who were born before the year 1980 and 11 digital natives born after the year 1980 were interviewed. Despite of the proposed theoretical differences of these groups only few differences on switching behavior were noticed. Commitment was a strong mooring factor in both groups, but slightly stronger among digital immigrants, whereas economic factors were a more significant push factor for the digital natives. For digital immigrants the lack of trust was a pushing factor when digital natives did not perceive similar effects. The noticed differences were generally due to the individual's personal life situation, not because of the technology orientation differences between the two groups. This might have been because the attitudes towards living environments are relatively static and unchanged regardless of one's year of birth. The results did not entirely support nor object the original claims of theories on digital natives and immigrants and their differences. There were some conflicts and similarities to these theories. The study also continued IS switching behavior research and widened the spectrum of examined environments. Alternatives attractiveness should be examined more accurately via its sub-factors.

Keywords: digital native, smart homes, push-pull-mooring, switching behavior, wireless data transmission technology

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Tämä pro gradu-tutkielma käsitteli diginatiivien ja digi-immigranttien vaihtokäyttäytymistä, kun tarkastellaan kyseisten henkilöryhmien vaihtoa perinteisen asumisen elinympäristöstä ympäristöön, jossa käytetään hyväksi älyteknologiaa. Vaihtokäyttäytymisestä kartoitettiin olemassaolevan teorian pohjalta tekijöitä, jotka vaikuttavat vaihtoinnokkuuteen ja sitä myötä vaihtokäyttäytymiseen vetävästi, työntävästi tai ankkuroivasti. Näiden kahden ryhmän tuloksia verrattiin toisiinsa, jotta saatiin selville eroavaisuuksia vaihtokäyttäytymisessä. Tutkimuksen tavoitteena oli avata keskustelua ja tuoda julki uutta tietoa eri sukupolvien vaihtokäyttäytymisestä tilanteessa, jossa heidän elämäänsä tuodaan uudenlaista teknologiaa. Tätä tietoa on mahdollista hyväksikäyttää jatkotutkimuksissa sekä apuna vastaavien älyelinympäristöjen suunnittelussa. Lisäksi tarkoituksena oli luoda uutta tietoa diginatiivikeskusteluun, joka on ollut ratkaisemattomana aiheena jo pitkään. Aikaisempia tutkimuksia tarkasteltiin kirjallisuuskatsauksen kautta ja tutkimuksen empiirinen osio toteutettiin laadullisena puolistrukturoiduilla teemahaastatteluilla, joissa haastateltiin 11:tä digi-immigranttia ja 11:tä diginatiivia. Haastateltavat lokeroitiin syntymävuosiensa perusteella. Ennen vuotta 1980 syntyneet laskettiin digi-immigranteiksi, kun vuonna 1980 ja sen jälkeen syntyneet laskettiin digitaalisiksi natiiveiksi. Tutkimuksen tulos oli, että huolimatta sukupolvien välisistä teoreettisista eroavaisuuksista, vaihtokäyttäytyminen erosi vähän ryhmien välillä. Sitoutuneisuus nykyiseen elinympäristöön oli vanhemmilla sukupolvilla merkittävämpi ankkuroiva tekijä, kun nuoremmalla sukupolvella vahvemmaksi työntäväksi tekijäksi osoittautuvat taloudelliset tekijät. Digi-immigranteilla luottamus ja sen vähäisyys nykyiseen elinympäristöön oli merkitsevä työntävä tekijä, kun taas diginatiiveilla kyseinen tekijä ei ollut merkitsevä. Erot johtuivat yksilöiden elämäntilanteista, ei niinkään sukupolven erityisistä ominaisuuksista. Syyksi epäiltiin, että suhtautuminen elinympäristöjä kohtaan pysyy verrattain muuttumattomana sukupolvesta riippumatta. Tulokset eivät tukeneet täysin teoriaa, että diginatiivit ja digi-immigrantit eroaisivat toisistaan merkittävästi teknologiaan asennoitumisen puolesta. Joitakin yhtäläisyyksiä kuitenkin huomattiin. Lisäksi tutkimus laajensi tietämystä tietojärjestelmätutkimuksen saralla. Vaihtoehdon viehätys –tekijän todettiin olevan vaihtoaikomusta ajava tekijä, jota tulisi jatkossa tarkastella sen ala-tekijöiden tasolla.

Asiasanat: diginatiivi, langaton tiedonsiirto, vaihtokäyttäytyminen, älykoti

PREFACE

With its ups and downs this Master's thesis took one year to complete and there are several people and organizations to thank. The most significant force that guided through me this was my supervisor Professor Tuure Tuunanen as he encouraged me and pointed me into the right direction when I was struggling for longer periods. Other people who I want to acknowledge are my second supervisor Doctor Markus Salo, and of course my friends, family and my girlfriend who supported me through this. It takes both the academic and mental support to complete such a project. I now understand that it was for my own good to be persuaded for a game of Jenga by my fellow students than to stare at the computer screen brain smoking.

I would also like to thank Telealan edistämissäätiö, whose grant supported me to focus solely on the thesis without the need to work at the same time. Also the support from University of Jyväskylä and the possibility to isolate myself to their research facility in Konnevesi for a week to analyze data was superb.

Although the basic idea of a thesis is that it is a personal task, one's environments and social contacts are a significant factor in making things happen and possible. Now I continue my life's journey with a new job and put my academic mind into work once again.

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1   INTRODUCTION

Smart homes and the technologies implemented in them are constantly developing towards the point where common consumers are able to buy and use them. This can be seen for example in the Kangas-project by city of Jyväskylä, Finland, where smart solutions are being planned to be implemented in the neighborhood. Smart homes and the technology implemented in them being relatively novel concepts, the information about user behavior and use intentions is insufficient. Before these smart technologies are implemented in the residential areas, it is necessary to research what kinds of technologies consumers are interested to use and more importantly, what are the key factors that affect the switching process from traditional housing to smart housing. The nature of living environments has been relatively static and free of high-end technology solutions and information technology (IT) until of late times. It is important to examine what affects the consumers switching behavior when introducing IT to formerly traditional environments, such as one's home.

From the start of the current millennium, the subject of dividing technology users to digital natives and digital immigrants based on their date of birth has been a conversation subject amongst researchers and still there has not been a consensus to end these debates. In brief the original claim is that generations that have spent their youth and grew up surrounded by technology have "rewired" brains and are naturally more talented in using technology than their predecessors (Prensky, 2001). After all criticism it still cannot be denied that younger generations have some characteristics that differentiate them from their elders. Nevertheless the claims of the original theory must be partially forgotten and new information must be explored. (Smith, 2012) This study's partial goal is to reveal if theoretical digital natives and immigrants have differing switching behavior towards smart living environments. Both age groups are potential future smart home technology users and therefore examining their switching behavior individually is wise.

Now as there are several generations who are potential smart home inhabitants it is necessary to examine and identify the determinants which affect their switching behavior. Thus this study's research problem is: 'How do switching

behavior determinants differ from one another when comparing digital immigrants' and digital natives' switching determinants in the context of switching from traditional living environment to smart technology assisted environment?'

The multiple options that are available as home automation system technologies and their standards have various characteristics and attributes. Wireless personal area network (WPAN) protocols, such as Zigbee, Z-Wave, Insteon, Wavenis, Bluetooth, EnOcean and WiFi are all relatively well-known technologies that are suitable to be used in smart home context. However, none of them have consolidated itself as a standard. A partial goal of this study is to differentiate these technologies and create a summary of comparison of them. Telealan edistämissäätiö supported this thesis with a grant and the comparison of wireless technologies is the contribution for that grant.

In information systems (IS) research there are already some studies regarding the user adoption of smart homes but although the user experiences have been positive, the adoption process has been rather slow among the masses. With this study the main goal is to examine smart housing from a slightly different perspective, the perspective of switching behavior, and open up the area more. Switching behavior has been a relevant subject in the area of marketing and economics for a long time but in IS studies regarding user switching behavior are fewer. Only recently there has been studies about push-pull-mooring (PPM) model adaption in the context of IS (Chang, Liu, & Chen, 2014; Hou, Shang, Huang, & Wu, 2014; Hou, Chern, Chen, & Chen, 2011; Hsieh, Hsieh, Chiu, & Feng, 2012). PPM model explains the predictors of user switching between services (Bansal, Taylor, & James, 2005). In this study the PPM model is implemented and its functionalities are examined by qualitative research. The model was chosen since it is extensively and successfully used in former switching behavior research both in general and in IS environments. In today's service dominant markets service-like aspects can be identified in smart home solutions and the use of PPM model is justified. The model is used to evaluate the switching behavior of potential users when switching from traditional housing to smart housing and to widen the knowledge on switching behavior in IS context.

First smart housing is explained generally and examined from two viewpoints. The general idea of smart house environments are presented with examples, and the technology aspect is examined via ubiquitous computing as a concept and introducing several wireless data transferring technologies. The technologies and their main characteristics are compared in one table. The theory of service-dominant logic by Vargo and Lusch (2004; 2008) is also presented to introduce the connection between modern day thinking of services and its connection to smart home environments.

The second chapter presents the theory behind the user division into two theoretically differentiating groups, digital natives and digital immigrants by Prensky (2001). The separation of generations by Tapscott (2009) is presented in order to explain how the interviewees' division by age is justified. The basic concept, theoretical characteristics and the comparison of said groups are introduced.

Also criticism on the subject is presented and discussed to bring forth overall knowledge from several viewpoints.

The third chapter covers switching behavior. Earlier studies by Lee (1966) and Jackson (1986) on migration are introduced briefly to cover the origins of later studies. PPM model by Bansal, Taylor and James (2005) is explained more thoroughly to give a detailed view on how switching behavior is approached is this study and to justify its use in the empirical section. To explain the bond between switching behavior and IT research, several previous studies examining switching behavior in IS environments are introduced briefly. Finally the results of the prior IS studies regarding switching behavior determinants are compiled into a table to give an overview of discovered determinants.

Fourth chapter covers the methodology of the study. The chapter presents the research objectives and research questions and covers the methods used in the empirical part of the study in detail. The chosen methods to create new knowledge are introduced and validated with both international and Finnish references. The theoretical part of this study is conducted as a literature review and the empirical part is a qualitative semi-structured interview.

The fifth chapter presents the results that emerged from the empirical part of the study. The results are first gone through by both target groups, theoretical digital natives and theoretical digital immigrants, respectively and after the general outcomes are introduced the results are compared to another.

In the sixth chapter the reflection of the results are discussed and presented as thoroughly as possible. The switching factors of the PPM model by Bansal, Taylor and James (2005) are re-examined and compared to the results that emerged from this study. The results and their implications are compared to the theories regarding theoretical digital natives' and digital immigrants' characteristics, and reflected how they match the suggested theories in the context of smart living environments. Also the theoretical implications to switching behavior in earlier IS research are presented.

The last chapter contains a summary, conclusions and the study's main content in brief. It re-assesses the research objectives and problems, summarizes the results and their implications as a new knowledge and concludes the study. The limitations and future research possibilities are also examined and discussed.

2 SMART HOUSING AND ITS SERVICES

In this chapter the concept of smart housing is examined and presented. The concept is introduced from the general viewpoint of smart house environments as a concept and delving deeper into smart homes as an environment for ubiquitous information systems. The aspect of service-dominant logic and its connection to smart homes is examined. Lastly several wireless data transfer technologies are presented and their general characteristics are compared.

2.1 Smart Housing

Smart homes are living environments where household objects, devices and instruments are connected to each other. Based on the inhabitants' needs and collected information about the surrounding environment, the smart home's functions are adjusted either automatically or by active control. (Gomez & Paradells, 2010; Koskela & Väänänen-Vainio-Mattila, 2004) Smart home's three parts are network, controlling devices and the devices that affect the smart home's environment. Network is for connecting the home automation to the controlling devices and the controlling devices are used to manage the systems and functional devices. These networks can be wired or wireless. (Sripan, Lin, Petchlorlean, & Ketcham, 2012) Smart homes can be controlled with a mobile device or with a computer. Mobile devices are very suitable for instant control. (Koskela & Väänänen-Vainio-Mattila, 2004) The smart factor in home and housing environments means that the system can independently react and adjust itself, in other words it can keep managing itself in the background without user's active attention and control. Smart home's sensors may collect information from the houses surroundings or even from the tenants themselves. With this information the system can analyze and provide more useful data, such as action suggestions, estimates and predictions. Nowadays the microprocessors and sensors in common persons' lives is not just futuristic babble but as technology is progressing, so is the production of said components getting more efficient and cheaper and the common consumer can afford them. If there are multiple devices to be managed in a single smart home, they can be connected to single control center device or controlled separately. (Cook, 2012.)

Smart technology can be implemented in almost any aspect of living environment. Smart heating provides ideal living and sleeping temperatures depending on the time, space and the surroundings. When there are no residents present the home is not unnecessarily heated as much, therefore providing both ecological and financial savings. (Briere, 2011) Lighting can be automated so that only the rooms where the residents are, are illuminated and with the perfect illumination for the atmosphere and depending on the available natural light. This saves both ecological and financial resources and offers some hedonic benefits. (Briere, 2011) In smart homes security is a very significant functionality. Smart homes environments and surrounding can be protected and monitored with different

kind of sensors, for example motion sensors or cameras. As other functionalities, security can also be automated so that it is activated when residents are not home or controlled remotely. Other smart security solutions could be for example electronic locks or an access control system. (Briere, 2011) In elder care or in a similar situation where the resident is not capable of living by oneself there are several smart home solutions for making living on their own possible. To prevent and monitor resident's accidents at home there are for example a floor that senses falling and alerts help if needed. There are also smaller smart home solutions in form of single household devices, such as a coffee machine, the refrigerator or entertainment systems which are connected to each other or use collected data to improve their user's experience. (Briere, 2011.)

There is, however, some challenges that have been recognized in the adaption of smart homes. Living environment and its dependency on IS has raised the question on security. For instance, being controlled by IS, hackers might be able to access the smart homes control systems and gain access to the house as well as control other appliances in the house. (Brush et al., 2011; Melenhorst, Fisk, Mynatt, & Rogers, 2004; Sripan et al., 2012) The second challenge is adaptation into living in a new environment. Living in a smart home requires significant changes in individuals living habits and customs, such as operating security systems and living with sensors. Living environments have remained relatively unchanged for some time and changing to a smart home environment would require learning to operate new devices and managing them. This would require reading manuals. (Sripan et al., 2012) Third significant challenge with smart home solutions is that they are substantially more expensive than their more traditional counterparts. This might act as a repellent when designing or planning new living environments. (Brush et al., 2011; Sripan et al., 2012) On the other hand some smart home solutions offer economical long-term savings, for example automated heating system. In the case of sensors, cameras and other monitoring devices the issue of intrusiveness has also been noted. The feeling of constantly being watched and observed might be intrusive and uncomfortable. (Melenhorst et al., 2004.)

2.2 Ubiquitous computing

As it is being constantly embedded to new appliances and purposes, IT is spreading more and more into our surroundings. It has become common in developed cultures that everyone has a personal mobile phone that they carry with themselves all the time, and have access to a computer and the Internet. Ubiquitous technology refers to technology that surrounds and is everywhere around us. The translation for the Latin word "ubique" is "that which exists everywhere". (Sørensen, Yoo, Lyytinen, & DeGross, 2005) This has led to a situation that the people who are using said technology are somewhat dependent on the Internet since its always available (Srivastava, 2004). According to Tapscott (2009) digital

natives or the millennials represent the first generation to grow up being surrounded by technology. This has led to some changes in the user behavior of said generations. More on this subject in the following main chapter.

The initial stage of ubiquitous computing is by Weiser (1991) in a seminal article. After that it has gotten several different terms to represent itself, such as pervasive computing, physical computing, tangible media or everyware (Greenfield, 2010). During this millennium the technology's evolution has accelerated by the improvement of wireless technologies, battery technology and networks as well as increased computing capabilities and software flexibility (Lyytinen & Yoo, 2002). Ubiquitous computing does not just mean the evolution of technology, such as mobile phones, but that the more traditional devices, for example a coffee maker, is getting its microchip and connection to other devices, too. Therefore it is a significant factor when observing the area of smart homes and living environments where ubiquitous information systems are an essential part of architecture.

2.3   Services today and smart housing as a service

The former way of viewing a product was that the value propositions it offers are in the product and its functions. When a customer purchases a product they are expected settle for the tangible product. Also the consumer has very limited possibilities to modify the good's qualities. (Vargo & Lusch, 2004) Now there is a new way of viewing today's markets. The old way of focusing to goods and products is stepping aside as the newer service-dominant logic has taken its roots. The exchange of tangible goods has changed towards the exchange of intangible resources, for example specialized skills and knowledge integrated in or paired with the product. Product manufacturers and therefore service providers need to adapt to these changes and modify their methods. (Vargo & Lusch, 2004.)

The service-dominant logic is based on the events where the concept of resources has widened to cover also the intangible skills and processes that are not measurable by numbers as they were considered in the past (Zimmermann, 1951). After this Constantin and Lusch (1994) defined that resources could be divided into operand and operant resources. Operant resources are professional, immaterial and effect producing factors such as knowledge and skills. Operand resources are those that are commonly comprehended as resources; they are natural like resources, which are material and consumed by use. (Constantin & Lusch, 1994)

In 2004 Vargo and Lusch presented eight foundational premises (FP) for service-dominant logic and added two more two years later (Vargo & Lusch, 2008). The ten FP are presented in Table 1.

Table 1 The ten FP of service-dominant logic (Vargo & Lusch, 2008)

FP 1	Operant resources utilization is the basis for all exchange. A service is exchanged for a service. For example subject A exchanges his or hers skills or knowledge to use subject B's skills or knowledge.
FP 2	"Indirect exchange masks the fundamental unit of service exchange" (Vargo & Lusch, 2008, 6). This means that services are performed or delivered through combinations of goods, money and organizations. This can make the service aspect of an exchange invisible.
FP 3	Goods do not provide value through just by themselves, the value is derived from the service which the good provides. In other words the goods are distribution mechanisms for the services.
FP 4	Operant resources are the base of competitive advantage. As said before, services can be viewed as distribution of skills and knowledge. For example the information flow in a company is an operant resource for the company and sets the base for the successfulness of the processes in the company.
FP 5	"All economies are service economies" (Vargo & Lusch, 2008, 7). All exchange between market actors is service exchanges, whether it is for example exchanging restaurant's cooking skills for money or outsourcing company's software development in exchange for consultation services
FP 6	Customer is always a co-creator of value. The value is always partly produced by the consumer. When the product is used, the marketing, consumption and value-creation is continued by the customer.
FP 7	Market actors do not deliver value, they only offer value propositions. Through services and goods, enterprises offer their utilized resources for their customers and by using the product they set and create the value.
FP 8	For successful business it is vital to build ongoing customer relationships. It is crucial to take notice of customers' needs and problems to deliver them the right solutions to meet the needs. The interaction with the customer and the co-produced value from the interaction makes the service-centered view customer oriented.
FP 9	All social and economic actors, such as households and enterprises, are integrators of the resources. In other words even the smaller groups use the resources to create value for the service.
FP 10	The beneficiary of the product is solely the actor that sets the value for the product. The value is uniquely formed and it is hard to predict. The value is created where the interaction takes place.

Smart homes are full of technology and different kinds of appliances. But the value and the benefits that the smart home solutions offer are not based solely on the functionalities and actions of these devices. There is also significant amount of services embedded to these technology devices. For example a security system would be almost useless if there was not a security provider and their service constantly monitoring and acting in a problem situation. Or a smart heating system would not be much of a use without a company that delivers that warmth. Even the companies producing smaller smart home appliances usually offer some services in the background of the main product for example maintenance, product software updates and customer service. Therefore the service dominant logic can also be found in the area of smart homes. The value propositions of a

smart home are not in the gadgets themselves, but in services provided in the background.

2.4 Wireless technologies in smart housing

With the latest upgrades in technology wireless information transmission and wireless network solutions (WNS) have become more and more used by the day. Wireless personal area network (WPAN) refers to a small scale network that connects individuals' devices, such as computers, mobile phones and personal digital assistants, wirelessly together (Karaoğuz, 2001). Technologies used for WPAN are for example INSTEON, Bluetooth, Z-Wave, Zigbee. WPAN is based on the standard IEEE 802.15. In this section the some of the wireless smart home technologies are briefly presented and in the end the essential characteristics of said technologies are compared in Table 2.

2.4.1 Bluetooth

Bluetooth is familiar to most consumers since it is common in mobile devices. Its key features are that Bluetooth devices can be paired with almost any other Bluetooth device in order to exchange information. It was designed to replace peripheral devices' cables in basic devices such as computers, mobile phones and such. (Lee, Su, & Shen, 2007.)

Derived from the classic Bluetooth technology, Bluetooth Low Energy (BLE) was developed by Bluetooth SIG in 2010 to offer a wireless data transfer technology with small-as-possible energy consumption. BLE is the distinctive feature of Bluetooth version 4.0 and known also as Bluetooth Smart. Compared to other similar technologies such as Zibgee, 6LoWPAN and Z-Wave, BLE is a strong applicant as a futures standard wireless data transfer technology since Bluetooth has already been implemented in majority of smart devices such as mobile phones. (Gomez, Oller, & Paradells, 2012.)

2.4.2 EnOcean

EnOcean is a wireless technology that is based on the idea of "no batteries, no wires". It is used primarily for building automation systems but also applied in other industries. An example of EnOcean implemented technology is a battery-free wireless light switch which utilizes the mechanical energy of simply pushing the light switch. Compared to similar technologies, EnOcean is elevated above others with its energy efficient performance and operation and its low installation and maintenance costs. (Martin, 2007.)

2.4.3 INSTEON

INSTEON is a data transfer technology that employs ac-power lines and radio-frequency protocols in order to communicate with and manage electronic devices

and appliances. This means that radio frequency communication can travel partially via for example light switches, motion sensors, or other electrically powered devices connected to power lines. It is developed by SmartLabs and to be used in home automation. Any device using INSTEON can send, receive or relay data. (Gomez & Paradells, 2010.)

2.4.4 Wavenis

Wavenis is a WNS that has been developed by Coronis and it is a part of their automatic meter reading solutions. Wavenis's noteworthy features are its relevantly long range compared to its power consumption. (Dohler, 2008) According to Gomez and Paradells (2010) Wavenis defines only one type of device so its use is somewhat limited but more specific than other wireless technologies.

2.4.5 Wi-Fi

Wi-Fi is commonly known among consumers and it has taken its place as a data transferring technology for example in homes and public services because of its low cost and portable technique (Kaushik, 2012). Based on IEEE 802.11 standard and being the most popular and successful wireless network architecture, Wi-Fi has established itself as a standard in many mobile devices such as laptops and smart phones. Wi-Fi is developed and designed for high data rates. (Lee et al., 2007.)

2.4.6 Zigbee

Zigbee is based on standard IEEE 802.15.4 specification and it is developed by Zigbee Alliance for high level communication protocols and to serve as a low-data-rate and short-range data transmission solution. The notable feature of Zigbee is that it is intended to be simpler and cheaper than other similar WPANs such as Bluetooth or Wi-Fi. Usually Zigbee is used in low-rate data appliances and therefore require long battery life and secure networking. (Gomez & Paradells, 2010.)

2.4.7 Z-wave

Z-Wave is developed by ZenSys for home automation, specifically to enable communication between home's appliances and devices. Z-Wace technology is fit for battery operated devices since it designed for reduces power consumption and designed for reliable transmission of short messages from a control unit to functioning unit. Z-wave supports multiple devices being simultaneously connected. (Gomez & Paradells, 2010.)

2.4.8 Comparison

Table 2 Main characteristics of wireless data transmission technologies (Gomez et al., 2012; Rathnayaka, Podar, & Kuruppu, 2012)

	Bluetooth	BLE	EnOcean	INSTEON	Wavenis	Wi-Fi	Zigbee	Z-Wave
RF band (MHz)	2400	2400	868	904	433/868/915 (2400 also available)	2400/5000	868/915/2400	868/908 (all chips) 2400 (400 series chip)
Range (m)	1000	250	30	45 (outdoors)	200 (indoors) 1000 (outdoors)	100	10-100	30 (indoors) 100 (outdoors)
Bit Rate (kb/s)	1000	1000	125	38.4	4.8/19.2/100 (min./typ./ax.)	54000	20/40/250	9.6/40 (from 200 series chip) 200 (only on 400 series chip)
Modulation	GFSK	GFSK	ASK	FSK	GFSK	B/QPSK, COFDM, QAM	BPSK/BPSK/ O-QPSK	BFSK
Spreading technique	FHSS	FHSS (2 MHz channel Width)	No	No	Fast FHSS	DSSS, CCK, OFDM	DSSS	No

<div align="right">(to be continued)</div>

Table 2 (continues)

	Bluetooth	BLE	EnOcean	INSTEON	Wavenis	Wi-Fi	Zigbee	Z-Wave
Error Control	16 -bit CRC	24-bit CRC, ACKs	-	8-bit CRC	BHC (32,21) FEC, data interleaving, scrambling. Per-frame or per-window ACKs (optional)	32-bit CRC	16-bit CRC, ACKs (optional)	8-bit checksum, ACKs (optional)
Security	E0/AES128	Security Modes/Levels, Pairing, Key Generation/Distribution, Confidentiality, Authentication and Integrity	Basic	Encryption (e.g., rolling codes)	3DES and 128 bit AES encryption	RC4/AES	Integrity, confidentiality, access control and key management	128 bit AES encryption (400 series chip)

3   DIGITAL NATIVES AND DIGITAL IMMIGRANTS

As the world has changed particularly in the more developed countries, digital technologies and systems are surrounding our everyday lives, so has the users and their habits of consuming these technologies and systems evolved in generations. These systems around us are known as ubiquitous systems since they are embedded to various items all around us. (Vodanovich, Sundaram, & Myers, 2010) According to Prensky (2001) users can be roughly divided into two categories: digital natives and digital immigrants. This chapter contains the generational division of said technology users into two groups, presents the theories of the division, and a comparison of these two theoretical groups by their characteristics. Being a subject that has roused discussion criticism on the subject is also presented and examined.

3.1   Division of generations

According to Tapscott (2009) majority of people can be divided into four generation groups depending on their birth year. The first generation is the Baby Boomers and it covers people born between 1946 and 1964. The classification is based on the historical event of World War II and outburst of children after that. As technology users Baby Boomers are people that grew up with televisions and therefore are the early generation of modern technology users. (Tapscott, 2009.)

The next generation is the Generation X or Baby Bust which covers people born between 1965 and 1979. Their generation is the oldest generation that possesses similarities with the Generation Y's computer and Internet skills. These Generation X's skills acted as a primer for following generations' technology habits. (Tapscott, 2009.)

The third generation is the Generation Y, also known as the Net Generation or the Millenials, who were born between 1980 and 1997. This generation was the first one to truly being born and grown fully surrounded by technology, digital media and services that were available for majority of people. (Tapscott, 2009.)

The latest generation is Generation Next or Generation Z and their generation starts from 1998 and it is still ongoing (Tapscott, 2009). Being relatively new

and still growing generation of technology users, this generation will not be observed in this study.

3.2 Digital natives

The starting point of the topic dividing people to digital natives and immigrants is in an article written by Marc Prensky in 2001. In his study Prensky (2001) claim that students of that day have changed significantly and there is a conflict between the students' way of learning and the educational system's way of teaching.

According to Prensky (2001) and Tapscott (2009) Generation Y, the Net Generation or the Millenials are the first people that have can be counted as digital natives. Digital natives are those who have been born and raised surrounded by technology and IS. Hence the name which refers that these people are the native speakers of the digital language. From infancy they have had the possibility to use computers, digital media players, videogames, cell phones and other appliances of the digital age and similar to mother tongue, digital language has become natural to them. As a result of the ubiquitous existence of technology these digital natives process information differently and have become native speakers of digital language when compared to their predecessors, the digital immigrants. (Prensky, 2001) Deal's, Altman's and Rogelberg's (2010) study supports the claim that technology usage is similar to languages. People who start using a new language earlier in their lives tend to learn it faster and better than people who start using it later in their lives. Children who are born midst into a new language tend to learn the new language easily and are even prone to resist the old language. (Deal et al., 2010.)

In Prensky's (2001) study the difference between teachers and students is in the habits and behavior. The students think and process their surrounding events in a different manner than their predecessors. This is due to living in an environment with different stimuli and interacting with them. (Prensky, 2001) Prensky (2001) and Small and Vorgan (2011) claim that the generation's thinking patterns and their brains have changed. Prensky (2001) presents that brains are reorganizing themselves physically during an individual's childhood according to the stimuli. This function is called neuroplasticity and it is the second main reason in addition of language comparison that Prensky (2001) states to be the cause of digital natives. Interacting daily with technology, both actively and passively, stimulates the brain structure and therefore affect the way these digital natives think and handle their environment. (Prensky, 2001) The reasons for digital immigrants' transformed behavior are not just physical. Social psychologic studies present that depending on individuals' living environments' culture their actual thought processes are different from one another (Luriia, 1966).

Due to interacting often with digital environments, the digital natives have enhanced several attributes that are closely related to the digital world. Ongoing

usage of for example video games and other similar digital media enhances individual's skills. In Prensky's (2001, 10) article examples of these skills are according to Greenfield (2014):

> reading visual images as representations of three-dimensional space(representational competence), multidimensional visual-spatial skills, mental maps, "mental paper folding" i.e. picturing the results of various origami-like folds in your mind without actually doing them), "inductive discovery" (i.e. making observations, formulating hypotheses and figuring out the rules governing the behavior of a dynamic representation), "attentional deployment" (such as monitoring multiple locations simultaneously), and responding faster to expected and unexpected stimuli. (Prensky, 2001, 10, according to Greenfield, 2014)

Digital natives are also natural at multitasking. Most of the millennials find little problem listening to music, talking on mobile phones or watching television while doing their homework. (Prensky, 2001) Prensky's (2001) notion that the digital natives cannot focus on just one thing at a time is supported by Tapscott's (2009) notion that when watching televisions, the millennials are usually focusing additionally on some other activity.

According to Tapscott (2009) the millennials, i.e. the digital natives, have characteristics that distinct them from their elders. Digital natives value freedom of choice and freedom in general. They love that they have variety of options to choose from, such as brands, products and so on. Digital natives are also eager to make things to belong themselves by customizing them starting from their own personal devices to creating their own online content in media channels. They are thorough when examining things. Despite of their young age, they like to find more information about a thing from the internet and therefore pick the most suitable for themselves. On organizational viewpoint digital natives value organizations' integrity and transparency when making decisions about purchases and jobs. They want to make sure that their values match up with the organization they are interacting with. What comes to working, education and their social live, digital natives want to integrate entertainment and play to them. Video games and similar playful activities have taught them that there is several ways to reach their goals. Similarly digital natives do not value lectures, they value collaboration and conversations. They listen to each other and their opinions and let those opinions affect their own. They also prefer events and environments to be faster and demand immediacy. They use instant messaging over emails as communication and expect to be replied to immediately. Digital natives are also rather innovative. They seek and try the newest appliances eagerly and same goes with their working and living environments. They want to live and work in an environment that is up-to-date. (Tapscott, 2009.)

As an addition to the characteristics presented by Tapscott's (2009), Smith (2012) presents eight claims that support above characteristics and state the following about digital natives that are result from the digital immersion. Digital natives possess new ways of knowing and being. Their style of learning has evolved significantly from their predecessors' and they are transforming society by digital revolution. As digital natives have and will come of working age their habits and behavior will affect society and become norms. They are also naturally

familiar with technology. They often desire to use and implement technology in everyday situations. Digital natives are capable of multitasking and are collaborative and are the native speakers of the digital language. (Smith, 2012)

As an addition to former statements by Prensky (2001), digital natives are seen as having unique viewpoints and abilities towards technology and they prefer gaming, interaction and simulation of everyday tasks. Digital natives demand immediate gratification. They expect short response times from other people, organizations or products that they are interacting with. Digital natives also reflect and respond to the knowledge economy. Especially during the Information Age the digital natives' actions and behavior presents the state of knowledge economy. (Smith, 2012.)

3.3   Digital immigrants

Prensky (2001) defines digital immigrants as people who were not born into the digital world but have adapted to the changed environment by learning during their adult lives. Debatable assumption is that older generations resist technology. Some digital immigrants learn to operate new technology better than others but they still retain to their former behavior with IS to some extent. This is called "digital immigrant accent" and it may occur as a situation where for example a digital immigrant seeks information first from books and only after that from the Internet or an email recipient prints out the email for no significant reason. (Prensky, 2001) Digital immigrants were born before 1980 but there has been some criticism about the validity of the age factor determining whether a person is a digitally immigrant or native (Helsper & Eynon, 2010; Prensky, 2001).

Digital immigrants learning habits are based on the learning that they did when they were younger. Unlike the digital natives, the immigrants had to perform their studies without any technological gadgets, such as computer or even pocket calculators, performing on task at a time. Computers were not available in every household but TV was. As computers are easily adapted by new children today, so were TVs amongst older generations. (Tapscott, 2009) Prensky (2001) states that the changes in the digital natives' brains are the reason for their differing learning and same goes for digital immigrants. Their habit of not sincerely trusting technology is shown as using traditional methods in addition to using technology. For example emails can be printed to be shown to others rather than sending them straight to recipients. Or printed manuals can be read thoroughly before even testing new technology. Or even made sure by phone call that the sent email was read by the recipient. These are all examples of said "accent". Their effort of trying to speak the digital language is interfered by their own native behavior and mindset from pre-digital age. (Prensky, 2001.)

As digital natives, digital immigrants have their own characteristics which describe and explain their behavior as technology users. According to Jukes and Dosaj (2005) these characteristics are the following.

Digital immigrants like their information sources to be limited and the flow of information to be rather slow and controlled. They like processing things one

at a time over multitasking. Data complexity wise digital immigrants like to use text over pictures, sounds, and video and prefer providing and processing their information logically, sequentially, and linearly. Digital immigrants' attitude towards education is that students should work independently over networking and interacting. They also prefer teaching and learning things "just-in-case". What it comes to following procedures, digital immigrants like standardization and following set guidelines. They also prefer not to emphasize rewarding or gratification. (Jukes & Dosaj, 2005.)

3.4   Comparison

The fact that digital immigrants have not lived surrounded by IS technology their whole lives does not mean that their skills in IS technology are inferior compared to digital natives, but suggests that they use the technology in different fashion.

Information processing ways are one of the major differences between digital natives and immigrants. Natives retrieve needed information quickly and process it with their peers. For instance digital immigrants prefer communicating via e-mail as digital natives prefer to use more fast flowing methods such as instant messaging. When comparing telephone use, digital immigrants prefer phone calls and speaking whereas digital natives choose texting. (Prensky, 2001)

By a larger view the difference in general use of Internet is an important factor to notice; digital immigrants can be considered as users and sharers of online content whereas digital natives are the creators of said content. The reason for this might be that digital natives possess greater skills in using the online tools, such as uploading videos to Youtube, building websites or handling the functions of Twitter. (Vodanovich et al., 2010)

There is also a difference on how these two user groups learn to use new technologies and appliances. Digital natives try out new technologies and through trial and error grow their knowledge and skills on the said technology whereas digital immigrants tend to read through manuals and instructions before having ago with the system itself. (Günther, 2007)

As compared before, technology usage can be compared to languages and as it is possible for older generations to learn new languages so it is possible them to learn to use new technology. The difference is that they have not had the same opportunity to absorb the language from infancy as the younger generations. (Deal et al., 2010) Prensky (2001) states that as their name refers, digital natives speak the digital language fluently and digital immigrants have an accent since their digital skills' learning process has started later in their lives.

The problems that occur from the difference of digital natives and immigrants are for instance that in the educational world digital immigrants are usually teaching the digital natives. The differences and issues in educational world is the subject that sparked up Prensky's (2001) article. To natives the preceding generation's ways of teaching are too outdated, simple, slow and boring (Prensky, 2001).

Another difference between digital immigrants and natives is how they see technology as an identity builder. Technology such as mobile phones, the Internet or emails are just mere tools for digital immigrants to help them get over their everyday lives when digital natives see them as extensions to their self-image and identity. (Cunningham, 2007.)

A comparative summary chart of digital natives' and immigrants' behavioral characteristics is presented below in Table 3.

Table 3 Comparison of digital natives' and digital immigrants' key behavioral characteristics (Jukes & Dosaj, 2005)

Type	Digital immigrants' characteristics	Digital natives' characteristics
Information	Slow pace and controlled release	Quick pace and multiple simultaneous sources
Information flow	Linear, logical and sequential	Hyperlinked multimedia information
Media	Text over pictures, sounds and video	Pictures, sounds and videos over text
Task processing	Single task at a time	Parallel processing and multitasking
Viewpoint on work	Independent	Interaction and networking with others
Viewpoint on training	Just-in-case	Just-in-time and if needed
Viewpoint on guidelines and standards	Prefer to follow guidelines and support standards	Prefer relevant, fun and instantly useful things
Viewpoint on gratification and rewards	Deferred gratification and rewards	Instant gratification and rewards

3.5 Criticism

Prensky's (2001) way to divide people to two distinct and separate groups by their birth year has justly turned some heads and raised criticism. (Bennett, Maton, & Kervin, 2008; Hargittai, 2010; Helsper & Eynon, 2010; Lippincott, 2012; Margaryan, Littlejohn, & Vojt, 2011; Selwyn, 2009; Smith, 2012; Thinyane, 2010) General main critique is that there is not enough empirical relevant research results to support Prensky's (2001) claims on the division of generations (Bennett et al., 2008). Some have argued on the consistency of Prensky's (2001) theory since there are significant differences in technology skills between individuals in a single generation (Margaryan et al., 2011). On the other hand some critical researchers note that representatives of a single generation do have some consistent characteristics which are not represented in other generations (Lippincott, 2012). Studies by Thinyane (2010) and Selwyn (2009) did not support the theory that all people that fit to the age of a digital native are as skillful with technology as the digital native theory suggests. These results suggest that not all today's student were naturally born digital native.

There have also been some counter acts to these criticisms. Smith (2012) presents that although the theory of digital division has its flaws, all of its claims about the millennial generation and digital natives should not be knocked over. According to Helsper and Eynon (2010) by actively interacting with information and communication technologies it is possible for older generations to become digital natives. Smith (2012) proposes that future research that focuses on digital natives should improve the present knowledge and make it more accurate and subject specific. Technology has nowadays spread all around us and it is constantly becoming more and more common. Living and operating inside your own home has not changed significantly during recent decades but now IT and its gadgets and services are creeping to our everyday lives whether you are born before or after the year 1980. This calls for some specification on how different people would react to the change. Because of Prensky's (2001) and Tapscott's (2009) original ideas and theories have been questioned and modified fairly, they can be used as guidelines and must not be taken as absolute truths.

4 SWITCHING BEHAVIOR

This chapter examines switching behavior. First the origins of switching behavior are presented and followed by the PPM model and the theory behind it. The model is essential for the study since it is used as a base for the empirical part of this study and in answering the research questions.

4.1 Switching behavior

Switching is changing an entity to another that fulfills similar needs (Bansal et al., 2005). The incumbent entity, where the switching originates, is a switch subject and the substitute entity, which acts as a destination for the switching, is the switching object. In the context of moving from a traditional home that does not utilize smart technologies to a smart housing solution, switching subject is the non-technology home and the new home with smart solutions acts as a switching object.

4.2 Migration theory

Boyle (2014) defines migration as an action where a person moves between two environments for a specific amount of time. This results into a permanent or temporary change of living according to Lee (1966). When people leave their original environment forever the migration is permanent. When talking temporary migration the people mean to return to their original environment after a certain period of time. Migration can be either voluntary or involuntary. (Jackson, 1986) In this thesis migration stands for moving from a traditional housing to a novel solution where smart housing technologies are implemented. Whereas migration theory has already been used in studies which examined customers' and/or users' switching behavior when switching between technologies (see e.g. Chang et al., 2014; Hou et al., 2014; Hou et al., 2011) implementing migration theory to this thesis and its smart housing subject is logical and justified. When switching to a smart technology home from a more traditional home there is two types of migration taking place: the physical movement from a place to another and the more intangible type where traditional home appliances and functions are switched to a more digital technology based and supported.

4.3 Push-Pull-Mooring theory

PPM model is a model of migration which foundations are established by Ravenstein (1885) by presenting the push-pull factors of the model. Jackson (1986) presents that PPM model in its modified form is the most important theoretical contribution in the migration literature.

The PPM paradigm states that there are factors that affect the migrants' decisions to move from one location to another. Some of them encourage, in other words pushes, the individual to move away from the switching subject. Some factors attract, in other worlds pull, the individual towards the potential switching object. (Lewis, 1982; Moon, 1995) Mooring effects are factors that reflect from the individuals' lifestyles and cultural background. They act as intervening variables which may drive or inhibit the migration process. (Bansal et al., 2005; Moon, 1995) As an example Chang et al. (2014) use alternatives attractiveness as a pull factor and dissatisfaction and regret with the switching subject as push factors. An example of a mooring factor is subjective norms, which represents the social environment of potential switcher, and its effect on switching behavior.

Apart from migration studies the PPM model has also been applied to other areas of study, for example consumer behavior and marketing. The PPM model has also been applied to IS studies where the switching process has not necessary been between two tangible products (Hou et al., 2011; Hsieh et al., 2012). A modern model based on PPM is built by Bansal et al. (2005) and it presents a unifying framework for consumer service switching behavior. The model can be seen in Figure 1 below. In this study the model is applied in the empirical part to provide the general structure for the choice of interview themes. Additional emerging themes are expected and kept track of.

Figure 1 The PPM model of service switching (re-drawn from Bansal et al., 2005, 101)

4.3.1   Push effects

According to Stimson and Minnery (1998) push effects are the determinants that affect the individual's motivation to leave their place of origin. Moon (1995) presents push effects as factors that that have negative influence to the quality of life in the place of origin and therefore push individuals towards switching. Satisfaction, quality, value, trust, commitment and price perceptions are push factors (Bansal et al., 2005).

According to Boyle et al. (2014) quality as in "quality of life" refers to the physical and economic factors of the origin. In the area of service, quality is seen as the comparison that the service consumers make on how the service performed and has fulfilled their expectations and needs (Grönroos, 1984; Lehtinen & Lehtinen, 1982; Lewis & Booms, 1983; Parasuraman, Zeithaml & Berry, 2002; Parasuraman, Zeithaml & Berry, 1985). In the context of smart housing, low quality of former living environment is a potential push factor.

In migration studies satisfaction refers to the individuals' satisfaction or dissatisfaction towards the place of origin (De Jong & Fawcett, 1981). Day (1984) defines consumer satisfaction that it is "a post choice evaluative judgment concerning a specific purchase selection". In the context of smart housing, low satisfaction means that the former home has not fulfilled the needs of the inhabitant. Therefore low satisfaction is theorized as a push factor.

Value is the tradeoff which occurs between quality and sacrifice (Zeithaml, 1988). In other words value refers to the feeling that the offered benefits of an item are in some extent greater than the costs. According to Sirdeshmukh, Singh and Sabol (2002) value is a straight determinant of service switching. The lack of perceived value pushes the individual towards switching to a new service or product.

Trust represents the individuals' relations with others in migration discipline, for example in the context of services the trust that the individual perceived towards the service provider to fulfill the promises (Morgan & Hunt, 1994; Richmond, 1988). Trust is also connected to commitment which leads to repurchase intentions (Hennig-Thurau, Langer, & Hansen, 2001; Sharma & Patterson, 2000). Commitment represents the belief that relationship with a service or product provider is worth to uphold (Sharma & Patterson, 2000). Thus trust and commitment are positioned as push factors (Bansal et al., 2005).

In migration research economics are a crucial factor and therefore pricing issues must be noted in the migration models. According to Dabholkar and Walls (1999) the probability of switching to a new service provider is higher if the current provider's prices are perceived too high.

4.3.2   Pull effects

According to Moon (1995) pull factors are "positive factors drawing prospective migrants to the destination". Dorigo and Tobler (1983) present pull factors as "attributes of distant places that make them appealing". Pull factors are similar to

push factors in the way that they are not the immigrant's characteristics but the attributes of the switching object.

Alternatives attractiveness is the only existing variable in the service-switching literature that has been noted. Alternatives attractiveness refers to the superior characteristics of competing service provider's service which influence the consumers' intentions to switch. (Bansal et al., 2005; Jones, Mothersbaugh, & Beatty, 2000) According to Bendapudi and Berry (1997) alternative's attractiveness refers to the positive expectancy on replacing service carrier's reputation, image and service quality. If a company's service or product is significantly different from competitors' and it is hard to directly compare them with each other, customers tend to remain with their existing provider (Bendapudi & Berry, 1997).

4.3.3 Mooring effects

The PPM model does not entirely explain the consumer behavior of migration or switching. Even when push and pull factors are significant the individual might not, however, migrate. Lee (1966) states that the situational and contextual constraints have influence to the migration decision also. Gardner (1981) states that these factors are mostly specific by individual although similar can be found in large numbers of individuals. Mooring effects includes such variables as switching costs, subjective norms, in other words social influences, attitudes towards switching process itself, past behavior and variety-seeking tendencies (Bansal et al., 2005). Gardner (1981) and Lee (1966) focus on the costs that occur when migrating but the other intangible costs such as emotional costs, time, effort, and ability have been studied by several other researchers (Bolton, Kannan, & Bramlett, 2000; De Jong & Fawcett, 1981; Jones et al., 2000). In their study Kim, Park and Jeong (2004) divide switching costs into loss costs that depicted the losses of leaving something to the old provider, adaptation costs which mean the loss of resources caused from learning new and move-in costs which refer to the economic costs involved when switching service providers. It is also noted that individuals' attitude towards migration has influence towards the migration decision (Desbarats, 1983). People with positive attitude towards migrating are more likely to migrate and consumers' switching intentions are affected by attitude towards switching behavior (Bansal & Taylor, 1999; Bansal & Taylor, 2002).

Subjective norms, which refer to person's habits of behavior that are modified by the environment's social pressure to behave in a certain manner, are also a noteworthy factor when studying the mooring effects of migration and switching (Ajzen & Fishbein, 1980; Desbarats, 1983). More recent study by Bansal and Taylor (1999) suggests that subjective norms have effect to consumers' attitude toward switching and their switching intentions.

As the factors in the individual's environment so do the personal factors act as facilitators or inhibitors of migration (Gardner, 1981; Lee, 1966). Bansal et al. (2005) add past behavior and the habit to seek variety to the model as mooring variables. As push and pull factors may appear similar in a group of people, the decision to migrate may differ due to the family's moving habits and culture (Jackson, 1986). In the migration literature variety seeking has not occurred as is

but multiple moves and differing choice sets are noted in the academic literature to have their effect on switching behavior. Bansal et al. (2005) speculate that switching intentions are positively related to the consumer's past switching behavior and their habit of seeking varying experiences. Also Ganesh, Arnold and Reynolds (2000) suggest that consumers' past switching behaviors influence their behavioral intentions.

As noted before, mooring factors affect the effect of other factors to the actual migration decisions (Lee, 1966). This means that even though push and pull factors are relatively strong and would support making a positive switching decision, the individual may still remain with their current service provider because of the power of mooring variables. For example the switching costs are too high or the significant other of said individual does not want to switch. According to Bansal et al. (2005) the relation between mooring and pull factors are not similar.

4.4   Switching barriers

As there are factors that either strengthen or reduce switching intention, there are several factors that affect the switching process as switching barriers. Fornell (1992) describes switching barriers as factors that affect negatively to individual's switching behavior regardless of dissatisfaction towards the individual's existing service. These barriers can be financial, social and psychological burdens that prevent switching to a new service provider. The strength of switching barriers is related to the magnitude of how the individual is forced to remain with one's existing service provider. The higher the switching barrier, the more likely the customer is forced to remain to his or hers existing service provider or product manufacturer. (Kim et al., 2004.)

4.5   Switching in information systems studies

Formerly the research regarding immigration and switching behavior has discussed mainly said theories in the area of consumer behavior and marketing (see e. g. Bansal et al., 2005; Boyle, 2014). During the recent years interest towards switching research and more specifically switching in the area of IS has grown. The areas which these studies have explored range from for example social networking sites and games (Chang et al., 2014; Hsieh et al., 2012; Wu, Tao, Li, Wang, & Chiu, 2014; Xu, Li, Heikkilä, & Liu, 2013) to cloud services (Bhattacherjee & Park, 2014; Park & Ryoo, 2013) and smartphone switching and mobile shopping (Lai, Debbarma, & Ulhas, 2012; Lin & Huang, 2014; Yen & Hsu, 2015).

There are studies that implement the PPM model to the context of IS and studies that present their own model for technology switching behavior when switching to a disruptive technology from an incumbent one (Fan & Suh, 2014; Hsieh et al., 2012). In Table 4 below found studies regarding IS switching behavior are listed. These studies examine the predictors that affect users' switching behavior from an incumbent product or a service to substitute product or service.

These predictors are listed each respectively and marked in parentheses if they have a positive or a negative effect to the switching intention of users. Also the research context of each study is specified. Regardless of the context switching costs are perceived as one of the major predictors that affect negatively to the probability of switching. Repetitive significant negative predictors are satisfaction with prior IT and the subjective norm. Other negative factors are noted in one or two studies. From the factors that affect positively to switching process the more common are alternative attractiveness, relative advantage and dissatisfaction with prior IT.

IS is multidisciplinary area and each environment where IS are embedded has its variables and things that need to be observed individually. For example security is an ongoing and significant subject. In some cases security can be an issue and a factor that affects negatively to switching decisions such as in cloud services where the IS's security could be breached and the user's property accessed (Bhattacherjee & Park, 2014). In some cases the same security factor can be seen as positive switching predictor as the IT solution itself offers increased security. In Scheiner's and Hess's (2015) study offered increased data security drives switching in the environment of instant messaging applications. Both studies by Ye, Seo, Desouza, Sangareddy and Jha (2006), and Ye and Potter (2011) observe web browser switching and notice also that in this matter security drive the users' switching towards alternative service provider. As this thesis discusses the switching predictors in living environment, increased and automated home security is expected to be a very positive switching predictor regardless of consumers' characteristics.

Similar contradictory factor as security is the effect of social relations and subjective norms. In some cases subjective norm and the effect from individual's social surrounding can be positive predictor of switching, e. g. Xu's, Li's, Heikkilä's and Liu's (2013) study on switching between social network games. In other cases social factors and subjective norms can be anchoring and affecting switching negatively such as in studies by Hou et al. (2014), which examined switching from massive multiplayer game world to another.

Because of inconsistencies such as above examples, this thesis with its subject area of smart homes and switching behavior is justifiable and needs more attention. Also the nature of living environments having been relatively static and free of high-end technology, it is important to examine what affects the consumers switching behavior when introducing IT to formerly traditional environment, such as one's home.

Table 4 Predictors of switching

Previous studies	Research context	Predictors of switching		
		Incumbent product/service	Substitute product/service	Other
Bhattacherjee et al. (2012)	IT generally	Satisfaction with prior IT (-)	Relative advantage (+)	Personal innovativeness (+)
Bhattacherjee and Park (2014)	Cloud services	Dissatisfaction with prior IT (+) Security concerns (-)	Relative Advantage (+) Expected omnipresence (+)	Switching costs (-)
Chang et al. (2014)	Social network sites	Regret with prior IT (+) Dissatisfaction with prior IT (+)	Alternative attractiveness (+)	Switching costs (-)
Fan and Suh (2014)	Mobile phones	Dissatisfaction with prior IT (+) Disconfirmation of prior IT (+)	Expectation with new IT (+)	-
Hou et al. (2011)	massively multiplayer online games	-	Alternative attractiveness (+)	Switching costs (-) Social relationship (-) Need for variety (+) Prior switching experience (+)
Hsieh et al. (2012)	Social network sites	Weak connection (-) Anxiety to use (-)	Relative enjoyment (+) Relative usefulness (+) Relative ease of use (+)	Switching costs (-) Past experience (-)
Kim, Shin and Lee (2006)	Email service providers	Satisfaction with prior IT (-)	Alternative attractiveness (+)	-
Lai et al. (2012)	Mobile shopping	Inconvenience of prior service (+)	Alternative attractiveness (+) Low perceived trust (-) Low perceived security (-) Low perceived privacy (-)	Switching costs (-)

Table 4 continues

Lin and Huang (2014)	Mobile shopping	Disconfirmation of prior IT (+) Dissatisfaction of prior IT (+)	Relative advantage (+)	Status quo bias/Inertia (-) Switching Costs (-) Network effect (-)
Park and Ryoo (2013)	Cloud services	-	Expected switching benefits (+)	Switching costs (-)
Schreiner and Hess (2015)	Instant messaging services	Dissatisfaction with prior IT (+)	Relative privacy (+)	Switching costs (-) Peer influence (+)
Xu et al. (2013)	Social network games	Satisfaction with prior IT (-)	Alternative attractiveness (+)	Subjective norm (+) Need for variety (+)
Chen and Hiit (2002)	Online brokerage service	Prior usage pattern (-)	Alternative attractiveness (+)	-
Zengyan, Yinping and Lim (2009)	Social network service	Dissatisfaction with prior IT (+)	Alternative attractiveness (+)	Peer influence (+) Switching costs (-)
Kim and Son (2009)	Online portal service	Satisfaction with prior IT (-)	Perceived usefulness (+)	Switching costs (-)
Ranganathan, Seo and Babad (2006)	Mobile digital services	Prior usage (-) Loyalty (-) Amount of subscribed services (-)	-	-
Ye et al. (2006); Ye and Potter (2011)	Web browsers	Satisfaction with prior IT (-)	Relative advantage (+) Relative ease of use (+) Relative security (+)	Switching costs (-) Subjective norm (-) Habit (-)
Bansal et al. (2005)	Auto-repair and hairstyling services	Satisfaction with prior IT (-) Price perceptions (+) Trust with prior IT (-) Commitment to prior IT (-)	Alternative attractiveness (+)	Attitude toward switching (-) Subjective norm (-) Switching costs (-) Prior switching behavior (+) Variety seeking propensity (-)

(to be continued)

Table 4 continues

Ganesh, Arnold and Reynolds (2000)	Online banking services	-	-	Individual traits
Keaveney and Parthasarathy (2001)	Online portal services	Amount of service usage (-)	-	Informational influence (+) Risk-taking habits (+)
Polites and Karahanna (2012)	Google Docs	Prior system habit (+) Switching costs (-) Status quo bias/Inertia (-)	Relative advantage (+) Relative ease of use (+) Subjective norm (+)	Propensity to resist change (+) Personal innovativeness (+) Google docs experience(+) Self-efficacy (+)

5 RESEARCH METHODOLOGY

This chapter presents research methodology and the empirical section of the study. It covers the research's objectives, problems and used methods in detail. It aims to give a clear image on how the new knowledge is created, and to examine the reasons why each method and technique was chosen. The chosen scientific approach, data collecting methods, and analyzing techniques are described in order to bring out the different stages of this study. Interview, its outline and demographics are presented to give clear picture of the data collection method.

5.1 Research objectives

The objective of this study is to find out what does two different age groups think about switching their present living environment into smart home environment. The first age group includes generations born between 1946-1980 (Baby boomers and the generation X) and the second the generation born between 1980 and 1997, the generation Y or the Millennials (Tapscott, 2009). As it was covered in the literature review, some researchers have claimed that people who belong into these two groups process and use technology in a differing ways (Prensky, 2001). This thesis aims to examine if these assumptions about birth year's effects on technology acceptance and use occur also when switching from a traditional environment to a more technology implemented one. These claims about digital natives and immigrants are nevertheless based on assumptions and they cannot be taken as absolute truths. Their empirical evidence is insufficient and there is even conflicting evidence against them. (Bennett et al., 2008; Margaryan et al., 2011; Thinyane, 2010) With common sense it is still rather obvious that the younger generation that has grown amongst technology has learned to use it more efficiently but it is not necessarily as black and white that older consumers tend to find latest technology less appealing compared to individuals from the younger generations.

Another study's objective is to bring new information about the consumers' switching behavior in a situation when IT comes to an environment that has been relatively static such as home and living environment. This may shed some new light also on the digital native and digital immigrant discussion.

Right now the digital natives or the generation Y are 18-36 years old. This means that a significant amount of them are either already or about to settle down for longer time periods what it comes to their living environments. As smart house technology is becoming more and more common, it is necessary to start mapping the factors and determinants that affect the switching intentions and interests. Based on the differences in reactions and opinions amongst these two age groups it is possible to design optimal smart home architecture and technology implements to cover each group's needs.

5.2   Past research

Past research about the differences of digital natives and immigrants has usually been based on the generalizations claims by Tapscott (2009) and Prensky (2001). The vagueness of these claims can be seen in for example Tapscott's (2009) research that states that digital immigrants work and process multiple stimuli while watching television. There is no proof that the natives' working efficiency maintains its level when multitasking. More recent study from Vodanovich et al. (2010) still supports the idea of dividing generations digitally by stating that digital natives do not always resist technology, where as digital immigrants do in some extent. Nevertheless there have also been several studies that emphasize the flaws in the theory. For example Helsper and Eynon (2010) point out that digital immigrants are able to learn to become more native and the gap between these two technology user groups can be closed. Thinyane (2010) and Margaryan et al. (2011) prove in their studies that age is only a single factor amongst others to affect individual's technology use, socioeconomic factors being also significant.

Past research about switching behavior has examined switching from marketing and economic viewpoints, mostly consumers switching from a service to another, but lately switching behavior research has raised interest also in the IS area. Most of these found IS switching studies were quantitative in nature and they focused on purely intangible IS products and services, such as cloud computing and social network sites (Bhattacherjee & Park, 2014; Hsieh et al., 2012; Park & Ryoo, 2013; Polites & Karahanna, 2012). What it comes to models and frameworks the dominant model in migration and switching literature is the PPM model by Bansal et al. (2005).

Smart houses are less researched area what it comes to their use. There are studies about smart home technologies and how to implement them in several ways, see for example Gomez & Paradells (2010) and Ricquebourg et al. (2006). Studies that examine the consumers' side and use of smart homes are few and far between. Koskela and Väänänen-Vainio-Mattila (2004) examine the use of control interfaces and evaluate them. Gill, Yang, Yao and Lu (2009), and Brush et al. (2011) examine slowing barriers that affect home automation adoption. Close to this thesis's subject comes Demiris's, Hensel's, Skubic's and Rantz's (2008) research on elders' perceived advantages and concerns on smart home applications.

This past research shows that each research area is incomplete what it comes to their respective subjects. The discussion on whether or not the technology usage and adoption habits of digital natives and digital immigrants differentiate as Prensky (2001) and Tapscott (2009) claim has remained unresolved. This study widens the discussion to cover also the differences in each groups' switching behavior. In addition to understanding how these two user groups adopt and use technology it is necessary to find out how their personal characteristics affect their process of switching intention development.

As most of the studies regarding switching behavior in the context of IS are quantitative in nature it is necessary to examine also the qualitative aspects. This study intends to find out how switching behavior is developed in a context where

the switching subject is currently relatively high-end technology free and the switching object introduces new technological solutions to that context. This is to help understand IS consumers' switching behavior regarding other future's novel technologies.

The subject of smart homes being an imminent norm of the near future and being soon available for the consumer masses it is important to understand more of this subject than just from technological viewpoint. To find out more of the future's possible smart home mass adoption it is necessary to examine the attitudes and feelings that potential users have on these novel solutions. To widen and find out new information in addition to past research this study is conducted with qualitative nature which helps to understand real life and its phenomena (Hirsjärvi, Remes, & Sajavaara, 1997).

5.3   Research approach

This study is designed qualitative as its goal is to provide comprehensive understanding of the differences between digital natives' and digital immigrants' behavior what it comes to switching to smart home environments. It is typical for qualitative research to examine real life in comprehensive way as possible and that the complexity of real life is being observed (Hirsjärvi et al., 1997). Qualitative research is to help researchers to understand and create new information about people and their social and cultural environments as phenomena (Järvinen & Järvinen, 2011; Myers, 1997). In qualitative studies the researchers can and must keep the subject as a whole and examine it in its context. A general feature of qualitative research is that the data collecting is comprehensive, versatile and made in natural environment by interpreting the research subjects' behavior, voice and speech. (Hirsjärvi et al., 1997) By observing and analyzing spoken data it is more efficient to find out new information compared to quantitative research, where textual data is more common (Myers, 1997). By qualitative study and the characteristics researchers are able to understand people, their social, and cultural contexts better (Kaplan & Maxwell, 2005). In the context of smart home living environments which are relatively novel concept, it is relevant to find out the base for new information and qualitative means are functional for this purpose. It is more efficient to map potential IS users' attitude towards new technologies by interviewing them than by conducting large scale surveys where the data collection situation is static and inadaptive.

In his article on qualitative research Myers (1997) presents three philosophical approaches to explain qualitative research more fundamentally it being either positivist, interpretive, or critical. In an attempt to increase the knowledge on a phenomenon, positivist studies assume that reality is objectively given it can be described by measurements. Therefore positivist researches test theories by setting hypotheses and finding evidence to support set hypotheses. (Orlikowski & Baroudi, 1991) As their name state, interpretative studies tend to find out explanations to phenomena through interpreting peoples' language, consciousness and meanings. Knowledge is built by analyzing the data gained from the delivery

of target people and trying to understand the meanings that people assign to certain phenomena. (Klein & Myers, 1999; Myers, 1997) Critical studies' tend to question the conceptual and theoretical assumptions of former studies. With people being variables the need for constant testing of former theories is seen necessary to understand every aspect of each environment and research concept. (Myers, 1997)

Philosophically this study is being treated as an interpretative and somewhat positivist study. Smart housing user research and the knowledge on it is still at its infancy and it is necessary to find out preliminary information about potential consumers' behavior, opinions, and feelings. To achieve this it is necessary to gather information from the consumers themselves and this requires interpretation. Quantitative research would generate large amount of data, but that data would be difficult to extensively and flexibly interpret in order to examine the genuine meanings and behavior behind the switching phenomena. The partial positivist nature of this study appears as the hypotheses are drawn from existing switching behavior literature and framework. These assumptions are tested in order to create information that covers this particular environment of smart home living environments.

Based on the criticism (see e.g. Hargittai, 2010; Helsper & Eynon, 2010; Lippincott, 2012; Smith, 2012) and the fact that the discussion is still ongoing, earlier quantitative studies and discussion on digital natives have not brought satisfying or consistent results. Constructing valid and reliable survey questions requires observation before the actual data collection and analyzation, which is typical for quantitative research methods (Metsämuuronen, 2000). This study performs that observation and the aim is not just to examine existing theories but to adapt them into smart home living environments context and find out new information about the subject in this new environment of switching. Based on the findings of this study the possible following quantitative research on the subject should have better starting point as the necessary preliminary qualitative research has already been done. Wanting to find out more about the real attitudes and feelings of target subject groups, the digital natives and the digital immigrants, this study uses qualitative methods.

IS can be implemented in almost every aspect of life. Therefore each IS related environment can be different and needs case-specific information to be mapped through qualitative research. Because smart home environment offers its own variables this thesis is processed as a partial case study, which according to Yin (2013) is suitable for studying phenomenon within real-life connections. A typical case study examines a single event or occurrence or a group of these, where the focus is on several processes. In case study single cases are observed by a data collection method. In this study the groups of digital natives and digital immigrants represent the cases and the data collection method is individual interviews.

5.4   Research questions

The goal is to combine existing knowledge on presented subjects to create comprehension about the future smart home consuming. By combining existing theories and using collected data, digital natives and digital immigrants are compared in order to find the differences between the behaviors of these two groups of consumers. In other words, this study aims to answer the following research question:

- How do switching behavior determinants differ from one another when comparing digital immigrants' and digital natives' switching determinants in the context of switching from traditional living environment to smart technology assisted environment?

In order to answer presented research question, two sub questions are presented to establish base for comparison. These sub questions are:

- What are the most important switching determinants of digital immigrants' and how do they affect their switching intention in the context of switching from traditional living environment to smart technology assisted environment?
- What are the most important switching determinants of digital natives' and how do they affect their switching intention in the context of switching from traditional living environment to smart technology assisted environment.

5.5   Data collection methods and techniques

Information and data was collected via two techniques for this study. Theories about switching behavior, service dominant logic, and digital natives and digital immigrants are presented and discussed through literature review. This study's primary new data was gathered via semi-structured interviews. To gather new information as much and extensive as possible the interview was constructed thematically.

When there is no clear comprehension about the research subject or what kind of answers will be found out or the answer are based on individuals' own feelings, thoughts and experience, thematic interview is a reasonable method. Thematic interviews are based on the factor that the interviewees know something about subject so that they make up feelings and thoughts. (Hirsjärvi & Hurme, 2011) Research subject being generally switching behavior when bringing IT to living environments, it is familiar to all individuals.

When examining such novel area as smart homes an interview is a good method since in the interview situation the interviewer can ask additional questions without remarkably breaking the flow. Also the pace and the order of the questions can be altered if needed.

On the other hand interviewees can find the interview event awkward and the answers can remain insufficient. Also the interviewee might answer in a way he or she thinks the interviewer wants him or her to answer. Another issue with interviews is that what they win in the scalability of the questions and quality and depth of the answers, they lose on the quantity of answers. Interviews are a lot time consuming and cumbersome for the researcher than for example surveys. (Hirsjärvi & Hurme, 2011)

The interview in this study was a semi-structured interview. In semi-structured interviews the general subject outline are somewhat identical for all and the questions can be pre-planned. There is, however, the possibility for the interviewer to change the order and alter the questions' form in necessary. (Järvinen & Järvinen, 2011; Myers & Newman, 2007.)

5.5.1 Interview thematic

Interview's themes were raised from the literature review as following. The themes were (1) push factors, (2) pull factors, (3) mooring factors, (4) switching intentions and (5) switching behavior. The first theme covered sub-themes quality, satisfaction, value, trust and commitment. The interviewees were asked to judge and review their present living environment's quality, evaluate their satisfaction towards it and if it fulfilled their needs, tell how safe they felt living there, if they had developed any particular feelings or commitment towards the environment, and whether they felt that their living expenses were high. After this theme the presentation about smart home solution examples was shown.

The second theme covered the sub-theme alternatives attractiveness. This was examined through questions whether the individual would see life more enjoyable or easier if they would start using smart home technology in their living environment. Also the interest towards said technology was enquired.

The third theme covered the sub-themes general attitude towards switching, subjective norms, switching costs, prior switching behavior and variety seeking. The interviewees were asked to describe their general attitude towards switching their living environment (whether it was no big deal or cumbersome etc.), to describe how they thought their social contacts would act if they changed their living environment with smart technology, whether they find learning new things cumbersome or harmful, describe their former moving/switching experiences, and whether they see smart home technology and technology in general interesting.

The last two themes were to bring up more general information about the interviewees' attitude and future switching behavior. In the fourth theme the interviewees were asked to evaluate how interested they would be in taking smart home technology to their next living environment and what things affected their decisions to change their living environments, both negatively and positively. In the final theme they were asked to estimate how likely they would change their present living environment drastically in the near future.

5.5.2 Interview outline

The interview's question structure contained 45 questions. They were composed to represent the five main themes: push factors, pull factors, mooring factors, switching intention, and switching behavior. First three of these included the 12 service switching determinants presented in Figure 1 according to Bansal et al. (2005). The questions themselves were written based on former survey studies and modified to suit the semi-structured form of the interview and the interviewees did not know what kind of theme each question represented. To get genuine feelings and therefore information on the subject it was emphasized to the interviewees to answer as truly and out of impulse as possible. The questions were asked in such manner that the interviewees would answer on their own behalf, not by stepping onto someone other's place or answering "the right answers". Reasoning and justification to yes or no answers were encouraged.

After the questions on the push factors theme the interviewees were shown an animated presentation about a fictional day in a smart home found from a website, owned by a company that operates in smart home business (Loxone, 2014). A screenshot of this animation and a link to it are presented in appendix 3. The presentation included several basic solutions that could be in an individual's smart home, such as automated lighting, security features and heating. The interviewer narrated and described the example scenario. It was emphasized to the interviewees that the smart home solutions shown were just a combination of examples and they were fully permissive and modifiable to one's liking. Presented example scenario was chosen because of its simple design both graphically and smart home solution wise. Thus it was comprehensible by both interviewee groups.

Each interview lasted approximately from 20 to 30 minutes. The interviews' audio were recorded in order to transcript and later analyze them efficiently. During the interview the interviewer made some notes to improve the data quality. The interview handout and the questions asked in the interview can be seen in Finnish in appendix 1 and appendix 2.

5.5.3 Interviewees

There were total of 22 participants in the interview. 11 of them were born before the year 1980 so they were considered as theoretical digital immigrants according to Tapscott's (2009) and Prensky's (2001) studies. The rest 11 of them were born after the year 1980 being considered theoretical digital natives according to Tapscott (2009) and Prensky (2001). From now on the theoretical digital immigrants are referred as digital immigrants or just 'immigrants' and the theoretical digital natives are referred as digital natives or 'natives'. The generation born after year 1997 was left out since there is no relevant research data on their behavior. All of the interviewees were Finnish and the interviews were conducted in Finnish. The interviews were processed anonymously. The demographic information about the interviewees can be seen in Table 5.

Table 5 Interviewee information

Year of birth	Place of living	Gender	Theoretical digital nativity	Time in current environment	Times moved
1946	Jokela	Male	Immigrant	36 years	7
1951	Nurmijärvi	Male	Immigrant	25 years	5
1952	Nurmijärvi	Female	Immigrant	26 years	3
1954	Hyvinkää	Male	Immigrant	61 years	1
1956	Hyvinkää	Female	Immigrant	24 years	5
1958	Helsinki	Male	Immigrant	13 years	6
1960	Hyvinkää	Female	Immigrant	15 years	20
1972	Jokela	Male	Immigrant	13 years	3
1975	Jokela	Female	Immigrant	14 years	3
1977	Hyvinkää	Female	Immigrant	6 years	5
1979	Hyvinkää	Male	Immigrant	5 years	4
1984	Nurmijärvi	Male	Native	2,5 years	5
1984	Nurmijärvi	Female	Native	1,5 years	12
1985	Jyväskylä	Male	Native	4 years	6
1988	Jyväskylä	Female	Native	1 month	10
1989	Jyväskylä	Male	Native	8 months	11
1989	Jyväskylä	Male	Native	6 months	7
1990	Jyväskylä	Male	Native	3 weeks	4
1990	Jyväskylä	Female	Native	3 years	10
1991	Jyväskylä	Female	Native	5 months	7
1991	Jyväskylä	Male	Native	1,5 years	4
1993	Jyväskylä	Female	Native	1 month	8

5.6   Data analysis

During the interviews the interviewer took preliminary notes as needed. These notes were mainly brief markups on for example interviewees' behavior and gestures that would be more difficult to decipher later on. After each interview the audio recordings were transcribed into text using the interview question sheet as a template. Altogether the transcription generated 142 pages of text.

After the transcription the contents were read through to get rough impression on the repetitive themes. After this the each interview was transported into Zotero system. There each theme and sub-theme (described in section 5.5.2) were distributed into distinctive notes and given tags according to whether they were digital immigrant's or digital native's answers. An example can be seen in Figure 2.

Each answer was highlighted with distinctive colors to indicate whether that answer was positive, negative or neutral. An example can be seen in Figure 3. After this each note was marked with a tag based on whether the overview of

the answer groups was positive, negative or neutral. When there was a distinctive actor mentioned in an answer that did not appear on Bansal, Taylor and James's (2005) PPM model, a tag was either generated or picked from previous generated ones to represent other possible emerging themes. For example as an interviewee mentioned being interested in the enhanced security benefits that the smart home technologies offer, a tag was generated to represent that factor. If other interviewees expressed similar opinions that particular answer was tagged with 'enhanced security' to strengthen the tags visibility. Eventually these generated tagged themes and notes were emerged in to existing themes since they were closely related. For example multiple interviewees were interested in the importance of ease of use, enhanced security, and the reduction of stress, but they can be treated as a sub-factor to alternative attractiveness. Similarly potential loss of privacy was recurrent new theme but it is seen as a switching costs. All in all there were 11 recurring themes that are presented in the results.

After the answers were coded and unified they were combined by sub-themes and whether the interviewee was theoretical digital native or immigrant. The next step was to analyze the answers by groups to distinguish repetitive results in both groups. The results were compared to the theoretic assumptions by Prensky (2001) and Tapscott (2009). This was to find out whether the results supported or conflict the existing theories. The last part was to compare both groups' results theme by theme and sub-theme by sub-theme to identify possible cohesion and differences.
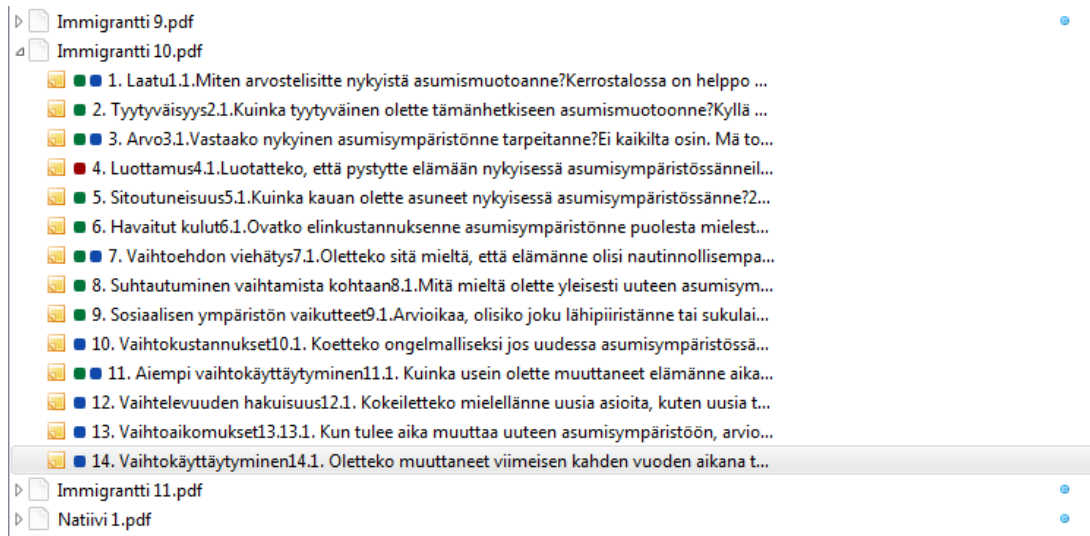
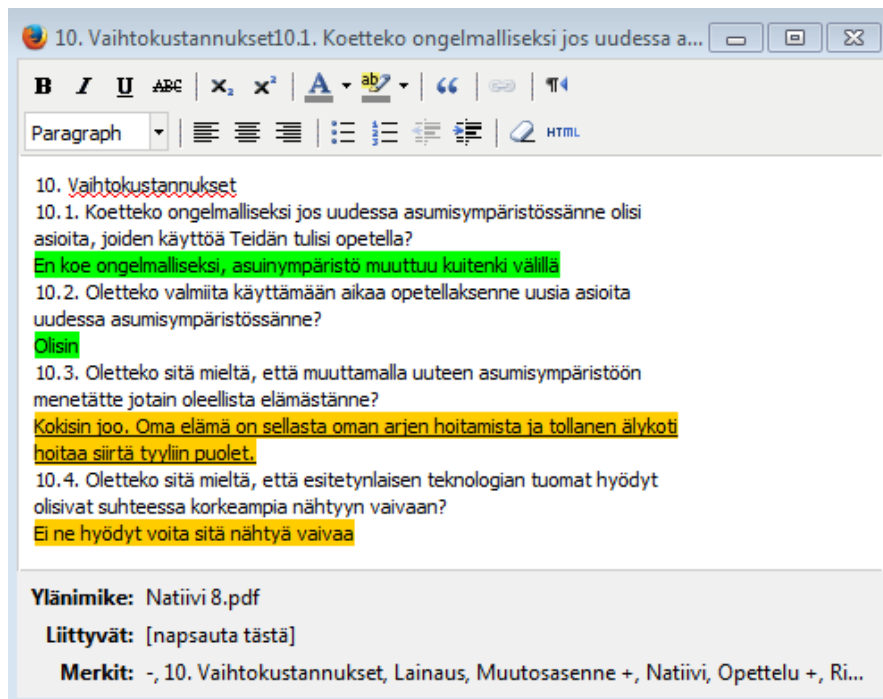Figure 2 A screenshot from Zotero: one interview transcription divided into themes

Figure 3 Screenshot from Zotero: an example of color coding in one answer theme

6 RESULTS

In this chapter the results that emerged from the empirical part of this study are presented and examined. The results are concluded via deduction from the interviews' data and grounded by direct quotation from the interviewees themselves.

6.1 Push factors

Here the results regarding push factors are presented. The push factors are perceived quality, satisfaction, perceived value, trust, commitment, and price perceptions. In each sub-chapter the results regarding digital immigrants' behavior are presented first and after that the results regarding digital natives' behavior.

6.1.1 Perceived quality

The perceived quality was assessed by asking the interviewee how they would evaluate their present living environments generally. After that the interviewee was asked directly if they felt that their living environment's quality was good or poor.

All of the digital immigrant interviewees evaluated their present living environments very positively. Apart from few minor flaws their living environments were good quality. When asked later, none mentioned poor quality being a pushing factor when switching. Such behavior is understandable since home, which is a big part of living environment, is chosen carefully and in such manner that it serves the inhabitant's opinions and needs. Particularly older interviewees mentioned that when their needs change, they might need to consider switching. The repetitive theme in evaluation was the appreciation of the environment's peacefulness and security. The time of living in present living environment varied from five years to 36 years. This refers to long-term living. Poor perceived quality might be a pushing factor but generally it is because of changed needs which are infrequent in the case of older generations.

64% of the digital native interviewees evaluated their current living environments very positively and the rest were neutral. As with digital immigrants, younger generations pick their living homes and environments according to their needs. But in younger age life's situations tend to change more unexpectedly and frequent than in later years. Naturally when these needs change the interviewees told that they would consider switching their living environments. None of the interviewees saw major flaws in their living environments' quality.

> "Well my (current) living environment is temporary and... It is ok, but it could be much better. Butt being a tenant has some restrictions. You do not have any interest or real need to invest money to any solutions. It is what it is and there is no improving it by yourself."

6.1.2   Satisfaction

Satisfaction was assessed by directly asking if the interviewees were satisfied with their current living environments in the means of their home and the services that are available. It was also inquired if they felt that living environment has any effect on their happiness.

91% of the digital immigrant interviewees were satisfied with their living environment. Only one recipient was not satisfied but neutral. Most of the slight critiques that were mentioned concerned on energy and its efficiency, cost and its inferiority to other solutions. Important satisfaction factors were again the feeling of security and peacefulness. There was clear implications that if these factors were not fulfilled the person would consider switching living environments. The interviewees were unanimous on the view that living environment affects their happiness. Therefore dissatisfaction can be seen as a relevant push factor.

> "Of course it (living environment) affects my happiness. When the environment is good and safe, then the person does not have to worry anything. Then one's life is in balance and then one can be happier."

> "Yes it does have an effect on my happiness. If my environment is not ok, it might unsettle me and it might turn disturbing."

Apart from couple of interviewees being neutral, 82% of the digital natives were satisfied with their current living environments. As in quality evaluation the standards are lower because of the constantly changing living situations. Younger people have not necessarily settled themselves into one place so they settle for less. Although the quality and satisfaction benchmarks being relatively lower the digital natives still think that living environments have an important part in their happiness.

> "Of course it has an influence. You spend majority of your free time at your home, roughly speaking one third of your life."

> "Yes it has influence. If the environment looks and feels good and it functions properly it is nice to live and spend time there. Then you feel better overall."

6.1.3   Perceived value

Perceived value was assessed by finding out whether the current living environment fulfills the interviewee's needs and whether the interviewee thinks that his/her living environment is worth the effort and money put into it. This was to find out if the interviewees get value from their environments.

All of the digital immigrants thought that their living environments match their current needs. Similarly the upkeep costs of current living environments are tolerable. However, interviewees were aware that their needs would change over time and after that the ratio of costs and value would change. Therefore some

changes should be considered. Nonetheless price perceptions were not seen very driving factor for switching.

82% of the digital natives thought that the value their current living environment is providing is sufficient, the rest were neutral. Similarly they thought that the effort and money spent on upkeep are reasonable compared to the provided value. But as in former factors, if the environments do not fulfill digital natives' needs, they tend to consider switching to a more suitable environment. High prices and economic issues were very significant push factors for majority of the digital natives.

6.1.4 Trust

Trust was measured by asking the interviewees how sure they were that they could continue living their lives unchanged in their current living environment in a case of an accident. The other thing was to find out whether the interviewee trusted that they would get help fast in a case of an accident, or not.

27% of the digital immigrants were certain that they would manage their lives without changing anything in a case of accident. On the other hand two were uncertain and thought it would require some level of switching of environment depending on the situation. 55% were uncertain on how they would handle special situations but reckoned that some changes should be made.

73% of the digital natives thought that they would manage themselves in a special situation. If such significant changes would occur the digital natives are confident that they would get help fast and could and manage their lives so that nothing would change. Only two of the interviewed digital natives thought that such special situation would make them consider switching their living environment.

6.1.5 Commitment

The interviewees were asked how long they had been living in the current environment, whether they felt commitment towards the environment, whether they had any sentimental value in the environment, if they felt they belonged to the environment and did they think that emotional factors such as sentimental value and commitment affect their possible consideration of switching living environments.

91% of digital immigrants had both sentimental value and commitment on their current living environment. The familiar neighborhood and ways of doing things generate sense of safety and peacefulness. All but one of these interviewees said that emotional factors are indeed a mooring factor and would lower their enthusiasm to alter their living environments.

> "Of course is affects. When things work as they should it lowers the intentions to move. Same goes with sentimental things. If you are happy you want to keep it as it is."

Although having lived in her current living environment for 26 years, one interviewee did not feel any commitment or sentimental value towards her living environment and thought that sentimental things have no effect of switching intentions. Another interviewee had sentimental value, but did not see it as strong mooring factor.

> "Basically the current surroundings and the fact that my children grew up here make it familiar and safe, and that builds up that sentimental value. On the other hand, 15 years is relatively short time so I could consider switching without letting my feelings affect the procedure."

Although having lived in their current living environments for significantly shorter time than the older generations, 64% of digital natives have built some sentimental value and felt commitment to their environment. Nevertheless the mooring power of sentimental value is weaker in amongst digital natives. Only 55% of them felt that sentimental value has any effect on their switching intentions. Others said that at least in their current situation sentimental values do not affect their switching intentions.

> "Yes I think that the more suitable the environment is one's current situation the more you grow attached to it. I have been several times in the situations that my contemporary living environment did not meet my needs and I needed to switch but the sentimental factors were slowed down the process."

> "I do not think that sentimental values affect my switching intentions. It (the living situation) is a temporary solution so sentimental factors are weak."

> "Last time I switched my living environment they (sentimental values) did not affect my decision making. I do not find that the emotional attachments would prevent me from leaving the environment."

The weakness of sentimental factors is understandable. Younger people have not settled themselves so that great emotional values would be established.

6.1.6 Price perceptions

The interviewees were asked if they felt that their living costs are high in their current living environment and whether high living costs are a factor that makes them to consider switching.

45% of the digital immigrants perceived their living costs are high. Also 45% of the interviewees, but not exactly the same people, thought that high living costs are a factor that would drive them towards switching. Later when the interviewees were introduced for example the energy saving solutions of a smart home, they were very interested in implementing them.

Only 27% of the digital native interviewees felt that their living expenses were too high. However, 73% digital native interviewees brought out that high price and living expenses are very significant driving factors what it comes to switching. Younger people tend to be more unstable what it comes to economics

and the changing situation must be taken notice when picking living environments.

6.2 Pull factor: alternative's attractiveness

To find out their feelings and attitude towards the smart home solutions, the interviewees were asked if they would find their lives to be more enjoyable and easier if they started using smart home technology. They were also asked if they found smart home technology interesting.

64% of digital immigrant interviewees thought that using smart home technology would increase enjoyment. This would be due to enhanced security which would lower concerns. Same way concern would lower as automation would take care of things and lower stress. The ecological benefits of smart home technology, for example automated heating system, would enhance their self-consciousness and therefore make them happier. The elder interviewees acknowledged their future and thought that smart home technology could lengthen their ability to function in their own home when their life situations change. Also the hedonic features of smart home solutions were interesting.

> "Yes, first and foremost is the increase in safety and security, both during night and day. Nowadays the security systems would be very good, but it would also be nice to wake up listening to your favorite music. "

> "It is important for me to take environmental issues into account. In a way it would be enjoyable to know that I am not using unnecessary energy when I am not home. Also it would be enjoyable that when I am feeling safe I am not worrying too much."

> "In some cases it could be (more enjoyable). It might bring some additional value to my life, for example being freer of stress."

64% of the digital immigrants thought that smart home solutions could make their life easier. The themes that came up were the automation and its propositions on not concerning everyday things and operations as much thus decreasing perceived stress. Also the older interviewees were interested in their ability to function in their own home and with smart home solutions it might stay the same regardless of their own physical state. Concerns that were raised repeatedly were that the usability of smart home technologies should be as easy as possible. Also some of the example technologies presented to them were trivial in their opinion, lowering the potential value. 18% of the interviewees did not find smart home technologies interesting, but 55% did. 27% were indecisive.

Alternative's attraction was a very significant factor amongst the digital natives. 82% of the interviewees thought that life could be more enjoyable when smart home technology is used. The themes that rose here were decrease of concerns and stress due to home automation. There were some negative concerns regarding the technologies, such as reliability and privacy issues.

> "Yes I find that life could be somewhat more enjoyable. Those automated heating and controlling system solutions are particularly interesting. You should not worry if you

remembered to turn the coffee machine off when you left. And with less stress your life might be more enjoyable."

"Yes it could be (enjoyable) it if the technology was reliable and there would be no risks. I am a little neurotic with these things and I would be scared that someone could hack in to my home system. Or during blackouts I could not get out. But if the technology fully reliable it would bring extra enjoyment to my life."

91% of the digital native interviewees thought that life would also be easier with smart home technologies. The decrease in stress and possible extra free time are tempting factors. 91% of the digital natives also found the smart home technologies interesting. The solutions will be especially taken into notice when planning and designing long-term living environments. As with the immigrants, the ecological benefits and enhanced security are factors that are interesting amongst the younger generation. Nevertheless three of the digital native interviewees felt little intimated with technology and ubiquitous computing coming to our everyday living environments. One said that sometimes smart technology makes things unnecessarily complicated.

6.3 Mooring factors

Here the results regarding mooring factors are presented. The mooring factors are attitude towards switching, subjective norms, switching costs, prior switching behavior, and variety seeking. In each sub-chapter the results regarding digital immigrants' behavior are presented first and after that the results regarding digital natives' behavior.

6.3.1 Attitude towards switching

The attitude towards switching was examined by asking the interviewees how they generally felt when their living environments changed in some way. It was also asked if they would be ready to take some smart home technology solutions to their home in a rather short time period, half a year. After that the interviewees were asked whether they felt that moving into a living environment with smart home technologies would be good idea, worthwhile, wise and tempting.

55% of the digital immigrants were positive towards change and switching in living environments, whereas only two interviewees' attitude was negative. According to some of the interviewees technology is seen as a certainty and to get most out of it one should embrace the change rather than oppose it. Homes are seen as contexts where smart technology is even welcomed and their benefits are clearly seen. 91% of the digital immigrant interviewees were still ready to at least test smart home technology. 36% were ready to take them into full use.

"It (change) is not disturbing. Change is always for the best. At least when it is planned and thought through it always has its benefits. I do not resist change in any means."

> "I am rather old-fashioned man, but nevertheless I have gone through the necessary changes. There are worse things than change."

82% of the digital immigrants thought that smart home using smart home technologies would be a good idea, worthwhile, wise and tempting. Nevertheless there were some exceptions. As long as the implementation of smart technologies is reasonable it is wise, but too much could passivate or even incapacitate people. Some of the smart home solutions were seen as trivial and not that tempting.

All of the digital natives had positive attitude towards living environment's change and 91% was ready to take some smart home solutions into their living environments during the next six months. Only one would let others test it first. As with the digital immigrants a repetitive theme was ease of use.

> "I do not mind change. Every new thing drives progress. Of course it depends how difficult it is to use these new solutions. But generally I do not resist change."

> "I do not think that I would take them into my environment so quickly. I would let others to test them out first and maybe adopt them before making any decisions."

However, amongst some digital native interviewees technology is not seen a driving factor but rather as bonus to the necessities that a living environment fulfill.

> "Yes I would be interested in smart home technology. But right now would not be my top most criteria when picking a new environment. It should come as a bonus."

91% of the digital natives saw smart home technologies as a good idea, worthwhile, wise and tempting. Even the younger generation recognized the possible benefit of enabling longer independency.

6.3.2 Subjective norms

The interviewees were asked to evaluate what would their social environment think about smart home technologies and if their social environment would think that smart living environments would be suitable for the interviewee.

64% of the digital immigrants thought that their social contacts, for example friends and relatives, would see them as a smart home technology user. Two of the majority estimated that some of their social contacts would oppose such and some would support them. Two immigrants announced that their social contacts would be worried on how they would manage themselves with new technology.

> "No, they would not care that much. Maybe some could think that I am a little nuts trying these new things."

> "Some would be worried but some might even be like wow, that's great!"

Nevertheless none said that subjective norms are a determinant when considering switching decisions in their living environments. Home and the things associated to it are rather personal matters and the final decision regarding to it is for

the resident. Two of the digital immigrant interviewees said directly that they do not care what others think and they do as they like.

Only 18% of the digital natives thought that their social contacts would not see them as a smart home resident. The interviewees thought that their elders would actually gladly see them using this technology and to evaluate it for them. Younger persons are seen more technologically oriented so they might be good test subjects.

> "They would think that since I am relatively young I could handle myself with such devices and adopt them. They would observe it with interest."

> "I think that they (elder relatives) might be very interested in it. They would question me how it is and whether it would suit them eventually."

Also 64% of the digital native interviewees thought that their social contacts would not be against it at any means.

> "Yes I think that they would think I would be suitable for such environments. But different people would react differently. My elders would appreciate the functional benefits and others would appreciate the novelty value of it."

27% of the digital natives thought that some negative issues might rise from their social environment. These issues related to the privacy and reliability issues.

> "They would think that am I not concerned about the security cameras and such? So basically they would consider these new solutions odd and disturbing and whether they can be trusted or not."

Regardless of the estimation, 36% of the digital native interviewees brought out that their social environments would have little or no effect on their switching decisions, living environments being personal issues.

6.3.3 Switching costs

The interviewees were asked if they found it troublesome to learn new things that are related to their living environments and whether they were ready to spend some time to learn new things in their living environments. They were also asked if they would feel like losing something essential from their lives if they changed their living environments with technology. Lastly they were asked if they saw the benefits that smart home technologies offer greater than the effort that they put into adopting them.

The 64% of digital immigrants had positive attitude towards learning and were ready to spend reasonable amount of time learning to operate and use new technology. There were few repetitive themes that came up. Ease of use was highly valued. Although 82% of the digital immigrants were ready to use time in order to learn new things, it should not take too long and be too complicated. The second theme was technology's certainty and in order to keep with society's development the digital immigrants felt that learning is somewhat mandatory and must be taken positively. Four of the immigrant interviewees brought up their

lack of technological skills and said learning to use new devices is somewhat cumbersome.

> "It does not bother me to learn new things. It is progressing."

> "The biggest point is the time I am willing to use to learn these technologies and to adopt them. It has to be very simple. But in the end I do not find it disturbing."

55% of the digital immigrants thought that they might lose something essential from their daily lives if they took and used smart home technologies. Three were afraid that technology is taking too much of our daily lives and does too much on one's behalf, thus making us more passive.

> "Hmmm, maybe I might lose the sense of making my own decisions. Technology might do too much things that I am used to handle myself. Technology takes the routines away."

Another negative theme was that technology was seen too intrusive. Although some solutions are developed to make our lives simpler, the complexity of technology might even increase the amount of stress in our lives.

> "I do not like if it takes a very long time learning a new thing or if there are several things to learn. I think that technology should be simple and benefit me, not to infiltrate my personal life."

In the end 91% of the digital immigrant interviewees saw that the benefits that smart home technologies offer are greater than the efforts and potential disadvantages.

82% of digital natives were not against learning to use novel technologies. Learning is seen interesting and progressive. Also three of the interviewees saw learning as a necessary procedure in order to develop society. However, the ease of use was highly appreciated.

> "It depends pretty much on the instructions. If they are not clear and force me to think too much and therefore there is a possibility for mistakes, then yes I find learning new things cumbersome. But if the instructions are clear and good then there is no problem on me learning."

> "No there is no problem as long as the benefits are clear."

64% of the digital natives thought that they would not lose anything essential from their lives if they implemented smart home technologies to their living environments. Some saw that there would be some negative effects.

> "Well it is essential in the future so I think that I would not lose anything that special"

> "In some point technology could take too big portion of our lives and life itself would become too systematic. There should be some randomness."

> "Yeas I think that I would lose something. Part of your everyday life is managing it and those smart home solutions might take a big part of it making yourself obsolete."

"There could be a feeling of not managing your own life. That you would hand your personal life to somebody else."

"Maybe you could lose your privacy if cameras and such are used as for example security measures. Somebody else would always able to observe my personal life."

Regardless of these issues, 82% of the interviewees saw that eventually the benefits would exceed the costs.

"Yes, definitely. It (switching to smart home) is ultimately a long-term solution and learning period and all are relatively short. And when you are controlling and managing it properly, there would not be any significant privacy issues."

6.3.4 Prior switching behavior

The interviewees were asked to describe their past moving and switching behavior regarding living environments.

82% of digital immigrants told that during their lives their living environments had gone through significant changes. All in all the prior experiences had left positive outcome and attitudes towards switching. The number of times each digital immigrant had moved varied from one to 20 times. The average times of moving was 5.6 times.

All of the interviewed digital natives had positive attitude towards moving and switching living environments. Compared to their elders, the digital natives had changed their living environments more often, ranging from four to 12 times with an average of 7.6 times. The exact numbers of each interviewees' switching past is presented in Table 5.

6.3.5 Variety seeking

The interviewees were asked to describe if they enjoyed trying new things, such as new technologies and devices and if they found the coming of smart home technology interesting.

36% of the digital immigrants told that they do not actively try and test new devices. The dominant theme here was that they let younger, more technology oriented people test and improve the solutions first. 82% of digital immigrants are, however, interested in how smart home technology is developing. Homes are more of a necessity than for example mobile phones and therefore the potential in the developed technology is taken more seriously.

"They (smart homes) are very important thing what it comes to the development of our society."

"Yes I am interested trying new things. I even have even read about this subject and studied it. I have taken it account whether these devices would offer me some benefits as well."

Amongst the digital natives, 73% of them try out new technologies without hesitation but there are some that let the earlier adopters to test them first. All of the

native interviewees see smart home solutions interesting. 82% of them were also keen on using smart home technologies once it is their time to settle for long-term living environment.

> "I would be extremely interested. Then the technology would have advanced even more and have become more common. Maybe I am even building my own home and then implementing the smart devices would be easier."

6.4   Switching intentions and switching behavior

The interviewees were asked how interested they would be to take some smart home solutions to their future's living environment, whether they are switching their living environment in the near future, what are generally the factors that affect their moving and switching living environments, and whether they have recently gone through changes in their living environments.

    82% of the interviewees in both groups estimated that next time they are planning on changes on their living environments they would take some smart home technology solutions into consideration if they would be as an option. According to the interviews the changing nature of each individual's life has great effects on their switching. Now the greatest thing that occupy the digital immigrants' minds are economic factors and none of them were planning on switching their living environments any time soon. Although some smart home solutions offer long time savings, switching to them costs. Decisions made regarding living environments are considered long and thoroughly. Digital natives brought out that their switching and moving behavior is mainly guided by their life situations such as work and relationships and 73% of them estimated that they would switch their living environments in near future.

6.5   Other results

The interviewees were also asked whom they would see smart home technologies suitable to. Common view amongst the digital immigrants was that these technologies were suitable for variety of people offering all-purpose benefits. More detailed groups were people with disabilities, the elderly, people that are technology oriented, families and younger people.

> "The greatest benefits are for the disabled and older people, but they also have more difficulties learning these technologies, which is a restriction."

> "It (smart home technology) is suitable to everyone. It is all matter of tailored design. It has economic, security and facilitating potentials to different kind of people"

When asked from the digital natives, the most common suggestion was that the smart home technologies are suitable to everyone but specifically they would be ideal for elders, disabled and families. They did not brand themselves particularly as a potential user group.

There were also 10 recurring themes that do not appear in the PPM model. Eight of them were factors that affected positively to switching intention. Most of them can be included as a sub theme to alternative's attractiveness. Ecological benefits from smart home solutions, such as automated heating and consumption of electrical energy were very interesting sub-factor in the attractiveness. Hedonic benefits such as enhanced entertainment and stress reduction were also a repetitive new theme. Ease of use was factor that was both an interest raising factor and a requirement for the smart home solutions to be interesting and worth learning. Raised security via home automation was also seen as an interesting feature and a factor. These emerged themes can be seen as sub-themes for alternatives attractiveness since they build up that factor. Other emerged themes that affected the interviewees' switching intentions positively were the changing needs and limitations that appear later on in life and 'have to'-attitude, which refers to the interviewees' acknowledgment that in order to keep up with evolving society new devices and changes need to be embraced, not shunned. Negative repetitive themes that emerged from the interviews were security issues and letting others to test new solutions. The first refers to the worries and concerns that the interviewees had towards new technology and its vulnerabilities. The second theme refers that interviewees would let others to test out new devices and services in order to find the primary problems and errors. This way the potential users in question could start using new and enhanced solutions without worrying about possible first generation faults in functions.

6.6 Comparison

Digital immigrants were more unanimous on the opinion that their living environment was of good quality, whereas 36% of digital natives said that their living environment's quality was so and so. None of the interviewees found their living environments to be of poor quality.

Satisfaction was quite similar in both groups; 91% of digital immigrants and 82% of digital natives were satisfied to their current living environments. The driving factors for satisfaction were evaluated slightly differently in the groups. Digital immigrants emphasized on the importance of safety and peacefulness. A repetitive theme from digital natives was that they were satisfied with their current living environments since their standards are rather low due to often changing situation in life. There was no difference on the groups' outlook on living environment's impact to happiness. Both groups were unanimous that their living environment is directly to their happiness.

Amongst digital immigrants living environments were found to fulfill the inhabitants' needs with acceptable costs and therefore to generate value. Similarly 82% of digital natives found their living environments to generate value to them. All in all generated value was found to be on at least satisfactory level and it was not found to be a driving switching actor at current levels. Nevertheless if the value would not reach the expected level, according to both interviewed groups it would be necessary to consider switching living environments.

Trust was seen varying amongst the groups. Digital immigrants were more conscious and 73% worried for their future's ability to function in their own home than digital natives and it was seen as a matter that will affect their future switching behavior. 73% of digital natives were rather sure that despite of possible accidents or other special situations they would be able to function and live in their current living environments without significant problems.

91% of digital immigrants felt commitment and sentimental value to their current living environment whereas barely majority (64%) of digital natives felt any sentimental value or commitment. Similar differences were seen on the opinions on whether intangible factors affect their switching intentions negatively. 91% of digital immigrants saw intangible factors as mooring factors whereas only 55% of digital immigrants felt that way.

45% of digital immigrants found their living costs to be high and that high living costs would be a factor that would get them to switch living environments. In proportion only 27% of digital natives felt that their living costs were high and apart from few they felt that high living costs would force them to switch living environments. 45% of digital immigrants and 73% of digital natives evaluated price perceptions to be a notable push factor.

Both groups found smart home technology to be somewhat interesting but whereas only 55% of digital immigrants were very interested the corresponding amount of interested digital natives was 91%. Few of digital immigrants and none of digital natives announced not being interested on smart home technology at all. Consistent opinions among both groups were that using smart home technology their enjoyment would grow and their lives would be somewhat easier. Both groups found that increased perceived safety, reduction of stress, ecological benefits, and lowered concerns would be the potential benefits to drive the ease and enjoyment offerings. In addition digital immigrants estimated that future's increased ability to function in their home would be a significant benefit. Both groups emphasized the importance of ease of use but only digital natives, being it only few of them, were worried on possible privacy and reliability issues that would broke the valuable pattern.

All in all digital natives had more positive attitude towards change and switching than the older generations; only 55% of digital immigrants thought that change is always positive whereas all digital natives thought so. Majority of both groups (91%) were ready to take some smart home technology solutions to their living environments in rather short notice. Both groups had their own opinions on technology in living environments. Digital natives thought that introducing and implementing technology in living environments is an important and desired subject. Digital immigrants were on the common ground; they thought that living environments are a suitable and reasonable place for technology to be implemented. Nevertheless some immigrants took technology advancements as a certainty and therefore stood with compulsory attitude towards change. According to some digital natives, technology should on the other hand come as a bonus to our living environments, not as a necessity or a switching criterion.

Between the two groups digital natives estimated more often (82%) that their social environment would think that they would be suitable to use smart home technology and would encourage such environment. 64% of digital immigrants estimated this as well on their behalf. The immigrants had some suspicions that their social contacts could be somewhat worried on how they would manage themselves surrounded by new technology. Digital natives mentioned that privacy safety matters would also be their social environment's issue but also that older relatives would observe their life in the smart home and use them as a test subject of sorts. All in all there was similar attitude towards subjective norms' effects in both groups; deciding matters related to living environments is none of other peoples' business and others' opinions would have very little effect.

Both groups had positive stance on attitude towards learning new things; 64% of digital immigrants and 82% of digital natives considered learning as a positive thing. Again, digital immigrants emphasized on ease of use and few openly rated their technology skills low, but same as change, learning technology is seen mandatory to keep one's independency for as long as possible. Digital natives saw learning interesting. 55% of digital immigrants were concerned that they would lose something essential from their lives if they would use smart home technology whereas the corresponding amount of digital natives was 36%. Nevertheless both groups evaluated the potential benefits of smart home technology to overcome the effort and costs that would go in implementing and adopting them.

Digital natives were unanimously positive towards switching living environments and moving. 82% of digital immigrants thought the same. Despite of digital natives being relatively young they had switched their living environments relatively more times than their predecessors.

Digital natives were slightly keener on trying out new technology while the older generations were more on letting others try them out first. 63% of digital immigrants and 73% of digital natives announced that they tend to try out new technology. There are, however, differences in individuals; some digital natives were more hesitant when it came to trying out new technology than some of the digital immigrants. Both groups saw the benefits of new technologies in living environments and thought that they would, in some point of their lives, take some new solutions to their living environments. Comparison is presented in a condensed and brief manner in Table 6. The symbols after the percentage mean the comparative significance of a factor between the two groups. Plus means that the significance is greater, minus means it is lesser, and dash means that the significance appeared to be equal in the respective group.

Table 6 Comparison of switching determinants between digital natives and digital immigrants

Determinant	Digital immigrants	Digital natives
Push factors		
Quality	100%: (+), Very significant but infrequently	64%: (-), Significant but frequently
Satisfaction	91%: (+), Very significant but infrequently	82%: (-), Very significant but frequently
Value	100%: (+), Very significant but infrequently	82%: (-), Very significant but frequently
Trust	55%: (+), Significant	18%: (-), Not very significant
Price perceptions	45%: (-), Slightly significant	73%: (+), Significant
Pull factors		
Alternative's attractiveness	64%: (-), Significant	82%: (+), Very significant
Mooring factors		
Attitude towards switching	45%: (+), Slightly significant	0%: (-), Not significant (yet)
Subjective norms	36%: (+), Slightly significant	18%: (-), Not very significant
Switching costs	9%: (-), Not very significant (intangible costs)	18%: (+), Not very significant (tangible costs)
Prior switching behavior	18%: (+), Not very significant	0%: (-), Not significant
Variety seeking	36%: (+), Slightly significant	18%: (-), Not very significant
Commitment	91%: (+), Very significant	55%: (-), Significant

7   DISCUSSION

The main goal of this study is to examine the theory on digital immigrants and digital natives by comparing their switching behavior in the context of smart home environments. The main research question is "How do switching behavior determinants differ from one another when comparing digital immigrants' and digital natives' switching determinants in the context of switching from traditional living environment to smart technology assisted environment?". To answer this main question two sub questions are set: "What are the most important switching determinants of digital immigrants' and how do they affect their switching intention in the context of switching from traditional living environment to smart technology assisted environment?" and "What are the most important switching determinants of digital natives and how do they affect their switching intention in the context of switching from traditional living environment to smart technology assisted environment?".

Next these sub questions and the main research questions are answered based on the empirical findings. This chapter examines the results from the previous chapter and reflects them with the theories presented earlier. The main research question is answered by comparison of the results of theoretical digital natives and theoretical digital immigrants and the implications are discussed. Also the theory on digital natives is revised and the research results' influence and relation are introduced. Finally the theoretical and practical implications of these results are presented and discussed.

7.1   The switching behavior of digital immigrants

Based on the empirical evidence the push factors by Bansal, Taylor and James (2005) are only somewhat equivalent in the case of theoretical digital immigrants' switching behavior in smart home environments. The empirical evidence suggests also, that the last push factor, commitment, is not in fact a push factor but a mooring factor. The justification is presented later on. The illustration on how the push, pull and mooring factors are affecting digital immigrants' switching behavior via switching intention is shown in Figure 4. The solid lines reflect that the factor is significant whereas the dash line mean that the factor is relatively weaker.

Quality and satisfaction are truly determinants that can trigger the individuals need for change and switching but not very often. When a digital immigrant perceives that his/her living environment does not anymore reach the preferred quality and satisfaction levels, switching living environments to one that does come into consideration. Value is directly connected to quality and satisfaction; if the living environment does not fulfil the individual's quality and/or satisfaction needs, then the gained value is too low and switching is being driven. In the case of digital immigrants who have already settled themselves in for a long-term home, choosing and possibly building living environments is done with care and

time. Each need, even upcoming new needs and changes of needs, has been carefully thought through and planned. This is to ensure that the living environment would meet the needs for as long period of time as possible, thus minimizing the necessity of switching.

Similar push factor is trust. Especially the older generation of digital immigrants, the Baby Boomers, have growing worry on their own security and ability to live in their own home. When not being able anymore to function in their current living environments, it might be very likely that they would seek for solutions to lengthen that independency by adding automation technology to their living environments.

Price perceptions do not appear to be relatively strong push factor among digital immigrants. This might be because once an individual has gotten used to a certain level of quality and value in his/her life for a longer period time, the seemingly high costs are tolerated and they do not specially trigger needs for switching.

The only pull factor in the PPM model is alternative's attractiveness. Although not being lived and raised surrounded by modern technology, digital immigrants find smart home technology rather interesting. The benefits it offers, such as increased security, energy savings via lowered power consumption, reduced stress by automation, and potential longer independency via facilitation solutions are all relevant also for the older generations. If being somewhat unskilled in technology, the possibilities smart home technology offers nevertheless overcome those insecurities. Being the only pulling factor, alternative's attractiveness was noticed to be a rather significant factor.

Several of the mooring factors suggested by the PPM model are challenged based on the empirical findings. Based on these finding two of the weaker mooring factors affecting digital immigrants' switching behavior are prior switching behavior and low variety seeking. Switching or changing one's living environment is not an event that is gone through very often, especially later in an individual's life. Although most of the digital immigrants had lived in their current living environment for relatively longer time, they do not shun or consider it odd to move or switch living environments. Smart home technology is possible to install to one's own home and living environment so it does not necessarily require one to move out from the familiar environment.

Another notably weaker mooring factor is unfavorable attitude towards switching. There are no suggestions that change would have any negative effect on the subjects' switching intentions since change was seen all-around a positive thing.

Similarly subjective norms are not seen as a very strong mooring factor among digital immigrants. Living environments are a subject that individuals build for themselves and then outer opinions are secondary. Some digital immigrants even evaluate that their subjective norms might even drive and encourage them to switch to smart living environments.

The last mooring factor presented in PPM model is switching costs. What it comes to the intangible costs, such as learning and adopting effort, it is not seen

as a very significant mooring factor amongst digital immigrants than the others. Although learning effort itself is not seen negative, complexity of the technology and the time consumed to the process of learning new technology are seen as a slight drag. Nevertheless spent effort and other resources are seen relatively trivial since smart home technologies are long-term solutions and their benefit offerings are significant.

As presented before, commitment is found to be more of a mooring factor than a push factor. This is reasonable since commitment in living environments' context means sentimental value, which is a very strong mooring factor. Especially the digital immigrants who had been living in same environments for quite long time see that it would be very difficult to let something go and switch it to another even if it brought benefits. In living environments low commitment would not have significant pushing effect it is justified that in this context it is considered as a mooring factor.

Figure 4 Digital immigrants' PPM model in the context of smart home living environments

7.2 The switching behavior of digital natives

Based on the empirical evidence there are some differences in the push factors of digital natives' switching behavior when compared to the original PPM model. Similar to digital immigrants, the commitment factor is seen more suitable to be a mooring factor. The illustration on how the push, pull and mooring factors are affecting digital natives' switching behavior via switching intention is shown in

Figure 5. The solid lines reflect that the factor is significant whereas the dash line mean that the factor is relatively weaker.

Being fairly young and in early stages of their lives, digital natives' situations change frequently compared to their elders. This means that their quality, satisfaction and value requirements modify in shorter cycles which requires constant adaptation in the means of living environments. Quality, satisfaction and value are more significant push factors amongst digital natives but it does not necessarily mean that the switching is towards more technology assisted living environment.

However, digital natives are interested in smart home technologies and were ready to implement them into their lives, if the opportunity was given. Same goes for price perceptions. Digital natives, who do not necessarily have stable income, a very price-conscious and if their current living environment is too expensive they easily switch to a more affordable one. Price perceptions are therefore a rather strong push factor.

Against the PPM model digital natives do not think lack of trust to be an issue that would affect their switching behavior. Although they worry that special situation or accidents might occur in their current living environments, they felt that such things would not significantly drive their switching intentions and they would manage themselves despite everything.

Alternative's attractiveness amongst the digital natives does not seem to be as strong immediate pull factor for digital natives. They do not see immediate need for such technology but are very interested on the benefits and possibilities of smart home technology. This is due to that smart home technology is seen more suitable for long-term living environments. As said before, most digital natives change their living environments frequently. Before they settle themselves in to a long term living environment, smart home technology is not intentionally planned or sought after since it is not that necessary for them. But if a living environment offered ready-to-use solutions digital natives would be interested in them. In long-term alternative's attractiveness is a strong pull factor for digital natives, but in current times it is weaker.

Apart from one factor, mooring factors are not strongly represented amongst digital natives. Attitude towards switching and change are all in all seen positive. This might be because digital natives are mostly used to switching and are ready to experience new things. In the future when digital natives have settled themselves in for long-term living environments their attitudes might have changed, but then smart home technology might have already be common part of living environments. Therefore attitude towards switching cannot be taken as significant mooring factor for digital natives.

Same goes when examining prior switching behavior and variety seeking factors. Despite their relatively young age, digital natives have switched their living environments already more than their predecessors and they have positive overall attitude towards switching. Variety seeking is common amongst the theoretical digital natives. Having rather low barriers for switching and moving for

example living mostly in rental homes and not being chained to a single environment, they constantly seek for living environments that suit their needs and requirements better. Prior switching behavior and variety seeking are rather weak mooring factors for digital natives.

Based on the empirical evidence subjective norms is not either a significant mooring factor. On the contrary digital natives' social environment and contacts see them as a very suitable smart home technology user. This might be because of society sees younger people to be more technologically skilled and suitable to test these new solutions. As with digital immigrants, digital natives think that subjective norms have very little effect on their intentions and decisions what it comes to living environments, which are decision about personal matters.

Switching costs do not prove to be that significant mooring factor either. Although younger individuals are price-conscious, relatively technology oriented, and they know that learning and implementing new technologies to their lives costs time and money, they can also see the benefits and long-term saving opportunities in smart home technologies. Of course if the monetary expenses turn out too high for digital natives' economy, they would not consider switching. But in the case of intangible switching costs digital natives do not see significant drag to their switching intention. All in all they do see that the benefits exceed the costs, both tangible and intangible.

There is, however, one mooring factor that affects digital natives' switching decisions. The only factor that has some mooring effects is commitment. Although digital natives have lived and are mostly currently living in temporary living environments and there were only slight evidence of formed sentimental values, mental commitment and sentimental values were seen as a relatively significant factor that would affect switching intentions negatively.

Figure 5 Digital natives' PPM model in the context of smart home living environments

7.3 Comparison of switching behaviors

When comparing the significance of push, pull and mooring factors to switching intention between the digital natives and digital immigrants there are few noticeable differences effectivity wise and some in the details on where a particular factor's effect originates from. Most of the differences are based on the situations that the groups' individuals are in life and there are fewer differences that come from one group being more technologically oriented than the other.

The push factors quality, satisfaction and value are all relevant switching factors in both groups but there are some differences in their frequency and nature. Due to their life situations of living already in their long term living environments the digital immigrants have less frequently changing needs in terms of quality and satisfaction and the value derived from these factors. Nevertheless the upcoming and expected changes are the kind of which benefit from the smart home solutions, for example lowered ability to function in one's own home. The digital natives' living situations are expected to go through more changes in the near future, but the changes' nature are the kind of where smart home solutions would act as a bonus, not as a necessity.

Trust is more significant of a pushing factor amongst digital immigrants since their change of living conditions requires facilitating and helping solutions

whereas the relatively healthy and self-managing digital natives do not necessarily need such services in the near future.

Price perceptions are on the other hand more significant pushing factor among digital natives who are very dependent but not as stable on their income as the older generations who have already possibly established their living environment and stabilized their household finances.

Alternatives attraction is in both groups, the digital natives and digital immigrants, a significant pulling factor. But the digital immigrants, who are more conscious on their own health and future functionality might find it a bit more greater factor since the gains are greater and more concrete to them from smart home technologies. The digital natives view smart home technologies as nifty and interesting bonuses to their living environments, but do not see urgent need for them to continue living their lives as up to now.

The mooring factors are again somewhat similar in both groups. Attitude towards switching, subjective norms, prior switching behavior and variety seeking are rather weak but still affecting mooring factors among digital immigrants whereas the digital natives feel that those factors have almost no effect to their switching intentions. Subjective norms are in some cases even somewhat pulling factors to the digital natives. Although digital immigrants are interested, digital natives are more interested in change and implementing new technologies in their lives. As the digital natives grow older and possibly settle themselves for long-term living environments, their attitude towards switching might evolve.

Switching costs are not seen as a very significant mooring factor for both groups but with different natures. Digital immigrants are more worried on the intangible losses, such as effort spent on learning, when digital natives are more worried on the tangible monetary costs of implementation of smart home technology. Nevertheless both groups do see the potential and long-term benefits of smart home technology so in the end switching costs do not affect that strongly.

Commitment which turned out to be more of a mooring factor than an originally presented pushing factor is a very significant and potent factor among digital immigrants. They are not that keen on leaving or changing their current living environments drastically. Digital natives thought that sentimental values might be a mooring factor the future, but not necessarily in their current state of lives.

7.4 Implications to digital native theory

One partial goal of this study is to shed more light on the debate on whether digital natives and digital immigrants have differing attitudes towards technology and its adoption as is proposed in some studies and theories (Prensky, 2001; Tapscott, 2009). The empirical results are for some part conflicting to some of the suggestions by Prensky (2001) and Tapscott (2009) about the differences of digital natives' and digital immigrants' behavior. In some parts the theory's suggestions are similar to things found out during this study. It must be taken into notion

that smart home technologies are still at their infancy and have not become common in large scale so the actual use was not examined in this study. The comparison is based on the feelings and attitudes that emerged during the interviews. This might have some impact on the results. The attitudes and feelings towards smart home technologies can be compared and the results can be applied to existing theories in some extent.

According to the original theories, digital natives prefer learning new technologies through trial and error (Jukes & Dosaj, 2005; Prensky, 2001). Against the hypotheses and assumptions, there are mentions among the interviewed digital natives that they use manuals and written instructions when introduced to a novel technology. On the other hand some of the interviewed digital immigrants mention that they are happy to try new technological devices and do not find them too bothersome. Both groups value and emphasized ease of use and ease of learning as factors that make smart home technologies seem like attractive solutions.

However, some of the matters that come up from the empirical data support the claims of former studies. Digital immigrants, Baby Boomers in particular, find that they tend to let the younger generations to use and 'run-in' the new technologies before adopting them themselves. This is also so that the more technology oriented groups could find out the issues and errors that are usual in the first generations of new solutions.

Another theoretical difference between digital immigrants and natives is that digital immigrants focus on long-term gratification and slow pace planning whereas digital natives prefer to get the benefits right away and rapidly (Jukes & Dosaj, 2005). The empirical findings support these suggestions since digital immigrants thought and appreciated the long-term benefits of the smart home technologies as the digital natives focused on the instant utilities.

The level of common technology knowledge and speculation seems to be slightly higher amongst the digital natives than the digital immigrants as Prensky (2001) claims. During the interviews the digital natives acknowledged details and possible technological issues slightly better than their elders. The vulnerabilities such as possibility to hack into the mart home systems was an issue raised midst the digital natives, where as digital immigrants did worry on more concrete issues. Similarly digital natives extended their discussion and benefits beyond the shown example presentation. They thought other possibilities that the example solutions could enable whereas digital immigrants focused only on the presented benefits. This similarity to the original theory is nevertheless relatively weak since the described attitudes were only fragmental.

All in all living environments seem to be a subject that levels the generations' differences in the context of technology use. Regardless of technology orientation and skills or the user's generation, the basic benefits and offerings are relatively same to everyone. Additionally smart home technology's nature can be perceived somewhat less disruptive as for example smart phone technology. Smart home technology is based on automation and its use does not require active operation and management. Automation's main purpose is to minimize that. As

smart mobile technology enabled countless number of new features and functions that may be overwhelming to some users, smart home technology's main idea is to automate basic home's functions which are already familiar to majority of users. Devices and solutions such as these might be overall easier for some to approach. Completely new technologies are those that less technologically oriented users are precarious with.

These implications support the critique that has been presented in the discussion of digital natives. As Selwyn's (2009) and Thinyane's (2010) research did, this study did not find continuity that all people from the same age group would possess similar technology skills and behavior towards technology since there was internal differences in both groups' results. On the other hand the counter-criticism by Smith (2012) which acknowledged that there are some basis in Prensky's (2001) and Tapscott's (2009) claims was also supported by this study. As Smith (2012) has proposed, this study has examines the digital native issue in a more subject specific environment and finds both similarities and differences.

7.5   Result comparison to prior IS research

As similar studies that compare two groups' switching behavior in the context of IS have not been found, it is difficult to compare the results of this study's to existing ones. Nevertheless the overall results that cover switching behavior in the context of smart home living environments can be compared and discussed with other studies in the field of IS. The results of this study and the switching behavior determinants that are found are somewhat similar or can be seen as equivalents to ones presented in Table 4.

In earlier research regarding switching behavior in IS context there has been found several factors which affect the switching process supportively. Alternative's attractiveness is a very significant pull factor in the IS area. New technology and the benefits it offers seem to be intriguing and interesting to consumers. Several of former studies regarding IS switching have propose that *alternative's attractiveness is a significant positive pulling factor* (see e.g. Chang et al., 2014; Hou et al., 2011; Kim et al., 2006; Lai et al., 2012). This thesis's results *indicate the same*. Also several earlier studies as well as this research come across sub-factors that belong under alternative's attractiveness. From earlier studies relative advantage, expected omnipresence, positive expectations with new IT, relative enjoyment, relative usefulness, relative ease of use, expected switching benefits, perceived usefulness, and relative security are all such sub-factors that enhance the alternative's attractiveness and therefore the positive switching intention (Bhattacherjee & Park, 2014; Fan & Suh, 2014; Hsieh et al., 2012; Lin & Huang, 2014; Park & Ryoo, 2013; Polites & Karahanna, 2012; Ye et al., 2006; Ye & Potter, 2011). Similar sub-themes from this study were ecological benefits, hedonic benefits, lowered stress, maintaining personal functionality, ease of use, and raised security. According to Bansal, Taylor and James (2005) alternative's attraction is the only significant pull

factor so it would make sense to break it down and examine the sub-factors affecting it. To understand the diversity of such factor as alternative's attractiveness, it should be taken into a closer and more focused viewpoint later on.

In earlier IS switching studies subjective norms and other factors related to the social environments', such as peer influence, have appeared to influence switching intention both positively and negatively (Polites & Karahanna, 2012; Xu et al., 2013; Ye et al., 2006; Ye & Potter, 2011; Zengyan et al., 2009). In this study *subjective norms is not found out to be a significant factor* apart from some positive effect it has to digital natives' switching intention. As discussed this might be due to the fact that living environments are a subject where individuals make their own decisions and let their social environments to have little or no influence. This emphasizes the importance that the researched environment and its key characteristics must be taken into account when examining switching behavior.

Other positive switching intention factors in earlier IS studies are related to the using experiences with prior IT solutions (see e.g. Bhattacherjee et al., 2012; Bhattacherjee & Park, 2014; Chang et al., 2014; Fan & Suh, 2014; Lin & Huang, 2014). In this study's context there are no comparable prior technologies to begin with so the comparison is difficult. Of course factors in earlier studies such as satisfaction with prior IT, regret with prior IT and inconvenience of prior service can be compared to the lack of value, satisfaction, and quality push factors which are found to be *significant driving factors* in this study.

Earlier IS switching studies have presented that there are also various factors that affect obstructively to switching behavior. Switching costs are noted in several earlier IS switching studies to be a significant mooring factor (see e.g. Hou et al., 2011; Hsieh et al., 2012; Lai et al., 2012). This study's results are conflicting with these earlier studies since *switching costs did not appear to be as significant factor*. This might be due to smart home technologies are novel solutions and the concrete benefits are yet to be verified and are based on attitudes, preconceptions and feelings. Nevertheless for now according to the consumers' attitudes and feelings the benefits are seen overall greater than the intangible and tangible switching costs.

Positive satisfaction with prior IT solutions, prior usage and past experience are also noted to be negative switching factors in earlier IS switching studies. In this study, in which the studied concept of smart home technologies is a novel and yet to become common among consumers, *similar determinants are not found.* These factors need to be re-examined after smart home technologies and solutions have become more familiar to consumers both usage and service provider wise. Nevertheless there are some similarities with the results of prior IS research and this study. Security concerns and low perceived privacy is noted as a factor lowering switching intentions in both cases (Bhattacherjee & Park, 2014; Lai et al., 2012).

Finally, compared to prior IS switching behavior research, this study does find some similarities what it comes to factors that come from individual's personal characteristics and behavior. Some earlier studies point out that prior

switching behavior, positive view towards change, and need for change are factors that drive the switching intention (Hou et al., 2011; Xu et al., 2013). Similarly this study presents that consumers have relatively *positive attitude towards switching and change* in general and this kind of earlier positive experiences on switching *encourages individuals to try out new things*. Also changed needs drive individuals *to seek better solutions* for themselves.

As presented in this section, there is some variability in the results of this study and the prior studies regarding IS switching behavior. This is understandable since the studied environments are also differing. As was seen in Table 4 the positive and negative switching factors differ from one study to another due to they all examine different environment. This supports the idea that various viewpoints must be examined separately in the field of IS to understand each phenomena in each environment individually and precisely.

7.6   Theoretical implications

This study continues the line of IS switching behavior research by focusing the outline to yet another more specific environment. The findings and comparisons presented before contribute to the switching behavior research by widening the scale of switching environments. Although smart home environments can be examined as a part of service environments based on the theory by Vargo and Lusch (2004; 2008) and implementing the PPM model of service switching behavior by Bansal, Taylor and James (2005) to said context is justified, there are some environment specific effects that can be seen. There is some contrast between Bansal's, Taylor's and James's (2005) and this study's implications. Some of the switching determinants found in the original PPM model of service switching are seen as significant whereas in this study they are seen as weaker factors. Commitment is found to be opposite to its original being a mooring factor. These findings indicate that the key determinants of switching can vary depending on the environment and the nature of the switching subject.

Switching literature covers the general factors and their functions of switching behavior but when they are applied into the area of IS and technologies there are details and variables that must be noticed. In IS research the use context must be noticed as well as the IS specific user behavior and attitudes towards novel solutions. This can be seen as the diversity of switching determinants and their positive or negative nature presented in earlier IS switching studies in Table 4.

This study contributes to the spectrum and the results are presented in Table 7 as a continuation to Table 4. The emerged sub-themes of alternative's attractiveness are presented to bring forth more detailed information. Since the earlier IS switching studies did not examine the switching behavior according by specific groups such as this study, the results are presented in general manner.

The incumbent product or service, in this study's case the traditional living environment, might have some characteristics that generate positive effect towards the individuals switching. If the individual does not find that their current living environment does not grant them sufficient value, quality or satisfaction,

or they do not trust their current environment, switching intention is higher. By contrast if they feel commitment towards their current living environment and feel that they would lose something important by switching, it would affect the switching intentions negatively.

The substitute product or service, in this study's case the smart home living environment, can have characteristics that generate similar effect to the individual's switching intention. In smart home context the one major factor is alternative's attractiveness, which represents how the substitute environment tempts the individual to switch to it. As discussed before alternative's attractiveness is a factor that consists of several sub-factors that build up the main factor. In the smart home context these sub-factors are the benefits that the solutions offer; ease of use, ecological benefits, hedonic benefits, stress reduction, and enhanced security. Substitute environments characteristics that lower the intention to switch are high price perceptions and privacy issues.

There are also characteristics that are linked to neither the incumbent nor the substitute environment but are the characteristics of the switching individual. In the context of switching to smart home environments the positive characteristics in question are changed personal needs and limitations and 'have to'-attitude. The latter represents the attitude that people see the switch as mandatory as the substitute environment is becoming more and more common and part of society's norms. Individual's characteristic that affects the switching intention negatively is 'others first'-attitude, which represents that some potential users tend to hang back and let others to run-in new technologies and solutions. This is to make certain that the first generation faults and errors are corrected by the time they might finally switch into using them.

Table 7 This study's contribution to the IS switching research

Context	Predictors of switching		
	Incumbent product/service	Substitute product/service	Other
Smart homes	Low perceived value (+) Low perceived quality (+) Low perceived satisfaction (+) Lowered trust (+) Commitment to prior environment (-)	Alternative's attractiveness (+): Ease of use (+) Ecological benefits (+) Hedonic benefits (+) Stress reduction (+) Enhanced security (+) Price perceptions (-) Privacy issues (-)	Changed personal needs and limitations (+) 'Have to'-attitude (+) 'Others first'-attitude (-)

Existing IS switching research that was found and presented in this study's literature review examined situations, where both the switching subject and object are relatively similar and are technological in their nature. Study by Fan and Suh (2014) examined the switching process of mobile phones whereas the others examined more switching between two intangible services. This study examines the situation where the incumbent environment is more traditional and high-end technology is little or less present whereas the substitute environment includes several new solutions, devices, and their functions. Since the consumers have only little firsthand experience on smart home technologies, the preliminary attitudes and feelings, which this study examines, might be somewhat optimistic and overrated. Nevertheless the interest and enthusiasm for new technologies and their benefits is genuine.

Based on this study's results it seems that when the switching environment is relatively long-term and the new technologies themselves do not necessarily present anything new but enhance the existing environments functions, such as automation, the preliminary switching attitudes and intentions are positive regardless of the individual's age or technological skills. As new technologies are developed and implemented in other similar environments in the future, this study's results and their implications can be used as guidelines to build up the future's research to match that particular environment.

The results could be utilized and applied in for example car industry, where technology assisted automation is growing and being developed constantly. As living environments, the basic functions of vehicles are already familiar to consumers and smart technology's automation solutions could be compared to smart home environments. Another potential future's use context for this study's results is wearable technology integrated in clothing and the research examining it. As the solutions are seen beneficial to all kinds of people it is necessary to examine how the potential consumers react to switching their regular clothing to ones that contain high-end technology. This study's results could be applied with

little revision to cover similar product and service industries, where automation technology is still on its way in large scale.

Although the results are based on potential consumers' preliminary attitudes and estimates, the process of switching behavior should be examined at this level as well in order to understand how eventual and final attitudes towards new technologies and concepts is being generated. This will improve and deepen the knowledge on switching behavior and its origin. When smart home technologies have become more common this study should be used as a point of comparison to figure out how consumers' switching behavior has evolved during new technology's development and adoption.

7.7 Practical implications

This study's results and the conclusions made from the results can be used as guidelines in service and technological solutions development as well as information for actors in smart house marketing. An important part of designing new service concepts and devices is to understand what are the factors and matters that affect consumer's behavior to switch from a traditional living environments, where one has lived for a long time and is familiar with, to one that has new technological devices, functionalities, and purposes of use. Generally when designing smart home technologies all kinds of potential users there are several guidelines that can be presented based on this study's results. The guidelines are presented condensed in Table 8.

The first one could be that the importance of practical benefits, such as ecological and economic savings must be emphasized more than the more trivial benefits when introducing the solutions to new potential consumers. The empirical results suggest that the potential users' interest towards smart homes is largely due to the automation solutions that offer savings in natural resources and money. Hedonic benefits, such as entertainment systems and solutions, are more trivial and seen more of a bonus than a necessity.

Second guideline for practice is that the technological solutions should be designed and developed to be unnoticeable so that they would not interfere with peoples' commitment and emotional attachments with their living environments. Consumers tend to highly appreciate their living environments to suit themselves both physically, but mentally as well, and if switching to smart home solutions would degrade that sentimental value the switching intention would also diminish.

Third guideline is to focus on the consumers' personal identities and their appreciation of them. The potential users need to be informed on the privacy matters and reassure that their personal life is safe.

Fourth guideline concerns the variability of the potential smart home technology consumers' needs. The solutions and services should be designed and marketed so that it is clear to the consumers that they do not have to apply every single solution, device and service into their living environments. They should have the opportunity to pick out ones they find interesting and useful to them.

During the interviews the relatively lower benefit propositions of more trivial solutions and services seemed to affect the total interest negatively although some solutions were perceived very attractive. Regardless of the user's age, ease of use was found to be very significant factor in interest development.

Fifth guideline for practice would be to emphasize the ease of use in development. The difference in technology orientation and the gap between different age groups are more insignificant than first one would expect. It is easy to put out potential user's interest with too steep learning curve and complicated use.

The sixth and final general guideline is to emphasize the long-term benefits of smart home technologies when marketing this to consumers who have little or no former experience on smart home technologies and have their doubts. On the other hand new technology is often shunned and its use quitted after short trial if the profits do not emerge quickly. Smart home technologies at least for now relatively expensive and the threshold to invest in them is high if the benefits and gains are not clear.

Table 8 Guidelines for practice

Guideline 1	Emphasize the practical benefits over trivial nice-to-haves.
Guideline 2	Design to benefit but not to interfere.
Guideline 3	Do not let the users get doubtful or worried.
Guideline 4	Let the consumers pick what they need, extra is burden.
Guideline 5	Emphasize ease of use for all.
Guideline 6	Introduce with instant benefits, sell with long-term benefits.

This study compared two generation groups with each other and their individual switching behavior determinants differ slightly. This means that in order to maximize switching intention, these two age groups should be approached differently when designing and developing smart home living environments for them. For older generations the emphasis should be on the long-term future benefits that enable the potential users to live in their familiar living environments longer and independently. Although having been living in their current environments for longer times than the younger age group, the elders acknowledge their future's changing needs and challenges what it comes to managing themselves in their own home. By presenting the smart homes' benefit and usefulness propositions via their own needs, the elders' interest and therefore switching intentions should be easier to acquire. What it comes to the younger generations, money is still the crucial factor. Younger generations have not established themselves as economically as their predecessors so they are very careful where they invest. Also the smart home solutions for younger consumers should be at least somewhat transportable and mobile. They are mostly in a life's situation were moving is very likely and they are not ready to invest into something that they would need to give up eventually because of moving.

8   CONCLUSION

In this chapter the main aspects of the study are revised and the conclusions are presented. First the results and outcomes are summarized followed with the potential contribution on the subject that these outcomes offer. Next the limitations of the study are discussed. Finally recommendations for future research are presented.

8.1   Conclusion and contribution of the study

The main objective of this study was to find out the differences of theoretical digital natives and theoretical digital immigrants regarding the switching behavior determinants in the context of switching from traditional living environment to one that uses smart home technology. PPM model by Bansal, Taylor and James (2005) is used as a model and framework to map these differences. Partial goal is to enhance the knowledge on the reliability and generalization of Prensky's (2001) theory on the differences of digital natives and digital immigrants. These goals are pursued via literature review on the subjects and by conducting an empirical research that consisted of semi-structured theme interview. The interviewees are divided according to their birth year to two groups. People born before the year 1980 are treated as digital immigrants and people born after year 1980 are treated as digital natives according to Tapscott's (2009) division of generations.

As an answer to the main research problem, there are relatively few differences in the switching behavior between the two groups of interviewees. Some of the differences are in the effectivity of particular determinants and some seem to be in the origin of the determinant. The differences seem, however, to be caused mainly by the differing life situations of these two groups rather than the technology skills and attitudes towards new technologies. Among the digital natives quality, value and satisfaction are push factors that frequently affect digital natives switching intentions, whereas these determinants are less frequent among digital immigrants. Trust is a stronger push factor among digital immigrants than among the natives whereas price perception is the other way around. Alternative's attraction is a significant pull factor in both group but among digital immigrants with their eventually upcoming dire needs, such as prolonged independency, it seems to be little stronger. Mooring factors are noticed to be less significant than Bansal's, Taylor's and James's (2005) PPM model suggests. They are also rather similar in both groups. Subjective norms are experienced to be even somewhat pulling factor for the digital natives. Switching costs are significant mooring factor for both groups, but digital immigrants are more worried on intangible losses whereas digital natives worry on tangible costs. Interestingly and against PPM model, commitment seems to be significant mooring factors, not a push factor.

What it comes to shedding some information on the discussion on whether the theory on digital natives and digital immigrants is eligible, some interesting

things emerged while the main research problem was answered to. Although digital natives' and digital immigrants' technology orientation is not noticed to be a factor in switching behavior per se, some differences between these two groups came up during the interviews. Learning habits in learning new technologies are not seen similar to the claims of the theories. Digital immigrants are also keen on trying out new things whereas also digital natives emphasize the importance of simple manuals. Ease of use is seen as an importance in both groups and both groups are similarly interested in the potential and functions of smart home technologies. However, the theories on the distinction of two user groups are supported in some manner. Especially older digital immigrants let the 'more technologically suited' to test new devices first and figure out the flaws before trying out themselves. Another claim that is supported is that the groups anticipate and settle for different kinds of planning and gratification. Digital natives prefer to plan and see the short-term benefits whereas digital immigrants prefer long-term benefits. All in all the subject of living environments seems to be an environment for technology that narrows down the possible division between these two generation groups.

The contribution that this study offers to the area of IS switching research is clear. Earlier studies that examined switching in IS context present various results on how consumers' switching behavior is affected in several different contexts. These contexts are mainly the kind of where both the switching subject and the switching object have technology implemented in them. This study's context widens the scale to where the switching subject is relatively high-end technology free and the switching object has new technologies implemented. The earlier IS studies examine and find factors that affect individuals' switching intention positively or negatively.

This study contributes to earlier studies also by introducing corresponding factors in the area of smart living environments. Switching subject related positive factors to switching intention are low perceived value, quality, and satisfaction and lowered trust towards the current living environment. Commitment to prior environment is switching subject's characteristic that affects switching intention negatively. Switching object also has similar factors. Particularly this study's results emphasize the positive effect of the alternative's attractiveness factor, and propose that this factor should be examined more closely by breaking it into sub-factors to understand the true meaning. These sub-factors are ease of use, ecological benefits, hedonic benefits, stress reduction and enhanced security. Switching objects negative characteristics are high price perceptions and privacy issues. Nonrelated to the switching subject or object, changed personal needs and limitations and 'have to'-attitude are positive factors that depend on the switching individual. Negative personal characteristic is 'others first'-attitude.

The study's results and contributions open up the discussion on how future's smart home environments should be planned and designed in order to make them as interesting as possible for the consumers from two different eras of technology. Similarly the factors that might hinder the consumers' switching intentions towards living environments with smart home technologies must be

taken into consideration so that these factors can be outdone. This does not necessarily mean the differences in the technology orientation of these generation groups, but the differing needs and values that generations have due to their current and future's physical state or life situations.

Finally this study contributes to the still ongoing discussion on the differences of digital natives and digital immigrants. Neither of the two extreme viewpoints is fully supported. Nevertheless this study backs up the way of thinking that the division of technology users should be taken as a guideline, not as an absolute truth. Some of the interviewed digital natives describe themselves as not being particularly technology oriented when some digital immigrants are very keen on trying new devices. The differences of digital natives and digital immigrants seem to be very conditional to the situation and the environment that these two groups act in. The differences between generations' technology habits and attitudes should be kept researched on and examined, but the black and white view of digital natives and digital immigrants must be gotten over.

8.2 Limitations of the study

The study is conducted as wide-ranging and eligible as possible but still there are some limitations and issues that need to be noticed when examining the results and their implications.

Being a subject that has relatively little qualitative research done, the interview questions were defined using previous quantitative research method questions as a base. In order to find out more exact information on an exact environment such as this study's subject, some freedom of choice and evaluation were used when conducting the interviews. There might also be some switching determinants that were missed because of using the PPM model which has a clear set of proposed factors. These emerging factors were tried to identify during the analyzing phase.

Similarly as the interviews were semi-structured there is the possibility that consistency did not remain perfect throughout the each interview. This is understandable since by altering the interview to some extent during its course the interviewer tried to get as much as information as possible on the interviewees' attitudes and feelings.

Being relatively novel and just currently emerging the mass consumer markets, smart homes and their technology are a subject that people have only little first-hand experience. Only some of the interviewees had some solutions, for example security systems, in use at their current living environment or knew someone with similar solutions. The issue regarding the interview sample is the varying level of knowledge on smart. Different level of knowledge might affect the attitudes and feelings the interviewees have towards the subject area. The level was not tested in any means but the example presentation was meant to even the differences. Therefore the results were derived from the feelings and attitudes that were based on the presented examples.

Although the interview sample was extensive there are some details that should be taken into account when examining the results. The digital immigrants were spread over the age distribution rather well and so were the digital natives, but digital natives were mostly high degree students. This might affect the results. In comparison on people that have settled themselves in and have a stable careers, students are constantly in the middle of change and need to adopt themselves to new situation so switching is familiar to them.

Another issue with the interview sample is the generalization. Most of the interviewed digital natives lived in Jyväskylä and the digital immigrant interviewees were scattered in Southern Finland. This results in that the sample cannot be fully generalized to cover whole Finland.

The data analysis is not without issues. The Zotero tool which was used for the analysis is fundamentally designed to be a source management tool and not as a proper qualitative data analyzing tool. Nevertheless it has functions and features that can be used to organize and manage data to a more comprehensible style. This way the actual data assembly and comparison are left to the researcher as manual labor. This research being the researcher's first qualitative study, the risks for human errors exist.

Although the coding, comparison and interpretation of the data was done as carefully as possible, there is a possibility that some of the interview answers were understood and analyzed incorrect because of human to human spoken communication. Each individual has their own way of saying things and reasoning but these are justifiable issues when the study's nature is qualitative. In environments such as this study the answers can be widely differing, biased and subjective.

An issue in examining digital natives and digital immigrants is the pure wideness of the age distribution among the groups. It is at least challenging to see and process for example digital natives born in 1984 and 1993, or digital immigrants born in 1946 and 1979 as pairs with same backgrounds and having grown up in same technology situation. Similarly it is hard to see that individuals born in 1946 and 1979 would have more similar features than individuals born in 1979 and 1984. The categorization by generations by Tapscott (2009) does not provide an eligible starting point for result validation.

The study did not measure in any quantifiable way the technological skills of the interviewees. The results and conclusions are based on the interviewees' delivery on feelings and attitudes. If these technology skills and 'tech savviness' would be tested and measured, it would require controlled laboratory environment and tests in addition to the interviews. This would be the only way to truly clarify if the subject groups' brain functions and train of thought differ from one another.

8.3   Recommendations for future research

Switching behavior should be examined and researched more situation-specifically since each environment and context has its factors and variables to affect

the determinants of switching intention. Technology is being implemented in several various aspects and environments of our lives and each of these environments might have its quirks and nuances that should be taken into consideration when studying it and preparing to design new solutions. Consumers are still volatile what it comes to new technologies. Before such solutions can be planned, accepted and adopted widely the true behavior of consumers regarding changing their traditional environments should be explained. This study's nature being qualitative further quantitative research is needed in order to validate the results. For now the results from this study are based on 22 individuals' feelings and attitudes. Next the results should be tested via quantitative means.

Same as switching behavior the discussion on digital natives and digital immigrants should be examined more case-specifically. The assumptions made on these two groups are still too broad and cannot be applied as is in most cases. Both groups and the generations these groups consist of should be taken into closer examination individually to map out the accurate switching behavior factors. All of these generations' individuals are a either current or future's potential smart living environment inhabitants and therefore sensible subject for extensive research.

In the case of future's IS switching research it is necessary to examine other similar switching environments where the switching subject is relatively high-end technology free and static, and the switching object introduces new solutions. This way it is possible to identify possible continuum and associations between the switching environments. These kinds of future's possible research areas might be vehicle driving automation and wearable technology.

As this and earlier studies' theoretical implications presented, switching behavior determinants should be taken into more focused look and re-evaluated in IS research. The area of IS being immensely variable and subject specific it seems too vague to examine particularly one determinant as it is. In IS's context alternative's attractiveness seems to build up from several sub-factors that are and it is important to examine and understand them separately.

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APPENDIX 1 – INTERVIEW SCENARIO (FINNISH)

Kuluttajien vaihtokäyttäytyminen äly-ympäristöissä
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Haastattelun tarkoitus
Haastattelun tarkoituksena on kerätä tietoa kuluttajien vaihtokäyttäytymisestä ja asenteista. Tietojen avulla selvitetään tekijöitä, jotka vaikuttavat vaihtokäyttäymiseen vaihdettaessa perinteisen asumisen ympäristöstä teknologia-avusteiseen ympäristöön. Haastatteluaineistot käsitellään nimettöminä. Tutkimus suoritetaan Jyväskylän yliopiston tietojenkäsittelytieteiden laitoksella. Lisätietoja tutkimuksesta voi kysyä ohjaajaltani:

Professori Tuure Tuunanen
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Haastattelun eteneminen
Haastattelun aikana tullaan esittämään yksinkertaisia kyllä/ei –kysymyksiä sekä avoimempia kysymyksiä. Haastattelun tietojen tallentamiseksi haastattelun ääni nauhoitetaan ja haastattelija tekee muistiinpanoja haastattelun ajan. Kysymysosioiden välissä haastateltavalle kerrotaan teknologiaratkaisuista, jotka esittelevät esimerkkejä teknologia-avusteisen asumisympäristön mahdollisista toiminnoista.

Haastattelun kysymykset koskevat Teidän mielipiteitänne, tunteitanne sekä käyttäytymistänne uudenlaisia asumisympäristöjä kohtaan. Keskiössä on asumisympäristö, jossa on käytetty älykkäitä teknologiaratkaisuita. Seuraavaksi listatut kysymykset esittävät haastattelun perusrungon. Haastattelija saattaa kysyä tarkentavia lisäkysymyksiä.

APPENDIX 1 – INTERVIEW OUTLINE (FINNISH)

<u>Työntävät tekijät</u>

1. Laatu

    1.1. Miten arvostelisitte nykyistä asumismuotoanne?

    1.2. Onko se mielestänne laadultaan hyvää?

    1.3. Onko se mielestänne laadultaan huonoa?

2. Tyytyväisyys

    2.1. Kuinka tyytyväinen olette tämänhetkiseen asumismuotoonne?

    2.2. Oletteko tyytyväinen palveluihin, jotka koskevat asumistanne ja elämistänne?

    2.3. Onko jotain, mitä haluaisitte muuttaa nykyisessä asumisympäristössänne? Mitä?

    2.4. Vaikuttaako asumisympäristönne onnellisuuteenne? Miten?

3. Arvo

    3.1. Vastaako nykyinen asumisympäristönne tarpeitanne?

    3.2. Onko asumisympäristönne ja elämismuotonne siihen kuluvan rahan ja vaivan arvoista?

4. Luottamus

    4.1. Luotatteko, että pystytte elämään nykyisessä asumisympäristössänne ilman ongelmia ja haasteita?

    4.2. Kuinka varma olette siitä, että ongelmatilanteessa saatte nopeasti apua nykyisessä asumisympäristössänne?

5. Sitoutuneisuus

    5.1. Kuinka kauan olette asuneet nykyisessä asumisympäristössänne?

    5.2. Tunnetteko sitoutuneisuutta nykyistä asumisympäristöänne kohtaan?

    5.3. Millaista tunnearvoa nykyisellä asumisympäristöllänne Teille on?

    5.4. Tunnetteko kuuluvanne nykyiseen asumisympäristöönne?

    5.5. Vaikuttaako tunne muuttopäätökseenne/-innokkuuteenne?

6. Havaitut kulut
  6.1. Ovatko elinkustannuksenne asumisympäristönne puolesta mielestänne korkeat?
  6.2. Saavatko korkeat elinkustannukset miettimään vaihtamista?

TIETOA ÄLYKKÄÄN KODIN TEKNOLOGIASTA

Vetävät tekijät
7. Vaihtoehdon viehätys
  7.1. Oletteko sitä mieltä, että elämänne olisi nautinnollisempaa jos opettelisitte ja käyttäisitte esitetynlaista teknologiaa ja laitteita?
  7.2. Oletteko sitä mieltä, että elämänne olisi helpompaa jos opettelisitte ja käyttäisitte esitetynlaista teknologiaa ja laitteita?
  7.3. Kiinnostaako esitetynlainen teknologia, laitteet ja palvelut Teitä? Miksi? Miksi ei?

Ankkuroivat tekijät
8. Suhtautuminen vaihtamista kohtaan
  8.1. Mitä mieltä olette yleisesti uuteen asumisympäristöön muuttamisesta?
  8.2. Olisitteko valmiita seuraavan puolen vuoden aikana muuttamaan asumisympäristöön, jossa olisi edellä esitetynlaista teknologiaa helpottamassa Teidän elämäänne ja asumistanne?

  Olisiko teknologia-avusteiseen asumisympäristöön muuttaminen Teidän mielestänne:
  8.3. Hyvä idea?
  8.4. Hyödyllistä?
  8.5. Viisasta?
  8.6. Houkuttelevaa?

9. Sosiaalisen ympäristön vaikutteet
  9.1. Arvioikaa, olisiko joku lähipiiristänne tai sukulaisistanne sitä mieltä, että Teidän tulisi muuttaa asumisympäristöön, jossa käytetään esitetynlaista teknologiaa?
  9.2. Arvioikaa mitä mieltä lähipiirinne ja sukulaisenne olisi siitä, että muuttaisitte asumisympäristöön, jossa käytetään esitetynlaista teknologiaa?

10. Vaihtokustannukset
  10.1. Koetteko ongelmalliseksi jos uudessa asumisympäristössänne olisi asioita, joiden käyttöä Teidän tulisi opetella?
  10.2. Oletteko valmiita käyttämään aikaa opetellaksenne uusia asioita uudessa asumisympäristössänne?
  10.3. Oletteko sitä mieltä, että muuttamalla uuteen asumisympäristöön menetätte jotain oleellista elämästänne?

10.4. Oletteko sitä mieltä, että esitetynlaisen teknologian tuomat hyödyt olisivat suhteessa korkeampia nähtyyn vaivaan?

11. Aiempi vaihtokäyttäytyminen
11.1. Kuinka usein olette muuttaneet elämänne aikana?
11.2. Kuvailkaa edellisiä vaihtokokemuksianne. Ovatko elinolonne tai –tapanne muuttuneet muuttamisen jälkeen merkittävästi?
11.3. Ovatko muuttokokemukset olleet positiivisia? Miksi? Miksi eivät?

12. Vaihtelevuuden hakuisuus
12.1. Kokeiletteko mielellänne uusia asioita, kuten uusia teknologisia laitteita?
12.2. Näettekö uuden asumisympäristön toiminnot ja palvelut mielenkiintoisina?
12.3. Mitä mieltä olette teknologia-avusteisesta asumisympäristöstä? Kommentteja?
12.4. Kelle näkisitte esitetynlaisen teknologian olevan hyödyllistä?

Vaihtoaikomukset
13.
13.1. Kun tulee aika muuttaa uuteen asumisympäristöön, arvioikaa kuinka kiinnostunut olette ottamaan teknologisia ratkaisuja ja laitteita kotiinne? Jos ette niin milloin?
13.2. Arvioikaa, oletteko seuraavan vuoden sisällä muuttamassa uuteen asumisympäristöön.
13.3. Kuvailkaa tekijöitä, jotka mahdollisesti vaikuttavat muuttamispäätökseenne positiivisesti.
13.4. Kuvailkaa tekijöitä, jotka mahdollisesti vaikuttavat muuttamispäätökseenne negatiivisesti.

Vaihtokäyttäytyminen

14.
 Oletteko muuttaneet viimeisen kahden vuoden aikana tai onko asumisympäristönne muuttunut viimeisen kahden vuoden aikana merkittävästi?

APPENDIX 3 – DAY IN A SMART HOME EXAMPLE (FINNISH)

Made by company Loxone, found from http://www.loxone.com/fifi/alykoti/koe.html