SMART HOME CONCEPT: DRIVERS AND BARRIERS AMONG THAI CONSUMERS TOWARDS THE INTENTION TO USE SMART HOME

UMAPHORN MISHRA

A THEMATIC PAPER SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF MANAGEMENT
COLLEGE OF MANAGEMENT
MAHIDOL UNIVERSITY
2017

ACKNOWLEDGEMENT

First of all, I would like to express my deepest gratitude to my advisor, Ph.D. Randall Shannon, for his guidance and support towards the entire project. This work would not have been successfully completed without his advises and recommendations, starting from the very beginning to the very last process of this research. Throughout the research, I have been struggled with various things as the topic itself is relatively new, especially in Thailand. In the beginning, searching for the published articles to support the details was not easy at all. With the guidance of my advisor, the scope of study has been narrowed down to where it would be most beneficial to the field of interest. I am also thankful for his patience and kindness on devoting his time to assist me whenever I was struggling throughout the entire project.

Secondly, I also would like to give my appreciation to the committee, Ph.D. Randall Shannon, Ph.D. Phallapa Petison, and Ph.D. Boonying Kongarchapatara for their suggestions in regard to this projects. The knowledge I have discovered through various comments from the committee have provided me with the opportunity to expand and widen the information to make a completion to this research.

Lastly, I would like to give my gratitude to all CMMU's staff, especially to Mr. Prasit Chuensirikulchai, who has assisted me throughout the process of this research submission, from the preparation of Independent Study presentation to the method of handing in the research paper. Also, I am heartily thankful to my family and friends who have always given me support throughout the entire time spent for this research paper. This project would not be successfully completed without the help from everyone.

Umaphorn Mishra

SMART HOME CONCEPT: DRIVERS AND BARRIERS AMONG THAI CONSUMERS TOWARDS THE INTENTION TO USE SMART HOME

UMAPHORN MISHRA 5749047

M.M (MARKETING AND MANAGEMENT)

THEMATIC PAPER ADVISORY COMMITTEE: RANDALL SHANNON, Ph.D., PHALLAPA PETISON, Ph.D., BOONYING KONGARCHAPATARA, Ph.D.

ABSTRACT

The purpose of this study is to understand the key drivers and the barriers towards the intention to use smart home products on Thai consumers. As this advanced technology concept is now becoming an uprising trends among all countries in the world. It is, therefore, essential for smart home company in Thailand to understand potential factors that will affect the decision to convert to smart home appliances. The assumption of this research is based on the six potential group of variables which are energy and cost savings, health consciousness, privacy and personal security concerns, familiarity to technology, perceive reliability of products and cultural dimension (imitation effect vs. innovation effect). The result is developed from the analysis of the potential variables towards to intention to purchase smart home of a total 300 respondents (n=300), who live in Bangkok, Thailand. The results show that several tested factors give positive relationship to the intention to use smart home (key drivers), while some showed negative relationship to the intention to use smart home (key barriers).

KEY WORDS: Smart home / Home technology / Drivers and barriers / Intention to use smart home

57 pages

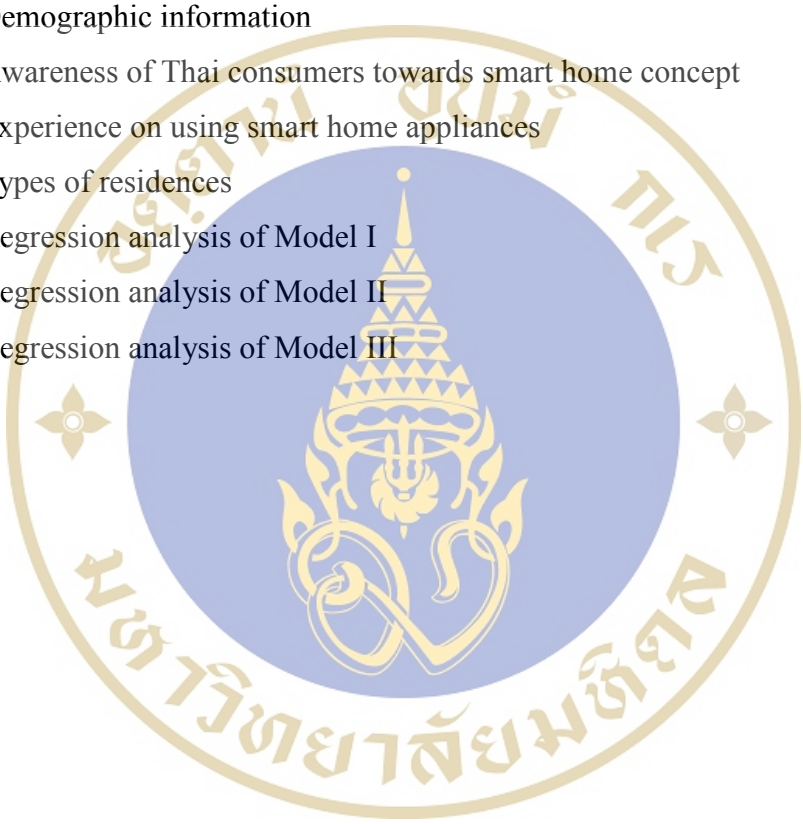
CONTENTS

CONTENTS (cont.)

CONTENTS (cont.)

LIST OF TABLES

LIST OF FIGURES




มหาวิทยาลัยมหิดล

CHAPTER I
INTRODUCTION

Introduction

The usage of the Internet around the world has increased tremendously from the estimated number of 400 million users in the year 2000 to 3.5 billion users in the year 2015; the number indicates significant increase for both developed and developing countries in terms of Internet data usage which has become an essential part of their daily lives (International Telecommunication Union, 2015; STATISTA, 2017). With the widespread of the Internet usage in most part of the world, a more advancement of technology is also developed to fit in with the habit of consumers. As the Internet has become a part of our lives, the concept of Internet of Things (IoTs) has derived in order to better the living of people. The concept of IoTs is believed to enhance the connection among people and all types of firm through the concept of anytime, anyplace, with anything and anyone, ideally using any path/network and any service. (Sundmaeker, Guillemin, Friess, and Woelfflé, 2010). According to Atzori, Iera, and Morabito (2010), IoTs is rapidly gaining attention within the concept of wireless telecommunication. This is basically referred to the communication of, for instance, Radio-Frequency IDentification (RFID) tags, sensors, mobile phone, and etc, in which they can interact with each other for a better communication.

The concept of smart home can be related to the concept of IoTs, in which it helps to extend the use of Internet in a form of network communication through everyday things and sensors. Furthermore, to give a clear definition of the term smart home, it can be defined as to any residence/home that have equipped with technology as a basis to communicate to one another. This technology is used to facilitate the living in the residence as well as the quality of life of human beings (Demiris and Hensel, 2008). The system does not only imply to people living in the house, but also when they are outside. The users can monitor their houses and control their appliances via smart phones or other devices remotely. Thus, these advanced technologies could perhaps

better the lives of people through their daily living activities and improve the quality of lives of people living in the household. Recent researches have showed that many countries have already adopted such concept and it started to spread wider among the people living in the country, for instance, UK, Sweden and other developed countries. Although smart homes have provided user with significant benefits, the lack of adequate knowledge and information on the technology itself causes a mismatch between their demands and the power a smart home can provide for them (Allameh, Jozam, Vries, Timmermans, and Beetz, 2012).

In Thailand today, many household appliance companies such as Siam Cement Group (SCG), KONCEPT furniture, and many others, have already started to introduce this type of technology to Thai consumers in which the appliances were built within the house with the purpose to response directly to consumers' specific needs and wants. Although a lot of people are now aware of the existence of smart home concept, only a specific group of people possess an interest in the actual purchase of products. Despite the current performance, due to the growth in IoTs industry, according to IDC (a global research company), the growth of smart home business in Thailand is expected to grow around 13.2% by the year 2020 (Bangkok Post, 2016). In order for the company to be able to reach the target growth rate, a precise understanding of factors that drive Thai consumers to the interest of this technology is essential as to persuade consumer into the actual usage of smart home equipment in the near future. Moreover, this study is also aiming to find the potential barriers that may obstruct Thai consumers from reaching to these advance technological household appliances.

1.1 Research Objectives

The aims of this study are to understand the factors that motivate Thai consumers towards using smart home appliances for their everyday use. Since, nowadays, there are still very few studies exploring the behavior of Thai consumers towards the intention to use Smart Home technology, in order to generate the growth of product purchasing, adequate understandings of consumers' behavior are important to develop a basic to gain the target growth rate. Also, to indicate the barriers of consumers in using smart home appliances in order to gain more understandings and to develop the

communication channels to fit into consumers' lifestyle in the future, by utilizing the result generated from this research.

1.2 Scope of Study

This study includes a quantitative research among respondents who may or may not be aware of smart home concept or products in Thailand. The data is needed for a further understanding of factors, as a core knowledge, to influence Thai consumers into gaining interest in the adoption of high technology appliances and engaged to them on daily basis. In terms of data collection, 300 respondents who live in Thailand will be targeted to participate in the questionnaires generated online.

1.3 Research Framework and Hypotheses

1.3.1 Research Framework

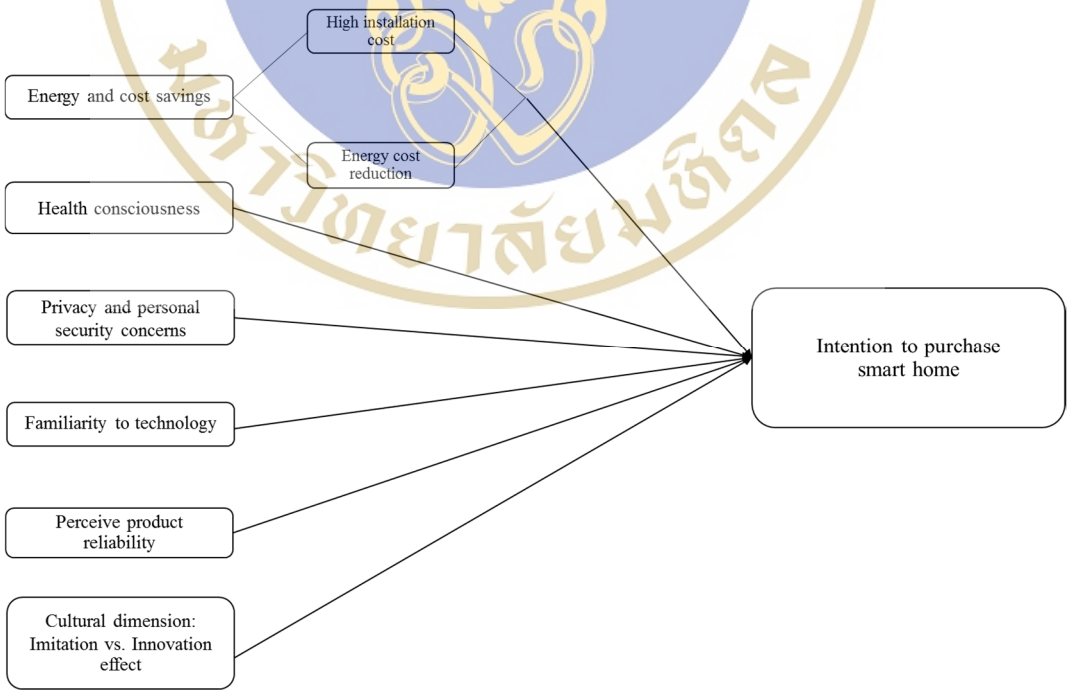


Figure 1.1 Research Framework

1.3.2 Hypotheses

Table 1.1 Hypotheses for intention to use smart home

H_{1a}	High cost of installation is negatively affect the intention to use smart home technology
H_{1b}	Long-term energy consumption savings is positively affect the intention to use smart home technology
H_2	Health consciousness is positively affect to the intention to use smart home technology
H_3	A household with elderly is highly related to the intention to use smart home than household without elderly
H_4	Privacy and personal security concerns is negatively affect the intention to purchase smart home technology
H_5	Familiarity to technology has positive effect to the intention to purchase smart home technology
H_6	Younger age group (lower than 40 years old) is highly susceptible to generate the intention to use smart home technology at home
H_7	Perceive reliability of the products is positively effect to the intention to use smart home technology
H_8	Imitation effect is highly related to the intention to use smart home than innovation effect

CHAPTER II
LITERATURE REVIEW

This chapter expands the ground understanding of smart home concept through researching from the past studies conducted from different countries worldwide including, the definition of smart home and the six factors potential factors which are, energy and cost savings, health consciousness, privacy and personal security, familiarity to technology, perceived reliability of product, cultural dimension**:** imitation and innovation effect**.**

2.1 Definition of smart home

The terms smart home has increasingly become known in wider group of population and in many countries across the world. To clearly define the term for a better understanding, it refers to a residence that contains high technologies that is interconnected to one another in order to analyze the activities of its users as to response accordingly to users' specific demand (Ma, Yang, Apduhan, Huang, Barolli, and Takizawa, 2005). These smart home appliances can connect to many different devices, such as PC, wearable devices, and other technology related devices in order to assist our lives even by remotely access through the use of Internet (Luor, Lu, and Yu, 2015). A study by Allameh, Jozam, Vries, Timmermans, and Beetz, (2012) stated that with user acceptance of smart home, it brings into several benefits especially in terms of spacing where less physical space is required for setting the objects and users can increase the social activities among peers and families. Hence, this advancement of technology will help connecting devices to assist and bring convenience to household for better livings of people around the world in various factors. This research has included six variables in regarding to the past study as a predictor for the intention to use smart home for consumers living in Thailand includes energy and cost savings, health consciousness,

privacy and personal security concerns, familiarity to technology, perceived reliability of products, and cultural dimension (imitation effect vs. innovation effect).

2.2 Energy and cost savings

Many recent studies within the past decades have mentioned that one of the major benefits that users can gain from using smart home technology is to be able to save the energy consumption of a household. This refers to when electronic home appliances can autonomously turn themselves on and off as the user has scheduled them through the connectivity of network even from outside the house (Jacobsson, Boldt, & Carlsson, 2016). Within the past decades where financial crisis has spread globally and the increase in price of energy, people have been struggled to pay for basic needs like food and transportation. Although some may have tried to manually monitor the usage of their electronic devices, they saw no significant reduction in terms of energy bills. Thus, with potential to save more energy of smart home technologies by enable users to monitor the usage would warn them before the receiving the large bill has interested householders as indicated by the study conducted in United Kingdom (Balta-Ozkan, Davidson, Bicket, and Whitmarsh, 2013)

However, with the advancement of such technology, the cost of installation and the appliances themselves can also be reasonably high in price. While a study conducted by Holroyd, Watten, and Newbury (2010) addressed that consumers are more willing to pay if there is a successful evidence of using the new innovative technology, even if the price is fairly high, as taken example from Apple iPhone where the price is fairly high but people are still willing to invest in such products for which they see the technology that will benefit them; however, there are several studies stated the different assumption. According to the study from Balta-Ozkan, Davidson, Bicket, and Whitmarsh (2013), it stated that the cost of installation is the major factor that can be placed as a barrier to use smart home. This is generally because the installation cost of the equipment/appliance is fairly high, it prevented lower income people or tenants living in rental home from using smart home and be excluded from the circle this high technology concept (Balta-Ozkan, Davidson, Bicket, & Whitmarsh, 2013). Instead, it is best equipped for people who have enough funds and foresee a long term worthwhile to

those who own a house of their own. A lot of people, according to the study, also see that, although smart home has a potential on energy cost savings, it is still a bit too far to see today due to the factor of pricing (Balta-Ozkan, Davidson, Bicket, & Whitmarsh, 2013).

Thus, energy and cost saving could be referred to the factor influencing Thai consumers into the intention to adopt smart home technology to their everyday lives. Moreover, in this regards, it could be assumed that in terms of energy and cost saving factor, the cost of installations and long term consumption savings will have the direct effect to the intention to use smart home technology.

H_{1a}: High cost of installation is negatively affect the intention to use smart home technology

H_{1b}: Long-term energy consumption savings is positively affect the intention to use smart home technology

2.3 Health consciousness

Smart home does not only provide technology to better the lives of users in terms of making it more convenience, but also enable people to have a better health monitoring and related attributes towards their health. The emerge of smart technologies can provide several health benefits for household ranging from functional monitoring, safety monitoring, physiological monitoring to cognitive support or sensory aids (Demiris and Hensel, 2008). Furthermore, with the increase in number of aging population, it is important to pay attention to the living of the elders in order to prevent accidents and increase their quality of life especially when unaccompanied. Especially to a household with elderly, smart home can help notify the time for medication, monitor health status and emergency alarm to the device of a family member living outside the house to prevent any case of emergency (Robles and Kim, 2010). Through the benefits of smart home and home health monitoring, according to a research conducted by Liu, Stroulia, Nikolaidis, Miguel-Cruz, and Rincon (2016), older adults showed a high acceptance toward monitoring technology as it allows themselves as well as the caregivers to manage health and activity patterns together with enabling them to see the change of their health status (Liu et. al., 2016).

With these advanced technology, the care service could be provided in a wider range and offered a better support for elderly and people with disabilities. Smart home is believed to be a good support for elderly and disabled people who live alone or with family members working outside most hours of the day and, thus, will be specifically required the assistance of these systems to monitor and alert them in a case of emergency (Chan, Campo, Esteve, and Fourniols, 2009). Apart from serving the elders living alone in the house, smart home could be convenience and useful equipment for family members who do not spend much time at home to be able to be alarmed in the case of emergency. Although no current studies show that family member living with elderly can be one of the factor affecting the use of smart home, the study on interest of elderly towards interest in using smart home can be used to hypothesized that a household with elders are more likely to give interest to applying the technology for better safety and to be able to closely monitor the elders as well. Furthermore, with the maturity of technology and future increase in the cost of healthcare, smart home may become a better choice for a group of people who pay attention and concern to their heath in order to gain/maintain good healthy condition.

H_2: Health consciousness is positively affect to the intention to use smart home technology

H_3: A household with elderly is highly related to the intention to use smart home than household without elderly

2.4 Privacy and personal security concerns

Among all other factors, many researchers have come to conclusion that concern on privacy and personal security could be one of the major factors influencing the intention to use smart home technology. The reason is that, in order for the technology to serve, provide appropriate and insightful service to users, the requirement of exchanging data between users and the device of operators is also essential. This means that users will have to allow the access of personal data as an exchange for the service, assistance or service that one will receive. The company needs to gain adequate and specific data of users as to being able to understand the behavior and needs of the

users thoroughly. There are numbers of experts emphasized on the importance of ensuring security and privacy of the users. Many have claimed that with the lack of confidence, according to Balta-Ozkan, Davidson, Bicket, and Whitmarsh (2013), users will not consider using the products. Hence, it is important for the company to provide sensible precaution and clearly state the condition for the user to understand such exchange for their benefits; otherwise they may encounter 'reputational risk' themselves (Balta-Ozkan, Davidson, Bicket, and Whitmarsh, 2013). For instance, with the monitoring system that a smart home can do in relation to health care benefits, people can be anxious due to the violation of camera system installed to detect the change and the risk of personal information being exposed to organization that has no authority to use it (Liu et. al., 2016).

Hypothetically, it would then be more acceptable for users to engage themselves to the technology when the service provider/company can promise to keep their personal information safe and secure as only to be the source of information for users' benefits without exposing the information to others. Thus, it can be predicted that in order for one to gain an interest in using smart home technology, the perception towards risk should perceived to be relatively low as to considering using product that will take personal information in order to provide adequately satisfied service. The assumption to this factor is that the concerns over users' privacy and personal security can cause a negative perception towards converting to smart home appliances.

H_4: Privacy and personal security concerns is negatively affect the intention to purchase smart home technology

2.5 Familiarity with technology

The application smart home may require significant technical knowledge to operate in which may cause difficulty to adjust for older group of people or individuals who are unfamiliar to using technological devices (Balta-Ozkan, Davidson, Bicket, and Whitmarsh, 2013). This can be inferred in terms of age group where older people will generally find it more difficult to adapt to the concept of smart home technology comparing to the younger age group of people where they tend to be more exposed to

various types of technology. Thus, making this factor an interesting subject to understand the motivation that drives consumers into using smart home technology.

Moreover, with prior experience of exposure to more advanced technology environment, there is a significant correlation between past relationship with more technology and the perceive ease of use of the internet/technology. That is, when people have had an experience of using specific technology, they tend to be more interested and find it simpler to adjust to more advanced technology, thus more likely to accept the technology (Vathanophas, Krittayaphongphun, and Klomsiri, 2008). Since smart home is considered as a highly innovated concept, people are still in the learning curb of the advancement and perhaps creating difficulty for those who are not familiar enough with function and operation of technological system to actually adopt and purchase. The familiarity to technology and the age group could therefore be a good determinant to how the consumers will be intended to adopt to smart home. This study will consider a group of people under 40 years old as a younger age group.

H_5: Familiarity to technology has positive effect to the intention to purchase smart home technology

H_6: Younger age group (lower than 40 years old) is highly susceptible to generate the intention to use smart home technology at home

2.6 Perceive reliability of the product

One of the questions raised among the potential users of smart home equipment is on the reliability of the integration of the devices as the concept itself has not been familiar to wider populations as well as the curiosity from its advancement. It has been stated that the element that may give concern to the integration of smart home appliances did not solely based on the malfunction of the product itself, but also with the function to predict human behavior, as human can be unpredictable sometimes, wrong interpretation can might as well be resulted as an incorrect output (Balta-Ozkan, Davidson, Bicket, and Whitmarsh, 2013). However, because of its highly advanced technology, smart home appliances are considered reliable with the designate to prolong product lifetime.

According to the research conducted by Balta-Ozkan et.al. (2013), there are also some interviewees who tend to be worried about the unintended consequences that may occurred using smart home technology in a case where circuits turned all electricity off including those that needs to leave on, e.g. life support machine. Thus, some advance control system should be implement to avoid these risks and make it become more reliable for the users as well as minimizing the risk of appliance malfunctions. While experts claimed that these advance smart home technology tends to have minimal errors and highly reliable, it shows different results from the public views. Many participants still hold a question of 'what if' where system malfunction and unintentional trigger of sensors could lead to a major problem in a household (Balta-Ozkan, Davidson, Bicket, and Whitmarsh, 2013). However, it still can be assumed that as a potential user, consumers will still be concerned on the reliability of the products and that if there is higher percentage or chance of malfunction, they will not consider using smart home at the first place. This study assumed that with the perceived reliability of smart home product will surely have a positive correlation to the intention of Thai consumers.

H_7: Perceived reliability of the products is positively effect to the intention to use smart home technology

2.7 Cultural dimension: imitation vs. innovation effect

The level of technology acceptance can be varied from one culture to another, where the factor could be from the habit and exposure based on different cultural dimension. Although there is no current research conducted directly to the adoption of smart home, other types of technology adoption could be a significant example to how cultures have played importation role in such adoption or the intention for consumers to use. The example in this regards is from a study conducted by Lee, Trimi, and Kim (2013), which has specifically focus on two different countries, South Korea (type 2 culture) and the US (type 1 culture) using Hofstede Model on four dimensions; individualism/collectivism, power distance (PD), uncertainty avoidance (UA), and long/short term orientation. Type 1 culture, the US., is defined as individualistic, low PD and UA, and a short term oriented, while type 2, on the other

hand, refers to South Korea where the culture is collectivist, score higher PD and UA and long term oriented. The research studied the impact of both cultures towards the adoption of mobile phone and assessed the innovation and imitation influences over time. Type 2 culture resulted in a high possibility to imitate one another among group as they are collectivists while showing a lower percentage to diffuse technology, in contrast with type 1 culture which has shown the opposite results.

To clearly define the terms, imitation effect includes factors of subjective norm and word of mouth among peers especially in an inexperience user. While innovation effect, on the other hand, users are more focused on the benefits, perceived ease of use and the usefulness of the product itself rather than other factors. Thus, innovation effect gives the user a pleasure from enjoying the usage ahead of the norms (Lee, Trimi, and Kim, 2013). In this case, a similar assumption is also applicable for Thai consumers to possess a similar cultural dimension as in South Korea consumers due to the share of similar beliefs, values and as being exposed as collectivist, in general. Hence, this study will be based on the assumption that Thai consumers will present a lower score on innovation effect as compare to imitation effect.

H_8: Imitation effect is highly related to the intention to use smart home than innovation effect

CHAPTER III
RESEARCH METHODOLOGY

This chapter describes the methodology use in this research from samples selections to the measurement of the variables on the intention to use smart home appliances of Thai consumers. The factors consisted in this research includes energy and cost savings, health consciousness, privacy and personal concerns, familiarity to technology, perceived reliability of product, and cultural dimension based on imitation vs. innovation effect. This chapter will give a clear description of the methods used in collecting data as well as the analysis of the data gained in the findings.

3.1 Sampling selection

3.1.1 Sampling size and characteristics

The total of 300 respondents are selected to complete the survey for this research. The respondents are male and female aged more than 18 years old and must be living in Thailand. They can be both experienced or non-experienced users of smart home appliances as the research is aiming to investigate the factors that affect the intention to use smart home products in the future.

3.1.2 Sampling methods

The methods in selecting the samples in this research is by using Snowball Techniques. This technique is considered powerful in order to distribute a questionnaire to samples through the use of social network/internet. With this method, the distribution of the questionnaire is being spread wider among the group of friends and families of selected samples, thus, making this it adequately reliable for the research.

3.2 Measurement of variables

As the questionnaires are targeted to distribute to Thai consumers only, thus the questions are being translated into Thai language for a better understandings of the respondents. The questionnaire consisted of three parts which are general information, potential variables that are related to the intention to use smart home product and demographic.

Part I: General information of potential smart home users

The first part of the questionnaire is aiming understand the awareness of Thai consumers towards smart home concept as to create a basic understanding for this research.

1. Have you heard of Smart Home concept?

□ Yes □ No

2. Have you had an experience using Smart Home products?

□ Yes □ No

3. Which of the followings smart home products/system are you aware of? (Check all that applied)

□ Smart Refrigerator □ Shade & Climate Control System

□ Sound Control System □ Smart Lighting

□ Elderly & Disabled Assistance System and Tools

□ Other (Please Specify)

4. What type of residence are you currently living in?

□ House

□ Condominium/Apartment

□ Other (Please specify)

Figure 3.1 Question to understand general knowledge about smart home concept

Part II: Potential variables related to intention to use smart home product in Thailand

This part of the questionnaire is focusing on the evaluation of the potential variables that predicted to have an effect towards the intention to use smart home product in Thailand. There are six potential variables construct in this research, which are, energy and cost savings, health consciousness, privacy and personal security concerns, familiarity to technology, perceived reliability of product, and cultural dimension based on imitation vs. innovation effect. The mentioned factors were studied from the past research related to smart home concept in other countries. To evaluate the variables, 5-point Likert Scale is applied to measure each statement ranging from strongly agree to strongly disagree. The components of each variable are listed in table 3.1 to table 3.6 as shown below.

Table 3.1 Components of energy and cost savings factor

Components	Reference
By switching my household appliances to smart home technology, it means there will be more cost of installation	(Balta-Ozkan et.al., 2013)
I think smart home will have high repair and maintenance costs	
By converting to smart home, I will be able to reduce my energy bills	

Table 3.2 Components of health consciousness factor

Components	Reference
I am concerned about my health condition	(Menon, Ramanathan, and Block, 2002)
I am concerned about my family member's health condition	
Having assist by smart home, such as, VDO camera monitoring and health alarm, I can make sure that my health condition is properly monitored	

Table 3.3 Components of privacy and personal security concern factor

Components	Reference
It bothers me to give personal information even if it benefits me	(Okazaki, Shintaro, Li, and Hirose, 2009); (Balta-Ozkan et.al., 2013)
I am concerned that the smart home data collecting system will be used to gather and use my personal information	
By installing smart home products, my privacy could easily be invaded	

Table 3.4 Components of familiarity to technology factor

Components	Reference
I considered myself familiar with technology	(Oliver & Bearden , 1985); (Balta-Ozkan et.al., 2013)
I considered myself knowledgeable about technology	
I am confidence that my experience with technology will enable me to operate well with smart home devices/appliances	
Without expertise on technology, I find smart home technology too complex to operate	

Table 3.5 Components of perceive reliability of product factor

Components	Reference
I believe the advancement of smart home appliance will deliver what it promises	(Dabholkar, 1996); (Van Dalan, Dabholkar, and Ruyter, 2007)
The new technology applied in smart home is expected to work well with me	
I believe that this smart home technology will be reliable for home usage on daily basis	
Malfunction of smart home technology concerned me	

Table 3.6 Components of cultural dimension: imitation vs. innovation factor

Components	Reference
Prior to using smart home product, I will gather information from friends/family before purchasing	(Bearden, Netemeyer, and Teel, 1989); (Kim , Haley, and Koo , 2009)
To ensure I am making a right decision as to purchase smart home product, I would follow what others have purchased	
The advancement of smart home technology appeals to me	

The rate of consumers' interests in purchasing smart home product is included in the questionnaire in order to evaluate the potential purchasing rate as shown in Table 3.7.

Table 3.7 Rate of interest in purchasing smart home product in the next 6 months

Not interested				Very Interested
1	2	3	4	5

Part III: Demographic Information

This part of the questionnaire is aimed to understand demographic information of the respondents as to gain further understanding and insight of consumers to the extent of interest in the intention to use smart home product.

7. Please select your Gender

❒ Male ❒ Female

8. Please select your age range

❒ 20 or younger ❒ 21-30 years old

❒ 31-40 years old ❒ 41-50 years old

❒ 51-60 years old ❒ 61 years old and above

9. Do you live with elderly above 60 years old?

❒ Yes ❒ No

10. What is your marital status? (Single answer)

❒ Single ❒ Married ❒ Divorced/ Widowed ❒ Others

11.Which is the best describe your current job? (Single answer)

❒ Students ❒ Office worker ❒ Management Executive

❒ Business owner ❒ Self-employed ❒ Housewife/ husband

❒ Retired ❒ Others

12. What is your total monthly personal income? (Single answer)

❒ Less than 20,000 baht ❒ 20,000 – 45,000 baht

❒ 45,0001 – 70,000 baht ❒ Higher than 70,001 baht

Figure 3.2 Demographic information

3.3 Data collection

The questionnaire conducted in this research is distributed via online survey. For a better understanding for the respondents of all ages in Thailand, the questionnaire is translated to Thai in order to give a clear explanation to the target respondents

3.4 Data analysis

After the target amount of questionnaires have been collected, this research is mainly analyzed using regression analysis to evaluate the relationship among independent variables (energy and cost savings, health consciousness, privacy and personal security concerns, familiarity to technology, perceived reliability of products, and cultural dimension: imitation vs. innovation) towards the dependent variable (intention to use smart home) of the respondents as to predict the likelihood of potential smart home users in the coming future. The main purpose is to evaluate the factors that give an impact towards the intention to purchase smart home as well as to understand the behavior of Thai consumers in this regards.

CHAPTER IV
RESEARCH RESULTS

This chapter is mainly discussing the findings from data collected. Throughout the 300 respondents participated in the survey, the results are being analyzed using correlation and regression analysis in order to find the relationship among the variables towards the intention to use smart home product. The main hypotheses test is performed at p-value < 0.05. Research findings are reported in the following manners: -

Part I: Demographic results and general information
Part II: Reliability analysis
Part III: Correlation and linear regression analysis
Part IV: Hypotheses testing

4.1 Demographic results

This section will provide the information of the demographic of the 300 respondents participated in the survey. The frequency of descriptive analysis is used to measure the number of gender, age, marital status, living with elderly, occupation, and income level.

Table 4.1 Demographic results (n=300)

Demographic		Number of respondents	Percentage **(%)**
Gender	Male	87	29
	Female	213	71
Age	Less than 20 years old	6	2
	21 – 30 years old	112	37.3
	31 – 40 years old	84	28
	41 – 50 years old	46	15.3
	51 – 60 years old	34	11.3
	61 years old and above	18	6
Marital Status	Single	205	68.3
	Married	95	31.7
Living with Elderly (>60 years old)	Yes	200	66.7
	No	100	33.3
Occupation	Employee	103	34.3
	Government/State enterprise officer	74	24.7
	Business owner	57	19
	Students	20	6.7
	Retired	16	5.3
	Housewife	14	4.7
	CEO	10	3.3
	Others	6	2
Income Level	Less than 20,000 THB	42	14
	20,000 – 45,000 THB	115	38.3
	45,001 – 70,000 THB	72	24
	More than 70,000 THB	71	23.7

According to the results in Table 4.1, from the total of 300 respondents, there are 87 males (29 percent) and 213 females (71 percent) participated in the questionnaire. The largest age group represented in this research is between 21 – 30 years old as equivalent to 37.3 percent, following by 31 – 40 years old, 41 – 50 years old, 51 – 60 years old, 60 years old and above, and less than 20 years old, which count into 28 percent, 15.3 percent, 11.3 percent, 6 percent and 2 percent, respectively. Most of the respondents are single, 68.3 percent, while only 31.7 percent are married. There are 66.7 percent of the respondents that are currently living with elderly at the age over 60 years old, in the same residence.

In terms of occupation demographic, the highest number of represent by the group of employee at 34.3 percent, following by government/state enterprise office at 24.7 percent, business owner at 19 percent, student at 6.7 percent, retirement at 5.3 percent, housewife at 4.7 percent, CEO at 3.3 percent and other occupation at 2 percent, respectively.

As for the income level, the majority of the respondents earned monthly income between 20,000 – 45,000 THB, which equivalent to 38.4 percent, while 24 percent earned 45,001 – 70,000 THB, 23.7 percent earned more than 70,000 THB and 14 percent earned less than 20,000 THB.

4.1.1 Awareness of Thai consumers towards smart home concept

The majority of all 300 respondents, equivalent to 90 percent, have already heard about smart home concept. While only 10 percent still have not heard about the concept before as shown in the result in Figure 4.1.

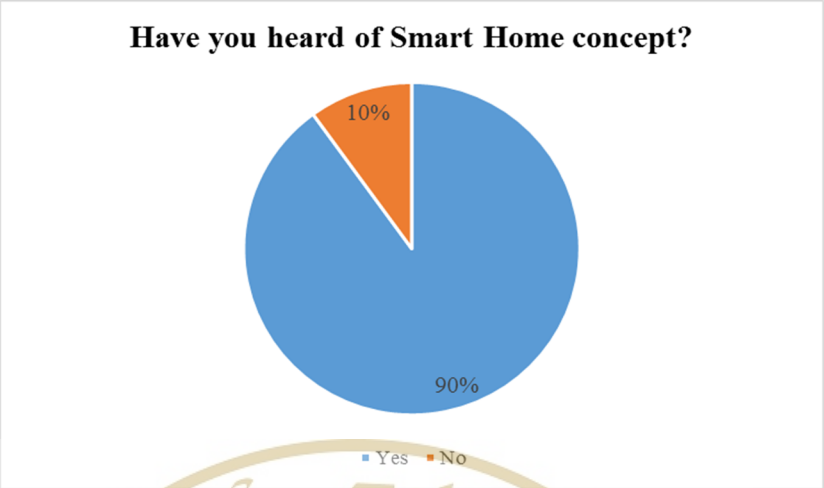


Figure 4.1 Awareness of Thai consumers towards smart home concept (n=300)

4.1.2 Experience on using smart home appliances

Although majority of the respondents has claimed that they are aware or have heard about smart home concept, only 32.3 percent has experienced using smart home products, while 67.7 percent have never had an experience with smart home product before. The result is shown in Figure 4.2.

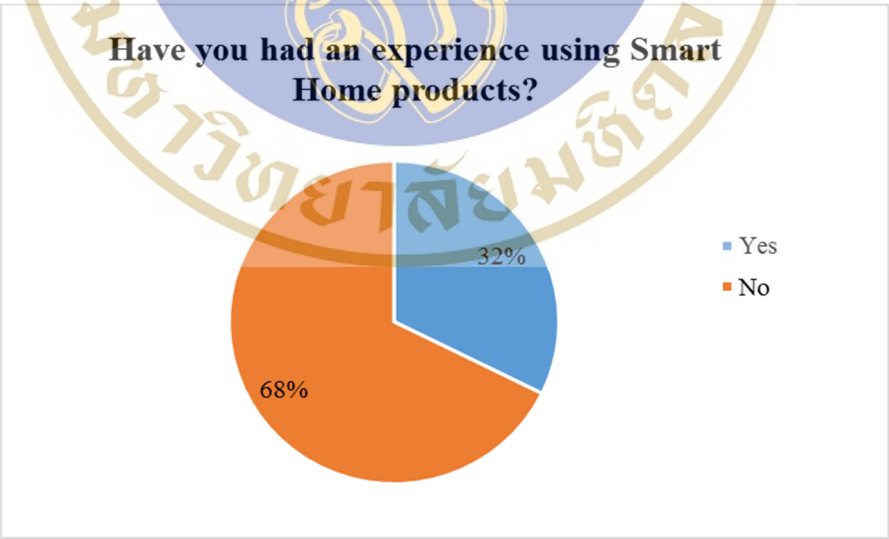


Figure 4.2 Experience on using smart home appliances (n=300)

4.1.3 Awareness of smart home devices

Table 4.2 Awareness of smart home devices (n=300)

Appliances	Number of respondents	Percentage (%)
Smart Lighting	266	88.7
Sound Control System	177	59
Shade & Climate Control System	121	40.3
Elderly & Disabled Assistance System and Tools	85	28.3
Smart Refrigerator	75	25
Others	30	10
None	22	7.3

According to Table 4.2, the majority of respondents are aware of smart lighting system as the appliances of smart home at 88.7 percent. Then followed by Sound Control system, Shade & Climate Control system, Elderly & Disabled Assistance System and Tools, and Smart Refrigerator with 59 percent, 40.3 percent, 28.3 percent, and 25 percent, respectively. Only 10 percent referred to other smart home appliances, while 7.3 percent have never heard or aware of any appliances.

4.1.4 Type of residences

Of all the 300 respondents participated in this research, 82 percent is currently living in a house while 13 percent lives in a condominium. While another 5 percent responses that they are living in other types of residences, such as commercial building for instance as shown in Figure 4.3.

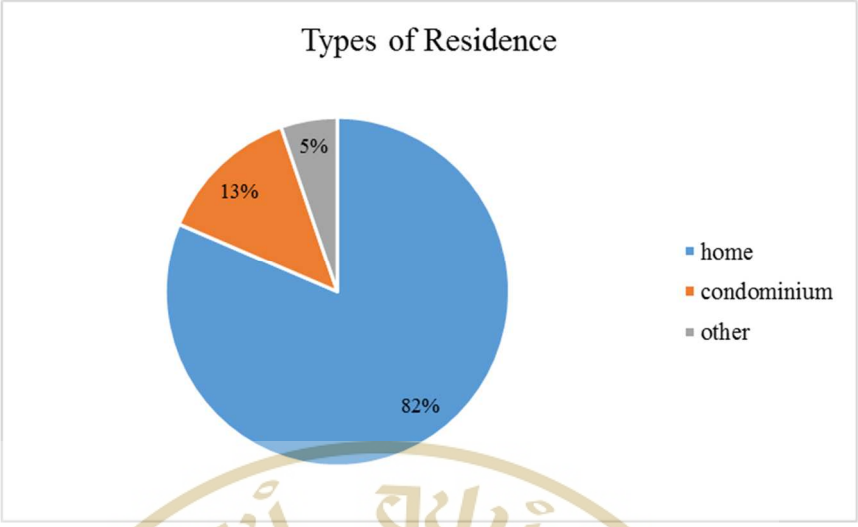


Figure 4.3 Types of residences (n=300)

4.2 Reliability analysis

In order to ensure the validity of the measurement, the questions contented in each factor are developed from the past study. The most common measurement for reliability analysis is using Cronbach's alpha. Generally, Cronbach's alpha reliability coefficient is ranging from zero to one, the closer to one means the higher internal consistency of items considered in the scale (Gliem & Gliem, 2003).

According to George and Mallery (2003), the rule of thumb for Cronbach's alpha is described as; alpha > .9 is 'excellent', 0.9 > alpha > 0.8 is considered 'good', 0.8 > alpha > 0.7 is considered 'acceptable', 0.7 > alpha > 0.6 is considered 'questionable', 0.6 > alpha > 0.5 is considered 'poor', and alpha< 0.5 is considered 'unacceptable'. By analyzing the reliability of the items, the results are shown in Table 4.3. The scale is relatively similar between privacy and personal security (three items), perceived reliability of products (three items), health consciousness (four items), and familiarity to technology (three items) which has the alpha of 0.791, 0.755, 0.712 and 0.705 respectively. These items are considered acceptable in terms of internal consistency. While the other two factors, which are cultural dimension: imitation vs. innovation (three items) and energy and cost savings (three items) has the alpha of lower than the acceptable range and considered as unacceptable.

Table 4.3 Cronbach's alpha for six factors

Factors	Items	Cronbach's alpha
Privacy and Personal Security	3	0.791
Perceive Reliability of Products	3	0.755
Health Consciousness	4	0.712
Familiarity to Technology	4	0.705
Cultural Dimension: Imitation vs. Innovation Effect	3	0.480
Energy and Cost Savings	3	0.352

4.3 Correlation and Linear Regression Analysis

This section reports the findings testing the hypotheses of this research. The methods include correlation and regression analysis.

4.3.1 Correlation Analysis

Using Pearson's correlation to find correlation coefficient (r) as shown in the results on Table 4.4. Familiarity to technology shows strongest positive correlation towards the intention to purchase smart home products with r = 0.344, p-value = 0.000. Cultural dimension as refers to imitation vs. innovation effect, perceived reliability of products and health consciousness also show positive correlation towards the intention to purchase smart home product (r = 0.318, p-value = 0.000; r = 0.285, p-value = 0.000; and r = 0.177, p-value = 0.002 respectively). However, the other two factors which are energy and cost savings, and privacy and personal concerns do not show correlation towards the intention to purchase smart home products at all.

Table 4.4 Pearson's correlation analysis

		Energy and cost savings	Health cons-ciousness	Privacy and personal security concerns	Familiarity to technology	Perceived reliability of product	Cultural dimension: imitation vs. innovation	Intention to purchase smart home product
Energy and cost savings	Pearson Correlation	1	.184**	.197**	.205**	.294**	.371**	.063
	Sig. (2-tailed)		.001	.001	.000	.000	.000	.273
	N	300	300	300	300	300	300	300
Health conscious	Pearson Correlation	.184**	1	.049	.209**	.409**	.298**	.177**
	Sig. (2-tailed)	.001		.396	.000	.000	.000	.002
	N	300	300	300	300	300	300	300
Privacy and personal concerns	Pearson Correlation	.197**	.049	1	.222**	.050	.026	.059
	Sig. (2-tailed)	.001	.396		.000	.390	.655	.309
	N	300	300	300	300	300	300	300
Familiarity to technology	Pearson Correlation	.205**	.209**	.222**	1	.507**	.320**	.344**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000
	N	300	300	300	300	300	300	300
Perceived reliability of product	Pearson Correlation	.294**	.409**	.050	.507**	1	.505**	.285**
	Sig. (2-tailed)	.000	.000	.390	.000		.000	.000
	N	300	300	300	300	300	300	300
Cultural dimension: imitation vs innovation	Pearson Correlation	.371**	.298**	.026	.320**	.505**	1	.318**
	Sig. (2-tailed)	.000	.000	.655	.000	.000		.000
	N	300	300	300	300	300	300	300
Intention to purchase smart home product	Pearson Correlation	.063	.177**	.059	.344**	.285**	.318**	1
	Sig. (2-tailed)	.273	.002	.309	.000	.000	.000	
	N	300	300	300	300	300	300	300

4.3.2 Regression Analysis

Model I: Intention = F **(**energy and cost savings, health consciousness, privacy and personal security concerns, familiarity to technology, perceived reliability of products, and cultural dimension**:** imitation effect vs**.** innovation effect**)**

In Table 4.5, the overall summary of Model I shows the adjusted r square at 0.225, by the mean that the score can be used to predict the intention to purchase smart home by 22.5 percent**.**

Table 4.5 Model I Summary

Model	r	r square	Adjusted r square	Std. Error of the Estimate
1	.496[a]	0.246	0.225	0.785

Table 4.6 Linear Regression of Model I - ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	58.398	8	7.300	11.849	.000
	Residual	179.269	291	0.616		
	Total	237.667	299			

Table 4.6 reports the ANOVA and F statistics in order to test for the overall significance of the models **(**F=11.849, p-value = .000**).** The model is significantly performed in the mean that at least one predictor was statistically significant at 0.05 alpha level as indicated by the p-values**.** Thus, the model can be used in order to gain a further understanding in the intention to purchase smart home product**.** The model can be written as below**:**

Intention to purchase smart home product = 0.103+ **(**0.110**) *(**the cost of installation is high**) + (**-0.327**) *(**the cost of smart home maintenance is high**) +** 0.115***(**smart home appliances can reduce energy cost**) +** 0.057***(**health consciousness**) +** 0.066 ***(**privacy and personal concerns**) +** 0.337 ***(**familiarity to technology**) +** 0.014 ***(**perceived reliability of product**) +** 0.347 ***(**cultural dimension**:** imitation vs**.** innovation effect**)**

Table 4.7 Linear regression analysis of Model I – coefficient

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	90.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	0.103	0.489		0.211	0.833	-0.859	1.065
	The cost of installation is high	0.110	0.082	0.093	1.345	0.180	-0.051	0.272
	The cost of smart home maintenance is high	-0.327	0.076	-0.294	-4.287	0.000	-0.477	-0.177
	Smart home appliance can reduce energy cost	0.115	0.056	0.114	2.039	0.042	0.004	0.226
	health consciousness	0.057	0.078	0.041	0.733	0.464	-0.097	0.211
	privacy and personal security concerns	0.066	0.085	0.042	0.774	0.439	-0.102	0.234
	familiarity to technology	0.337	0.086	0.241	3.929	0.000	0.168	0.506
	perceived reliability of product	0.014	0.138	0.007	0.101	0.919	-0.258	0.286
	cultural dimension: imitation vs innovation	0.347	0.092	0.233	3.768	0.000	0.166	0.529

Table 4.7 explains the linear regression analysis of the overall model. Of all the three construct of energy and cost saving variable, and the other five variables, four

variables, including the sub-construct, show statistically significance at 5% significant level (or p-value < 0.05). The four significant variables are cost of smart home maintenance is high (standardized coefficient beta at -0.294, sig. = 0.000), smart home appliances can reduce energy cost (standardized coefficient beta at 0.114, sig. = 0.042), familiarity to technology (standardized coefficient beta at 0.241, sig. = 0.000) and cultural dimension: imitation vs. innovation (standardized coefficient beta = 0.233, sig. = 0.000).

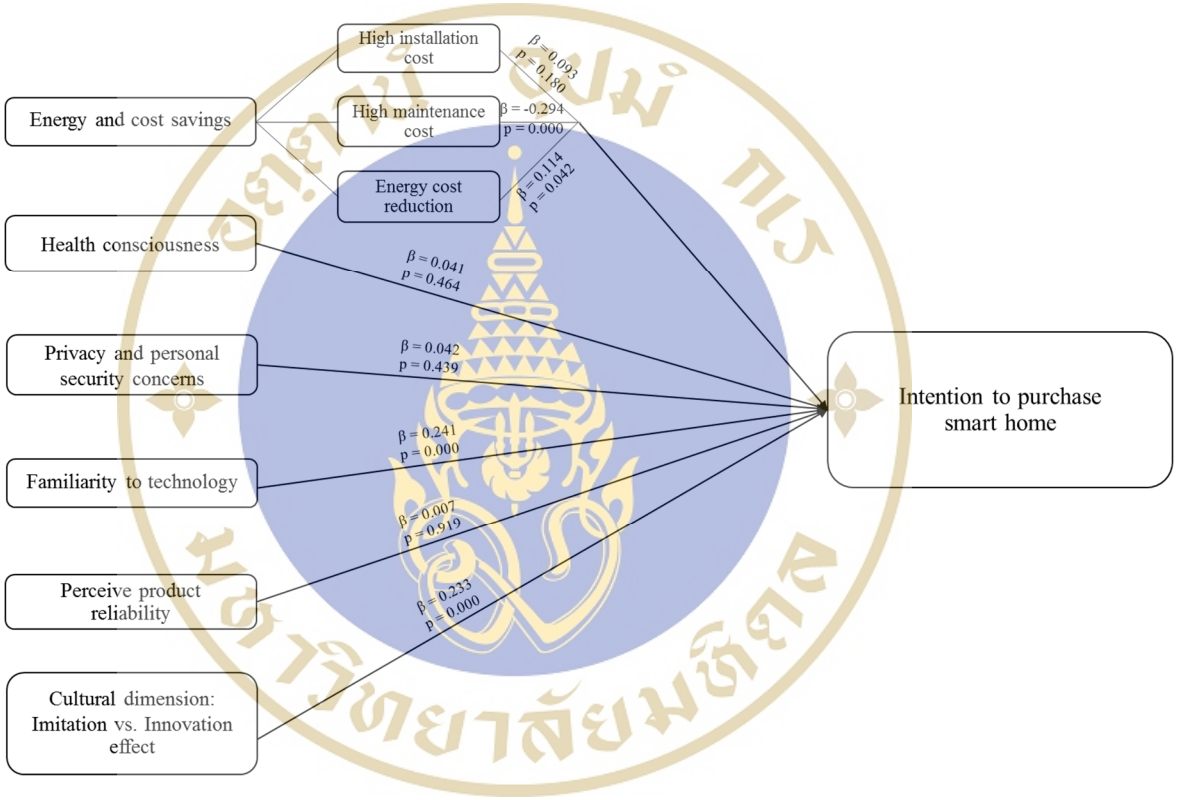


Figure 4.4 Regression analysis of Model I

Model II: Intention = F **(**cost of installation, cost of maintenance, energy savings, health consciousness, privacy and personal security concerns, familiarity to technology, perceived reliability of products, imitation effect and innovation effect**)**

To investigate further in the variables, Model II is developed to find the impact of the variables in accordance to the initial set up hypotheses of the research by further analyze the variables using regression model**.**

Table 4.8 Model II summary

Model	r	r square	Adjusted r square	Std. Error of the Estimate
1	.539[a]	0.291	0.269	0.762

Table 4.8 explains the overall summary of Model I in which the adjusted r square is equal to 0.269, by the mean that the score can be used to predict the intention to purchase smart home by 26.9 percent.

Table 4.9 Linear Regression of Model II – ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	69.174	9	7.686	13.229	.000b
	Residual	168.493	290	0.581		
	Total	237.667	299			

Table 4.9 reports the ANOVA and F statistics in order to test for the overall significance of Model II **(**F=13.229, p-value = .000**).** The model is significantly performed in the mean that at least one predictor was statistically significant at 0.05 alpha level as indicated by the p-values**.** Thus, the model can be used in order to gain a further understanding in the intention to purchase smart home product**.** The model can be written as below**:**

Intention to purchase smart home product = 0.000+ 0.151 *(the cost of smart home installation is high) + (-0.342) *(the cost of smart home maintenance is high) + 0.119 *(smart home appliances can reduce energy cost) + 0.070 *(health consciousness) + 0.074 *(privacy and personal security concerns) + 0.302 *(familiarity of technology) + (-0.55) * (perceived reliability of products) + 0.096 *(imitation effect) + 0.326* (innovation effect)

Table 4.10 Linear regression analysis of Model II – coefficient

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	90.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	0.000	0.475		0.000	1.000	-0.935	0.935
	The cost of smart home installation is high	0.151	0.080	0.127	1.879	0.061	-0.007	0.309
	The cost of smart home maintenance is high	-0.342	0.075	-0.308	-4.580	0.000	-0.488	-0.195
	Smart home appliances can reduce energy cost	0.119	0.055	0.118	2.157	0.032	0.010	0.228
	Health consciousness	0.070	0.076	0.050	0.921	0.358	-0.080	0.220
	Privacy and personal security concerns	0.074	0.083	0.047	0.894	0.372	-0.089	0.237

Table 4.10 Linear regression analysis of Model II – coefficient (cont.)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	90.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
	Familiarity to technology	0.302	0.084	0.216	3.609	0.000	0.137	0.467
	Perceive reliability of product	-0.055	0.134	-0.028	-0.413	0.680	-0.319	0.208
	Imitation effect	0.096	0.100	0.074	0.965	0.335	-0.100	0.293
	Innovation effect	0.326	0.089	0.274	3.662	0.000	0.151	0.501

Table 4.10 explains the linear regression analysis of Model II. The two constructs of the first variable, energy and cost savings, remains statistically significance at 5% significant level (p-value < 0.05). These constructs are the cost of smart home maintenance is high (standardized coefficient beta at -0.308, sig. = 0.000) and smart home appliances can reduce energy cost (standardized coefficient beta at 0.118, sig. = 0.032).

The other sub-constructs that is being analyzed in this model is innovation effect and imitation effect which constructed in cultural dimension variable. This model shows that innovation effect is significant (0.000) with standardized coefficient beta at 0.274. While imitation effect is not statistically significance in this model.

Apart from the mentioned constructs, familiarity to technology remains statistically significant at 0.000 with standardized coefficient beta at 0.216. While the other three variables which are health consciousness, privacy and personal security concerns and perceived reliability of the products are not significant in this regard.

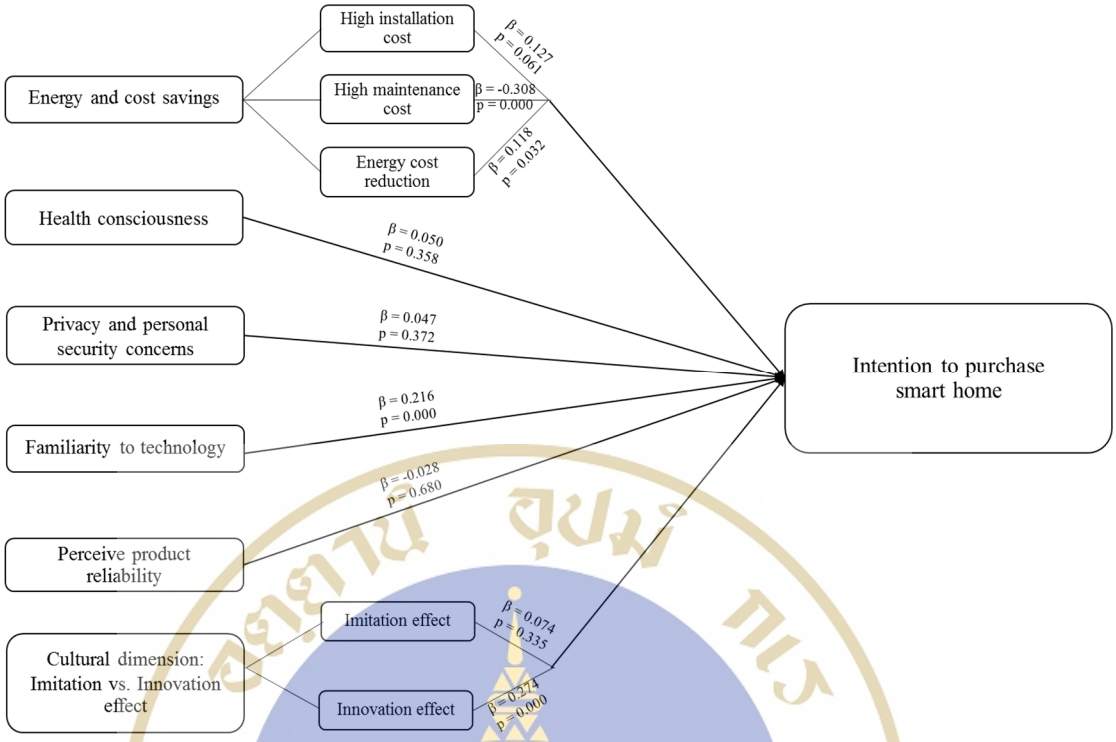


Figure 4.5 Regression analysis of Model II

Model III: Intention = F (cost of installation, cost of maintenance, energy savings, familiarity to technology, imitation effect, and innovation effect)

Table 4.11 Model III summary

Model	r	r square	Adjusted r square	Std. Error of the Estimate
1	.522[a]	0.272	0.262	0.766

Table 4.11 explains the overall summary of Model III in which the adjusted r square is equal to 0.262, by the mean that the score can be used to predict the intention to purchase smart home by 26.2 percent

Table 4.12 Linear Regression of Model III – ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	64.701	4	16.175	27.588	.000[b]
	Residual	172.965	295	0.586		
	Total	237.667	299			

Table 4.12 reports the ANOVA and F statistics in order to test for the overall significance of Model III (F=27.588, p-value = .000). The model is significantly performed in the mean that at least one predictor was statistically significant at 0.05 alpha level as indicated by the p-values. Thus, the model can be used in order to gain a further understanding in the intention to purchase smart home product. The model can be written as below:

Intention to purchase smart home product = 0.432 + (-0.238) *(the cost of smart home maintenance is high) + 0.137 *(smart home appliances can reduce energy cost) + 0.344 *(familiarity to technology) + 0.370 *(innovation effect)

Table 4.13 Linear regression analysis of Model III – coefficient

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	90.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	0.432	0.369		1.173	0.242	-0.293	1.158
	The cost of smart home maintenance is high	-0.238	0.056	-0.214	-4.228	0.000	-0.349	-0.127
	Smart home appliances can reduce energy cost	0.137	0.052	0.136	2.651	0.008	0.035	0.239
	familiarity to technology	0.344	0.074	0.246	4.677	0.000	0.199	0.489
	innovation effect	0.370	0.064	0.311	5.817	0.000	0.245	0.495

By analyzing the data focusing solely on the significance values at 5% significance level, the result from Table 4.13 shows that, by looking at standardized beta, innovation effect has the most impact to the intention to purchase smart home product is innovation effect (0.311) then followed by familiarity to technology (0.246), the cost of smart home maintenance (-0.214), and energy cost reduction (0.136).

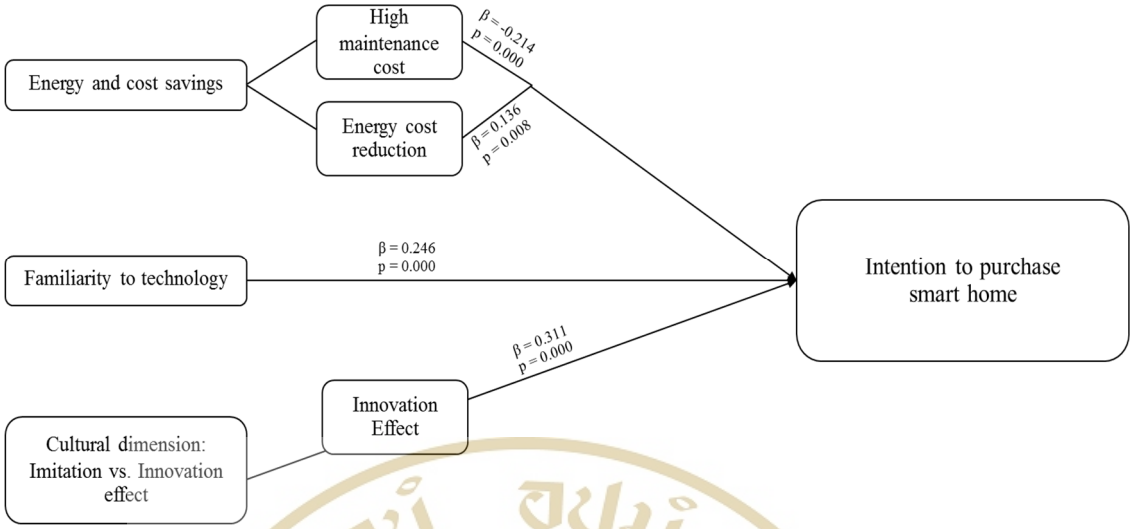


Figure 4.6 Regression analysis of Model III

4.4 Hypotheses Testing

Figure 4.4 shows a regression analysis of Model I which include all the variables tested in this study. According to the results from regression analysis of all variables, this research has found that four factors have an impact, these fours variables are high maintenance cost, energy cost reduction, familiarity to technology and innovation effect as shown in Figure 4.6 (Model III).

4.4.1 Energy and cost savings

Since the hypothesis is set up relating to the cost of installation and energy consumption saving, thus regression analysis is testing the three constructs of this variable to see the significant of the factor towards the intention to purchase smart home. The hypothesis is tested as written below:

H_{1A}: High cost of installation is negatively affect the intention to use smart home technology

According to Model I, II and III (Table 4.9, 4.10, 4.13), the results from regression analysis on the cost of installation does not show statistically significance at 95% confidence level (0.05), thus the factor does not have impact on the intention to purchase smart home product. However, the cost of maintenance, on the other hand,

shows statistically significance in all model**.** When computing only the significance variables on Model III as shown in Table 4**.**13, the factor is still remained significance **(**standardized beta coefficient = -0.214, sig**.** = 0**.**000**).** Thus, it can be described that the cost of installation, alone, does not have any impact on the intention to purchase smart home, but only the cost of maintenance that shows a significant impact to the future intention of Thai consumers**.** The result also indicates that with high cost of maintenance, instead, can negatively impact the intention as well**.**

H_{1B}: Long-term energy consumption savings is positively affect the intention to use smart home technology

Table 4.10 shows Model II regression analysis where energy cost reduction is significant with standardized beta at 0**.**118**.** While Model III in Table 4**.**13, computing significance variables, shows that energy cost reduction is statistically significance with standardized beta at 0**.**136**.** Thus, it is statistically proved that energy consumption savings is positive affect the intention to use smart home technology**.**

4.4.2 Health consciousness

H_2: Health consciousness is positively affect to the intention to use smart home technology

According regression analysis, health consciousness has shown no statistically significance to the intention to purchase smart home product.

H_3: A household with elderly is highly related to the intention to use smart home than household without elderly

Table 4.14 reports the finding using T-Test analysis to find the differences in terms of intention to purchase smart home products among respondents living with or without elderly in the same residence, the result show that the difference in terms of the intention to purchase smart home products between the two groups are high. The mean score for a residence with elderly of age more than 60 years old is 2.590 while mean score for residence with no elderly of age more than 60 years old is 2.720. Table 4.15 shows that the p value is large as sig. is more than 0.05 (sig. = 0.002), meaning that the variance is equal between two groups. Thus, the significance test is relied on the first row in which sig. = 0.234. According to the result, the tested model is not significant

and as a household with elderly score less than a household without elderly. Therefore, the hypothesis is rejected

Table 4.14 T-Test for living with elderly – mean score

	Living with elderly (>60 years old)	n	Mean	Std. Deviation
Intention to purchase smart home products	Yes	200	2.590	.952
	No	100	2.720	.753

Table 4.15 T-Test for living with elderly

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Intention to purchase smart home products	Equal variances assumed	9.970	0.002	-1.191	298	0.234	-0.13000	0.10912
	Equal variances not assumed			-1.287	243.165	0.199	-0.13000	0.10102

4.4.3 Privacy and personal security concerns

H_4: Privacy and personal security concerns is negatively affect the intention to purchase smart home technology

According regression analysis, health consciousness has shown no statistically significance to the intention to purchase smart home product.

4.4.4 Familiarity to technology

H_5: Familiarity to technology has positive effect to the intention to purchase smart home technology

Model I, II and III show that familiarity to technology is significant at 5% significance level at standardized beta at 0.241 in Model I, 0.216 in Model II, and 0.246 in Model III. The results indicate that familiarity to technology has an impact to the intention to purchase smart home product.

H_6: Younger age group is highly susceptible to generate the intention to use smart home technology at home

Table 4.15 reports that age group below 40 years old, as considered as younger age group in this research, has a higher mean score for intention to purchase smart home product (mean = 2.693) while the group aged higher than 40 years old has lower mean score (mean = 2.510). However, when tested for significant of the model, p-value is at sig. = 0.388 and F = 0.747, in which the p-value is greater than 0.05, meaning that the variance is not equal across the two groups. Thus, the significance test is relied on the second row in which sig. = 0.096, as a result it shows that the statistic is not significant in this model. It can also be interpreted that there is no differences in terms of age towards the intention to purchase smart home. According to the finding, the hypothesis is rejected.

Table 4.16 T-Test for age group – mean score

Age		n	Mean	Std. Deviation	Std. Error Mean
Intention to purchase smart home product	Below 40	202	2.6931	.88932	.06257
	Higher than 40	98	2.5102	.88801	.08970

Table 4.17 T-Test for age group

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Intention to purchase smart home product	Equal variances assumed	0.747	0.388	1.671	298	0.096	0.18287	0.10943
	Equal variances not assumed			1.672	192.383	0.096	0.18287	0.10937

4.4.5 Perceive reliability of the products

H_7: Perceive reliability of the products is positively effect to the intention to use smart home technology

According to regression analysis, perceived reliability of the products is not statistically significance in the model. Thus, it shows that the variable does not have .any impact on the intention to purchase smart home product

4.4.6 Cultural dimension: imitation effect vs. innovation effect

The regression analysis of Model I (Table 4.9) shows significance impact of cultural dimension with standardized beta at 0.233. Thus, further investigation of the impact on imitation effect vs. innovation effect is being process in order to find the level of impact between the two factors (imitation effect and innovation effect)

H_8: Imitation effect is highly related to the intention to use smart home than innovation effect

According to Model II in Table 4.9, innovation effect is statistically significant at 5% significance level while imitation effect does not show significant impact to the intention to purchase smart home. Thus, looking at the standardized beta

of innovation effect in order to see the degree of impact is equal to 0.274. While Model III (Table 4.12), where insignificant value is eliminated, standardized beta of innovation effect is 0.311.

Moreover, in order to test for the significant in terms of both factors, ANOVA test is used to further describe the result. Table 4.18 shows a statistically significance at p = 0.000 for both factors, imitation effect and innovation effect. ANOVA analysis reports the F statistic where F = 15.055 for imitation effect and F = 13.707 for innovation effect.

Table 4.18 ANOVA for imitation effect and innovation effect

		Sum of Squares	df	Mean Square	F	Sig.
Imitation	Between Groups	23.928	4	5.982	15.055	0.000
	Within Groups	117.215	295	0.397		
	Total	141.143	299			
innovation	Between Groups	26.350	4	6.587	13.707	0.000
	Within Groups	141.770	295	0.481		
	Total	168.120	299			

By analyzing further between the two factors, imitation effect and innovation effect, in order to find the predicted hypotheses that imitation effect is highly related to the intention to purchase smart home than innovation effect, using compare mean method with n = 300 for both variables; the results shows that the mean score in innovation effect is slightly higher (mean = 3.860) than imitation effect (mean = 3.545) as shown in Table 4.19. The standard deviation for imitation and innovation effect is 0.687 and 0.750 respectively. Thus, the hypothesis is rejected.

Table 4.19 Imitation effect vs. innovation effect – compare mean

Imitation vs. innovation		n	Mean	Std. Deviation
Intention to purchase smart home product	Imitation	300	3.545	0.687
	Innovation	300	3.860	0.750

CHAPTER V
CONCLUSION

This chapter links the gathered results back to the main purpose of this research as to enhance understanding of Thai consumers towards the intention to use smart home technology. The conclusion expands the findings and applies the results in terms of managerial implications. This chapter is also discussed the limitations found in this research and explore the future research which can be utilized from this study.

5.1 Conclusion

This study has addressed the major determinants factors towards the intention to use smart home for Thai consumers. The assumption was that the six factors, which are energy and cost savings, health consciousness, privacy and personal security, familiarity to technology, perceive reliability of the products and cultural dimension on imitation effect vs. innovation effect, were correlated with the intention to purchase smart home in the near future. The given factors were addressed in the past study as to have effect on the intention to use smart home. According to the result from Chapter 4, not all the factors show significance impact towards the future purchase of smart home products. Only four factors, which are, two sub-constructs of energy and cost savings variables (high maintenance cost and energy cost savings), familiarity with technology and innovation effect among individuals, are found to be significant.

With the concern solely based on the factors that are statistically significance, the results indicated that with higher maintenance cost of smart home products it will, perhaps, decrease the interest in purchasing smart home appliances as seen from the negative standardized coefficient beta on the tested models at -0.294, -0.308, and -0.214, ranging from Model I, II and III. Moreover, the result also shows that with higher familiarity to technology, which applies to better knowledge and more exposure to technology can be predicted to affect the purchase intention for Thai

consumer as well. Lastly, the fourth factor, innovation effect has shown a statistically significance impact to the intention to purchase on Thai consumers. The initial assumption was that Thai culture tends to be more collective, thus there should be a greater impact on the imitation effect rather than being innovative. However, this study has indicated a different result where imitation effect did not show significant impact in term of statistic, but instead a higher score on innovation. In addition, from the initial statement which predicted that a household living with elderly is more likely to generate higher potential to use smart home than the residence without elderly. The result also shows relatively similar score among the two groups, however, it indicates that a household with elderly showed less intention score as compare to a household without elderly. Giving this circumstances, it clearly states that, living with or without elderly my not be an effective predictor to the future purchase of smart home appliances in Thailand.

Moreover, in terms of age group, although the result of the test showed that a group under 40 years old scored higher as compare to a group of respondents older than 40 years old, the test was not significant to indicate the finding. This could be interpreted that the intention to purchase for both groups are not truly different between the two group. In other word, the differences between younger group and older group are not truly defined and that the intention to purchase smart home may vary among all age.

5.2 Managerial Implications

The result of this research shows a linkage between given factors towards the intention to purchase smart home product in Thailand. These results can be useful for the smart home related product companies/distributors to see the factors that could directly affect the decision of the consumers as well as giving an in depth understanding towards the behavior of Thai consumers in the actual use of smart home product. Some of the factors addressed in this research have been previously studied to show an impact on the decision to use smart home product in other countries, but not in Thailand. According to the results, it has been clearly stated that some of the factors did not show an impact, in terms of statistics, to the decision of consumers. This study indicates that

the company should focus more on providing information on how smart home can promote the savings to consumers' energy bills as the result shows positive impact towards the decision in future purchase of smart home product. Instead of the cost of installation being the impact, high maintenance, on the other hand, is significantly impact the intention to purchase. Instead of cost of installation being the important factor, high maintenance cost, on the other hand, is significantly impact the intention to purchase. With a negative impact of high maintenance cost of smart home, it could also be indicated as a barrier for Thai consumers to adapt to such technology, thus the company could enhance or better an after sales service as to eliminate the negativity towards the decision. Hence, by knowing the key barriers into purchasing, company could use the outcome to create a better solution as to reduce concern regarding to high maintenance cost, or perhaps be overlooked.

In targeting the age group of consumers, this research has shown relatively the same results between younger age group (below 40) and old age group (above 40) in the interest in using smart home. However, potential consumers with more familiarity or exposure to technology, such as smart phone, tablets, or other gadgets, tend to have more relation to the interest rate. Also, the innovative factor can be another interest factor that affect the interest rate in Thai consumers. The result can indicate the direction of promoting the product, not by targeting the age group, but generally to people who have interests in smart technology products can be the strongest point of focus for smart home company.

Most importantly, the study has shown that nowadays, consumers have already known about the concept of smart living, but the majority still has not had any experience with it. This could mean that creating the awareness of the product may not be the effective direction, but more on educating and providing adequate information and interest in potential consumers to convert from using regular home appliances to smart living products.

To conclude, this research can be supported as the first background knowledge for the company in order to understand the factors that have direct effect to the potential consumers. In addition, this study can also be served as a guideline for creating business strategy as to tackle the right inducing factors/problems that will enhance consumers in decision making to convert into smart home. Energy and cost

savings, familiarity to technology and innovative effect give a positive perception to the consumers while the concern over high maintenance cost is considered hidden issue that give a negative perception to the consumers. Hence, emphasizing on the positive factors supported by this study, and thoroughly understand the insight of consumer in this regard can gradually gain interest in consumers as the products themselves have a wider range of benefits consumers could gain to improve their quality of life and a better utilization of their time and spending in the long run.

5.3 Limitations

Throughout the research, there were several limitations to the study, which created a gap to this study. First of all, the method of this research is mainly focus on quantitative that only help gaining general understanding of the key factors. However, with the use of qualitative method, an in depth understanding could be developed to further understand the demand of the potential consumers. Secondly, in distributing the questionnaire, it only provided for respondents living in Bangkok area, which does not represent the entire province in Thailand. Lastly, the lack of reliability testing in this research has create some misleading to the question which resulting in lower Cronbach's alpha in several variables in this research.

5.4 Future Research

A future research in related to smart home usage could be done using both quantitative and qualitative method in order to gain a more in depth study of the behavior of consumers. The study could be developed in order to investigate the appropriate channel to communicate to consumers, aiming to increase the sales of the product since the results have shown that majority of them know the concept of smart home, but have never had an experience them. By getting a better understanding on how to promote the product to the correct communication channel, the company can increase the actual product usage as well as creating the growth of the industry as a whole.

Moreover, although the products themselves are technology related, a survey through offline channel should also be included in the data collection process.

By distributing the survey through the Internet, only a specific group of people can be reached, however, with the distribution of questionnaire through offline channel, an old fashion paper formed survey, a wider group of respondents could be participated and captured the information differently. For example, older people who might need health assistance using advance home product technology might not be widely include in the online survey, but more through offline. The result gained can also be used to expand the findings in terms of cost-effectiveness of the experienced users in order to get a better insight of the users.

This study may not have included all the possible factors that give the effect to the interest in using smart home. A level of income can also be another determinant use in a future research. The differences in income level may help elaborate the intention to purchase smart home in a much deeper perspective as it is more realistic in term of purchasing power of consumers. In addition, to this study on the subject of age differences, although this research indicates a relatively similar mean score towards the, the future research may conduct to investigate further into this subject by expanding the group of age to see the difference in particular age group, in a shallow gap of age to observe the differences among each group and be able to define them clearly. Lastly, there are also other factors that determine the effect towards the intention to purchase, in which researchers could develop in order to gain an insight regarding to the topics and to apply them to the product itself or sales service in order to increase the quality of life for consumers in the near future.

REFERENCES

Allameh, E., Jozam, M. H., Vries, B. d., Timmermans, H., & Beetz, J. (2012). The role of Smart Home in Smart Real Estate. *Journal of European Real Estate REserach, 5*(2), 156-170.

Atzori, L., Iera, G., & Morabito, T. (2010). The Internet of Things: A survey. *Computer Networks*, 2787 - 2804.

Balta-Ozkan, N., Boteler, B., & Amerighi, O. (2014). European smart home market development: Public views on technical and economic aspects across the United Kingdom, Germany and Italy. *Energy Research & Social Science*, 65 - 77.

Balta-Ozkan, N., Davidson, R., Bicket, M., & Whitmarsh, L. (2013). The development of smart homes market in the UK. *Energy*, 361 - 372.

Bangkok Post. (2016, December 16). *IoT gaining in popularity among Thais* . Retrieved from www.bangkokpost.com: http://www.bangkokpost.com/tech/local-news/1160757/iot-gaining-in-popularity-among-thais

Bearden, W. O., Netemeyer, R. G., & Teel, J. E. (1989). Measurement of Consumer Susceptibility to Interpersonal Influence. *Journal of Consumer Research*, 473-481.

Bruner , G., & Kumar , A. (2007). Gadget Lovers . *Journal of the Academy of Marketing Science* , 329-339 .

Chan , M., Campo , E., Estève , D., & Fourniols , J.-Y. (2009). Smart homes — Current features and future perspectives . *Maturitas* , 90–97 .

Dabholkar, P. A. (1996). Consumer Evaluations of New Technology-Based Self-Service Options: An Investigation of Alternative Models of Service Quality. *International Journal of Research in Marketing*, 29-51.

Demiris, G., & Hensel, B. (2008). Technologies for an Aging Society: A Systematic Review of "Smart Home" Applications. *Yearbook of medical informatics*, 33 - 40.

Demoulin, N. T., & Zidda , P. (2009). Drivers of Customers' Adoption and Adoption Timing of a New Loyalty Card in the Grocery Retail Market. *Journal of Retailing*, 391-405.

George, D., & Mallery, P. (2003). *SPSS for Windows step by step: A simple guide and reference* (11.0 update (4th ed.) ed.). Boston: Boston: Allyn & Bacon.

Gliem, J. A., & Gliem, R. R. (2003). Calculating, Interpreting, and Reporting Cronbach's Alpha Reliability Coefficient for Likert-Type Scales. *Midwest Research to Practice Conference in Adult, Continuing, and Community Education*, 82-88.

Gurhan-Canli, Z., & Batra , R. (2004). When Corporate Image Affects Product Evaluations: The Moderating Role of Perceived Risk. *JMR*, 197-205 .

Holroyd , P., Watten, P., & Newbury, P. (2010). Why is my home not smart? . *Aging friendly technology for health and independence*, 51-59.

International Telecommunication Union. (2015). *ICT Facts & Figures*. Retrieved October 3, 2016, from www.itu.int: https://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2015.pdf

Jacobsson, A., Boldt, M., & Carlsson, B. (2016). A risk analysis of a smart home automation system. *Future Generation Computer Systems*, 719-733.

Kim , S., Haley, E., & Koo , G.-Y. (2009). Comparison of the Paths From Consumer Involvement Types To Ad Responses Between Corporate Advertising And Product Advertising . *Journal of Advertising* , 67-80 .

Kim, S., Haley, E., & Koo, G. (2009). Comparison of the paths from consumer involvement types to ad responses between corporate advertising and product advertising. *Journal of Advertising*, 67-80.

Lee, S.-G., Trimi, S., & Kim, C. (2013). The impact of cultural differences on technology adoption. *Journal of World Business*, 20 - 29.

Liu, L., Stroulia, E., Nikolaidis, I., Miguel-Cruz, A., & Rincon, A. R. (2016). Smart homes and home helath monitoring techonologies for older adults: A systematic review. *International Journal of Medical Informatics*, 44-59.

Luor , T., Lu , H.-P., & Yu , H. (2015). Exploring the critical quality attributes and models of smart homes . *Maturitas* , 377-386.

Ma, J., Yang, L. T., Apduhan, B. O., Huang, R., Barolli, L., & Takizawa, M. (2005). Towards a smart world and ubiquitous intelligence: A walkthrough from smart things to smart hyperspaces and UbicKids. *nternational Journal of Pervasive Computing and Communications*, *1*(1), 53 - 68.

Menon, G., Ramanathan , S., & Block, L. G. (2002). We're At As Much Risk As We Are Led to Believe: Effects of Message Cues on Judgments of Health Risk . *JCR* , 533-549 .

Okazaki, Shintaro, Li, H., & Hirose, a. M. (2009). Consumer Privacy Concerns and Preference for Degree of Regulatory Control. *Journal of Advertising*, 63-77.

Oliver, R. L., & Bearden , W. O. (1985). Crossover Effects in the Theory of Reasoned Action: A Moderating Influence Attempt. *JCR*, 324-340 .

Robles, R. J., & Kim, T.-h. (2010, February). Applications, Systems and Methods in Smart Home Technology: A Review. *International Journal of Advanced Science and Technology*, *15*, 37 - 47.

STATISTA. (2017). *Number of internet users worldwide from 2005 to 2016 (in millions)*. Retrieved April 22, 2017, from www.statista.com: https://www.statista.com/statistics/273018/number-of-internet-users-worldwide/

Sundmaeker, H., Guillemin, P., Friess, P., & Woelfflé, S. (2010). *Vision and Challenges for Realising the Internet of Things.* Brussel: European Commission.

Van Dalan, W. M., Dabholkar, P., & Ruyter, K. (2007). Satisfaction with Online Commercial Group Chat: The Influence of Perceived Technology Attributes, Chat Group Characteristics, and Advisor Communication Style. *Journal of Retailing*, 339-358.

Vathanophas , V., Krittayaphongphun , N., & Klomsiri , C. (2008). Technology acceptance toward e-government initiative in Royal Thai Navy. *Transforming Government: People, Process and Policy* , *2*(4), 256 - 282 .


มหาวิทยาลัยมหิดล

APPENDICES

Appendix A: Quantitative Questionnaire Items

Questionnaire to extend the understanding of the factors driven and key barriers among Thai consumers towards the intention to use Smart Home

---

This questionnaire is conducted by a master individual study student from College of Management Mahidol University in order to better understand customers' motivations to use smart home equipment as well as to understand the barriers that may obstruct consumer from the intention to use. Your information filled will be kept confidential and also will be used for this research only. The questionnaire will take approximately 15-20 minutes, please kindly fill in every questions as provided. Thank you very much for your collaboration.

What is Smart Home?

Smart home can be defined as a residence equipped with various technology that help in everyday functions, tailored assistance for individuals and monitor residents to increase the efficiency of the living in everyday lives. This advanced technology is connected with devices through sensors and Internet that can remotely access/communicate to its functions, i.e. camera monitoring, automatic turn on/off light, emergency alarm and etc.

Part I: General Information about Smart Home

Introduction: Please mark a ☑ next to your choice and fill in the gap

1. Have you heard of Smart Home concept?

❒ Yes ❒ No

2. Have you had an experience using Smart Home products?

❒ Yes ❒ No

3. Which of the followings smart home products/system are you aware of? (Check all that applied)

❒ Smart Refrigerator ❒ Shade & Climate Control System

❒ Smart TV ❒ Sound Control System

❒ Smart Lighting ❒ Elderly & Disabled Assistance System and Tools

❒ Other (Please Specify)

4. What type of residence are you currently living in?

❒ House

❒ Condominium/Apartment

❒ Other (Please specify)

Part II: Evaluate of related questions on Smart Home

Instruction: Please identify to what extend you agree or disagree with each of the following statements.

5. Please rate how you agree with the following attributes about using Smart Home products/devices. (Single answer for each statement)

Items	Low				High
	1	2	3	4	5
	Strongly disagree	Disagree	Moderately agree	Agree	Extremely agree
Energy and Cost Savings (Balta-Ozkan et.al., 2013)					
By switching my household appliances to smart home technology, it means there will be more cost of installation					
I think smart home will have high repair and maintenance costs					
By converting to smart home, I will be able to reduce my energy bills					
Health Consciousness (Menon, Ramanathan , & Block, 2002)					
I am concerned about my health condition					
I am concerned about my family member's health condition					
Having assist by smart home, such as, VDO camera monitoring and health alarm, I can make sure that my health condition is properly monitored					

Items	Low				High
	1	2	3	4	5
	Strongly disagree	Disagree	Moderately agree	Agree	Extremely agree
Privacy and Personal Security Concern (Okazaki, Shintaro, Li, & Hirose, 2009); **(**Balta-Ozkan et.al., 2013**)**					
It bothers me to give personal information even if it benefits me					
I am concerned that the smart home data collecting system will be used to gather and use my personal information					
By installing smart home products, my privacy could easily be invaded					
Familiarity to Technology (Oliver & Bearden , 1985); **(**Balta-Ozkan et.al., 2013**)**					
I considered myself familiar with technology					
I considered myself knowledgeable about technology					
I am confidence that my experience with technology will enable me to operate well with smart home devices/appliances					
Without expertise on technology, I find smart home technology too complex to operate					
Perceive Reliability of Product (Dabholkar, 1996); (Van Dalan, Dabholkar, & Ruyter, 2007)					
I believe the advancement of smart home appliance will deliver what it promises					
The new technology applied in smart home is expected to work well with me					
I believe that this smart home technology will be reliable for home usage on daily basis					
Malfunction of smart home technology concerned me					

Items	Low				High
	1	2	3	4	5
	Strongly disagree	Disagree	Moderately agree	Agree	Extremely agree
Cultural Dimension: Imitation vs. Innovation (Bearden, Netemeyer, & Teel, 1989); (Kim , Haley, & Koo , 2009)					
Prior to using smart home product, I will gather information from friends/family before purchasing					
To ensure I am making a right decision as to purchase smart home product, I would follow what others have purchased					
The advancement of smart home technology appeals to me					

6. How likely would you be interested in purchasing smart home product in the next 6 months?

Not interested				Very Interested
1	2	3	4	5

Part III: Demographic Information

7. Please select your gender

❒ Male ❒ Female

8. Please select your age range

❒ 20 or younger ❒ 21-30 years old

❒ 31-40 years old ❒ 41-50 years old

❒ 51-60 years old ❒ 61 years old and above

9. Do you live with elderly above 60 years old?

❒ Yes ❒ No

10. What is your marital status? (Single answer)

❒ Single ❒ Married ❒ Divorced/ Widowed ❒ Others

11.Which is the best describe your current job? (Single answer)

❒ Students ❒ Office worker ❒ Management Executive ❒ Business owner

❒ Self-employed ❒ Housewife/ husband ❒ Retired ❒ Others

12. What is your total monthly personal income? (Single answer)

❒ Less than 20,000 baht ❒ 20,000 – 45,000 baht

❒ 45,0001 – 70,000 baht ❒ Higher than 70,001 baht

- Thank you very much for your time -