Determining Customer Value of Ubiquitous Home Services:

The Case of Indonesia

by

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Certification of Originality

I, **Vinsensius Benny Purwanto**, hereby declare that this research is my own work and has not been submitted in any form for the award of another degree at any university or institute of tertiary education. Any information derived from the published or unpublished work of others has been properly cited or acknowledged appropriately.

March 2016

Vinsensius Benny Purwanto

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Abstract

The concept of ubiquitous computing (the ability to perform computational activity anywhere and anytime) has been long developed; and its realization in the form of U-services (services delivered through ubiquitous computing) is now underway. One example of U-services available in the market is U-service of Home Automation System (HAS). A home equipped with HAS allows users to control and monitor electronics appliances, such as lights, television, CCTV, door lock, or sensors anywhere and anytime (ubiquity). In Indonesia, there's an increase in the number of HAS service providers recently. However, the market reaction towards HAS business is still unknown. Therefore, based on Theory of Reasoned Action (TRA) and Structural Equation Modeling (SEM), this research focuses on analyzing the market from users' perspective by identifying the perceived value of HAS as ubiquitous home service for homeowners in Indonesia, the need factor and their relationship with HAS buying intention. A quantitative research based on questionnaire survey which targeted random Indonesian homeowners was done. It is found that some perceived benefits of HAS, such as investment in HAS (monetary value), productivity, security and enjoyment are important factors in increasing the intention to buy HAS. HAS benefit in providing energy saving is also found to be important for female. On the other hand, the price of HAS (for younger people) and privacy issue are found to be the statistically significant factor in reducing HAS buying intention. The best performing benefit of HAS is its benefit in providing ubiquity. However, it is found that the ubiquity itself cannot influence HAS buying intention. It is also found that the general attitude towards HAS can influence HAS buying intention positively. The need for uniqueness can be the buying driven factor as it can increase HAS buying intention and outweighs the satisfaction with the current home. Based on that information, real estate developers and HAS providers can obtain valuable input for

developing HAS services. It can also be used as a framework for developing another type of u-services.

Keywords Ubiquitous Computing, U-service, Home Automation System, Perceived Customer Value, Theory of Reasoned Action, Structural Equation Modeling

CHAPTER 1

I. Introduction

I.1. Background

The term "ubiquitous services" or "u-services" emerged following the idea of "ubiquitous computing", which literally means computing everywhere. It allows users to perform computational activity anywhere and anytime. U-services are the services delivered through ubiquitous computing and enable users to perform their day-to-day activities. Nonetheless, Choi et al. (2012, p.1) argue that "one of the main problems of today's ubiquitous computing system is that they cannot meet their quality requirement". To address this issue, they study about information quality (IQ) and system quality (SQ) of mobile data services (i.e., mobile u-services) to improve user satisfaction. Their study shows that scope, usefulness, and understandability should be emphasized for IQ, whereas accessibility, ease of use and system reliability should be emphasized for SQ. While the study of Choi et al. (2012) has contributed to our understanding of mobile u-services, there is still a need in understanding other types of u-services of which customer value is yet to be determined (Alcantara et al., 2015). In terms of ubiquitous home services, even though there are 2 themes (i.e. "user-technology interactions" and "acceptability and usability") mostly analyzed from the user-centered literature, those themes are emerged as a consequence of a technological vision that is struggling to gain user acceptance (Wilson et al., 2015). Smart home developers are still seeking to broaden the appeal of smart homes (Wilson et al., 2015). Therefore, understanding HAS value from the customers' perspective is very important in order to be more appealing to the customers. Moreover, ubiquitous home services that can give the ability for users to take control of their home anywhere and anytime includes light control, HVAC (Heating, Ventilation, and Air Conditioning) control, audio-visual, doors lock, sprinkle control and many others. Considering the variety of the services, understanding the customer value is very important to successfully develop proper ubiquitous home services. Hence, this study focuses on analyzing perceived customer value (benefits and sacrifices) of Home Automation System (hereafter, HAS) as Ubiquitous Home Services and considers Indonesia as an emerging market for home automation.

Jakarta as one of the major cities in Indonesia with the fastest urban development growth rate can lead the development of HAS business in Indonesia. In terms of GDP growth from 2013 – 2030, it is ranked number 12 just below Tokyo, Japan in 11th position and above Sao Paolo, Brazil in 13th position (Oxford Economics, 2012). Jakarta's rapid development

influences the growth of its real estate business. The city development provides wider opportunity for real estate business players to flourish. Shaffer (2015) reported that "property prices in Jakarta have more than doubled since 2009, but with a new infrastructure push in the city, the boom might only be getting started". Moreover, the population increase in Jakarta indicates more real estate demand. "By 2020, the population of Greater Jakarta is expected to grow from 25 million to 35 million, with a mass migration that will further worsen the problems for residents, including poor sanitation, a lack of housing and transportation issues" (World Population Review, 2014).

Considering those opportunities and demand, competition among real estate developers to attract more customers is inevitable. They have to be able to utilize their resources and investment wisely. Ubiquitous home services enabled by IT and automation systems is one solution for developers to create competitive advantages and be more appealing to potential customers. Rudi Setiawan, principal at Solidiance (an Asia Pacific growth strategy consultancy trusted by Fortune 500) in Indonesia said that "currently the opportunity of building automation system is rather limited, but there are signs that it is growing and getting the acceptance of some key developers in Indonesia, such as Agung Podomoro and Intiland. Moreover, many HAS providers can be found in Indonesia recently. Starting from the local companies which have partnership with overseas companies, such as PT Diyen Mandiri, PT Fibaro Sistem Indonesia, PT Media Perkasa Propertindo, and PT Australindo Graha Nusa to the multinational companies, such as Schneider Electric and Haier, they are doing their business in Indonesia. In order to successfully market the service, it is necessary for them to understand users perception towards the HAS availability. They have to deliver the correct service package and target the correct segment to achieve the optimum result. Therefore, this research also explores the users' perspective towards HAS based on certain category: age, gender, family size, annual income and consider their needs that can be fulfilled by HAS.

Beside the important practical implication in understanding perceived customer value of HAS, this research also contributes in enriching the existing knowledge about the relationship between beliefs, attitude, behavior intention and needs in terms of ubiquitous home services in a developing country. By using the same framework, other research on different u-services and country can be done. Depending on the variety of perceived customer value and the relationship between beliefs, attitude, behavior intention and needs within one country, future development of u-service being researched can be predicted.

I.2. Objective

This research aims to answer the following question:

"What are the perceived value of HAS that drives the purchase intention of Indonesian homebuyers?"

The perceived value of HAS is explored based on 10 attributes as follow:

a. Benefits
   i. Security
   ii. Living Enjoyment
   iii. Productivity
   iv. Energy Saving
   v. Ubiquity
   vi. Monetary Value (Investment)

b. Sacrifices
   vii. Price / Cost
   viii. Privacy Issue
   ix. Lifestyle Changing
   x. Unreliability

I.3. Significance of Study

This research can be used as an input for real estate developers and HAS providers to properly approach the business on HAS in Indonesia as an emerging market. It can also be used as a framework to analyze other type of u-services.

CHAPTER 2

II. Theoretical Background

II.1. Home Automation System as Home U-service

The concept of ubiquitous computing can be implemented in many sectors in the form of providing services to users (*u-services*). South Korea has developed u-city as the form of combination of many u-services. Leem & Kim (2012) have studied South Korea u-city and classified various types of u-services based on its implementation on each sector as mentioned in "Various types of u-services" on appendix section. The various types of U-services can be classified based on three criteria: *service operation*, *city function,* and *utilization object* as mentioned in "Classification standards of u-services" on appendix section (Leem & Kim, 2012). The combination of both u-service types and classification standards of u-services resulted in current u-city service strategies in South Korea (Leem & Kim, 2012).

Based on current u-city service strategies in South Korea, HAS is classified as commercial, generality, and life u-service. Commercial HAS means that home automation service is provided with some additional cost incurred for commercial purpose. Profit gained from that commercial activity can be used as an investment to improve the future development of HAS in the long run. The generality of HAS means that the implementation of HAS can be done in any cities regardless of the characteristics of cities (general). The implementation in one city can serve as a basic function for further implementation in other cities. Meanwhile, the life category of HAS means that HAS is a u-service that aims to raise the efficiency of individuals' life instead of improving industry efficiency or business environment. Based on its characteristics, exploring HAS can provide better understanding in u-services with commercial, general and life characteristics.

II.2. Perceived Customer Value

It is very important for a company to understand how customers perceive its products or services offered and meet their expectation to attract more buyers and therefore increase revenue. The term *Customer Value* is not the same as *Customer Values. Value* is the outcome of an evaluative judgment, whereas the term *values* refers to the standards, rules, criteria, norms, goals, or ideals that serve as the basis for such an evaluative judgment (Holbrook, 1994, 1999). *Value* implies a 'trade-off' between benefits and sacrifices; moreover, it implies an interaction between a customer and a product or service (Day, 1990; Payne & Holt, 2001).

On the other hand, *values* are important personal beliefs that people hold with respect to themselves and the goals for which they strive (Rokeach, 1968, 1973). Therefore, perceived customer value can also be described as the "trade-off" between perceived benefits and perceived sacrifices. Understanding the trade-off between perceived benefits and perceived sacrifices means understanding the perceived customer value.

II.3. Theory of Reasoned Action

According to Fishbein and Ajzen (1975) in Theory of Reasoned Action, the intention to perform a behavior is derived from 2 factors: the *attitude towards behavior* and the *subjective norms*. Therefore, if people have the positive attitude and positive subjective norms from their surrounding towards certain behavior, they tend to have higher intention to do that behavior. The attitude towards behavior and subjective norms are derived from other factors. Beliefs and evaluation form the attitude towards behavior; meanwhile normative beliefs and motivation to comply form the subjective norms. The diagram of the Theory of Reasoned Action is shown in figure 1.

This theory suggests the importance of identifying perceived benefits and sacrifices which constitute beliefs. Those beliefs are associated with attitude that leads to behavior intention. In the context of HAS, perceived benefits and sacrifices of HAS can be postulated as attributes forming negative and positive attitudes towards HAS, which consequently lead to customers' intention to purchase HAS. A variety of studies have applied this theory, such as the study done by Bang et al. (2000) to measure consumer concern, knowledge, belief and attitude towards renewable energy and Mahapatra and Gustavsson (2010) to measure the adoption of innovative heating systems. In addition, this theory is further extended to Theory of Planned Behavior which considers *perceived behavioral control* as the third determinant of behavioral intention. According to (Ajzen, 1991, p. 188) perceived behavioral control means the perceived ease or difficulty of performing the behavior. It considers self-availability of skills, resources, opportunities and the importance of each factor for the achievement of desired outcome (Baker et al., 2007). Based on the Theory of Planned Behavior, identifying perceived benefits and sacrifices constituting belief remain to be important.

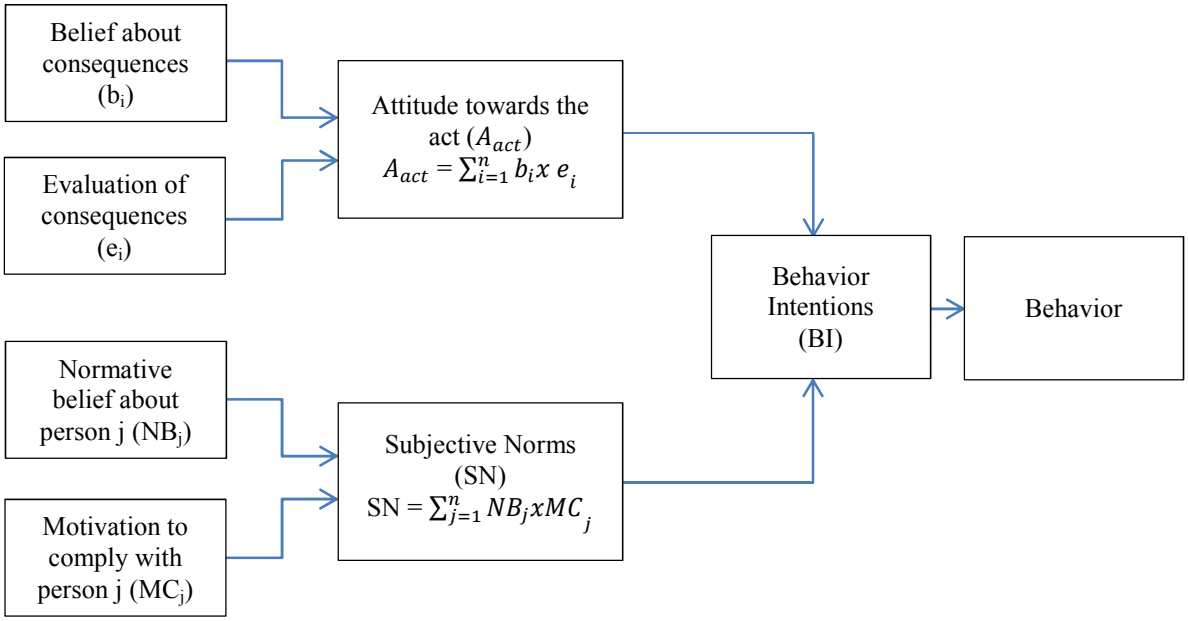

Figure 1. Theory of Reasoned Action (Fishbein & Ajzen, 1975)

II.4. Studies on the adoption of HAS-related products and services

Charlie et al. (2015) in their study about smart homes and their users mention some benefits from functional point of view: comfort, security, scheduling tasks, convenience through automation, energy management, and efficiency. Additionally, the study done by Mahapatra and Gustavsson (2010) about adoption of innovative heating system mention certain attributes of heating systems, such as environmental benignity, increased market value of house, investment cost, and functional reliability. Nazmiye et al. (2013) in their study about social barriers to the adoption of smart homes mention some barriers faced in adopting smart homes, such as fit to current and changing lifestyle, reliability, privacy, and costs.

Mahapatra and Gustavsson (2010) also explained about the influence of need in buying intention. According to them, the lack of need due to satisfaction with existing system will result in attitude-behavior gap which leads to not adopting the innovative heating system even though the innovative heating system is favorable compared to existing system. It indicates that the "need" factor can influence on buying intention. The higher need of something will result in the higher on its buying intention.

Another factor influencing buying intention according to Mahapatra and Gustavsson (2010) in their study about adoption of innovative heating system is the socio-demographic conditions, such as age of the potential adopter and household income. The unfavorable socio-demographic conditions can negatively influence the adoption of innovative heating

system. Younger homeowners with less financial capacity to invest in innovative heating system will unlikely adopt the innovative heating system. However, the situation improves over time with increase of awareness and income (Isaksson, 2005).

Charlie et al. (2015) explained that smart home potential users may include low and middle income households as well as high income technophiles. Moreover, they also identify women, children, and families rather than unitary households or individual users as smart home prospective users. Therefore, beside the influence of age and household income, this study also explores the role of gender and family size on HAS buying intention.

Baker et al. (2007) in their study about the effects of gender and age on new technology implementation in a developing country (Saudi Arabia) using theory of planned behavior discussed that the intention to use technology is positively influenced by attitude towards technology, subjective norm and perceived behavioral control (Ajzen, 1991, p. 188: perceived ease or difficulty of performing the behavior). Based on that study, HAS as an emerging technology should also be positively influenced by the attitude towards technology. However, regarding the demographic variables (age and gender), their study concluded that they are not significant in influencing the intention to use technology. They argued that it was due to more homogenous workforce in Saudi Arabia.

II.5. Conceptual Framework

This research focuses mainly on HAS as one of u-services implementation. It focuses on exploring *perceived customer value* of HAS as ubiquitous home service and measures the beliefs of the homeowners in Indonesia towards HAS from some different dimension or multi-dimensional approaches as explained by Raquel and Angeles (2007). The Theory of Reasoned Action advanced by Fishbein and Ajzen (1975) serves as a justification for identifying perceived customer value (perceived benefits and sacrifices) which leads to buying intention. There are other factors that can determine the buying intention. However, the scope of this study is limited to identify significant perceived benefits and sacrifices of HAS. Based on the review of literature related to the adoption of HAS, this research includes attributes that drive the perceived benefits and sacrifices of HAS. Specifically, the perceived benefits of HAS are measured as security, living enjoyment, productivity, energy saving, ubiquity, and monetary value, while the perceived sacrifices of HAS are measured as price, privacy issue, lifestyle changing, and unreliability. Based on that concept, the first and second hypotheses are developed as follow:

Hypothesis 1a. Beliefs on the potential benefits of HAS will be associated with positive attitude towards HAS.

Hypothesis 1b. Beliefs on the potential benefits of HAS will be associated with higher intention to buy HAS

Hypothesis 2a. Beliefs on the potential sacrifices of HAS will be associated with negative attitude towards HAS.

Hypothesis 2b. Beliefs on the potential sacrifices of HAS will be associated with lower intention to buy HAS.

By exploring the perceived benefits of HAS on 6 attributes (security, living enjoyment, productivity, energy saving, ubiquity and monetary value) and their relationship with attitude towards HAS and HAS buying intention, hypothesis 1 can tested. On the other hand, hypothesis 2 can be tested by exploring the perceived sacrifices of HAS on 4 attributes (price, privacy issue, lifestyle changing and unreliability) and their relationship with attitude towards HAS and HAS buying intention.

Based on Theory of Reasoned Action, the attitude towards an action can leads to behavior intention. In the context of HAS, the general attitude towards HAS can influence HAS buying intention. Therefore, the 3rd hypothesis is developed as follow:

Hypothesis 3. Positive attitude towards HAS will be associated with higher intention to buy HAS.

According to Mahapatra and Gustavsson (2010) in the adoption of innovative heating system, the relationship between the manifestation of attitude and behavior can be influenced by the lack of need due to satisfaction with existing system. In line with Mahapatra and Gustavsson (2010), this study also explores the effect of need in HAS buying intention. The "need" factor as the moderating effect of general attitude towards HAS and HAS buying intention relationship will be tested. Moreover, the direct relationship on HAS buying intention will also be examined. There are 2 kinds of "need" to be explored in this research: need for uniqueness and satisfaction with current home. The fourth hypotheses are as follow:

Hypothesis 4a. Higher need for uniqueness will be associated with higher intention to buy HAS.

Hypothesis 4b. Higher satisfaction with the current home will be associated with lower intention to buy HAS

Based on Hong and Tam (2006) on their study about understanding the adoption of multipurpose information appliances, the need for uniqueness plays an important role in people's judgment and choice behavior. In a developing country like Indonesia, HAS is a unique technology which is not widely used yet. Therefore, the role of need for uniqueness in influencing HAS buying intention is also examined on this research. Beside the need for uniqueness, current home satisfaction is also examined on this research as opposed to the need for uniqueness based on Mahapatra and Gustavsson (2010).

In addition to the above hypotheses, individual factors suggested by the literature such as gender, age, household income, and family size will also be included to determine how the perceived value of HAS, attitude towards HAS and HAS buying intention vary across different market segments.

CHAPTER 3

III. Methodology

III.1. Structural Equation Modeling

As explained by Hair et al. (2014), Structural Equation Modeling (SEM) is a second generation statistical technique that can be used to test or predict a theory and incorporate unobservable variables which measured indirectly by indicator variables. Another explanation by Williams, Vandenberg, and Edwards (2009) describe SEM as a multivariate analytical approach used to simultaneously test and estimate complex causal relationships among variables, even when the relationships are hypothetical, or not directly observable. Both of them suggest the use of SEM to estimate the unobservable variable which will be used to estimate *Evaluation of Consequences* (e_i) on this research.

There are two approaches can be used to estimate the relationships in SEM (Hair et al., 2010; Hair, Ringle, and Sarstedt, 2011; Hair et al., 2012). The first one is Covariance-based SEM (CB-SEM). CB-SEM is primarily used to confirm (or reject) theories (Hair et al. 2014). There are some requirements to use CB-SEM approach, such as the presumption of normal distribution of data and representative sample size, which are often difficult to be met (Astrachan et al. 2014). Another SEM approach is Partial Least Squares SEM (PLS-SEM), which will be used on this research. The objective of using PLS-SEM is to predict key target variables that are not directly measured (constructs) or to identify key "driver" constructs (Hair et al. 2014). PLS-SEM has the ability to handle small sample sizes, complex models with numerous endogenous and exogenous constructs, and indicator variables, or non-normal data distributions while still producing viable results (Astrachan et al. 2014). Following our objective to identify the customer value towards HAS which "drive" the HAS buying intention and its ability to handle small sample size, complex model and non-normal data distribution, PLS-SEM is used on this research.

III.2. Research Model

Referring to figure 1 on chapter 2 explaining Theory of Reasoned Action, beliefs on attribute i (b_i) represent perceived customer value towards HAS on attribute i (belief of HAS on attribute i), attitude towards the act (A_{act}) represents general belief on HAS and behavior intention (BI) represents buying intention of homeowners in Indonesia towards HAS. The evaluation of consequences (e_i) as the weight of b_i is estimated using Structural Equation Modeling (SEM). By utilizing SEM, the relationship between perceived value on each

attribute (b_i), the overall attitude towards HAS (A_{act}) and the behavior intention (BI) can be explored. Based on Theory of Reasoned Action and PLS-SEM, the structural model of this research is developed and displayed on figure 2.

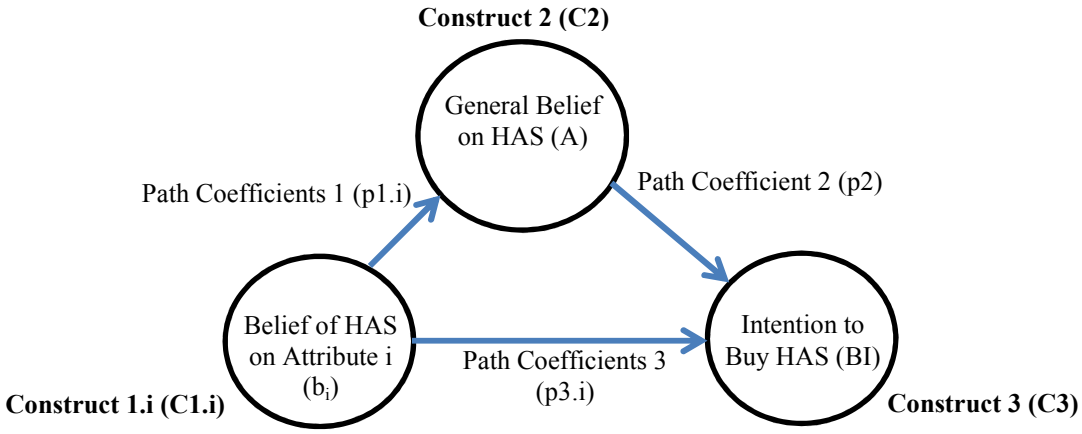

Figure 2. Conceptual Model

Notes:

1. The research measures the intention to buy HAS and not the buying action considering Indonesia as an emerging market for HAS and to avoid limitation on respondents selection
2. Subjective norms are not considered
3. Evaluation of consequences (e_i) is estimated by using PLS-SEM as path coefficient 1 (p1.i), which represent path coefficients of relationship between beliefs (b_i) and attitude (A)
4. Path coefficient of relationship between A and BI (p2) and path coefficient of relationship between b_i and BI (p3.i) are also estimated by using PLS-SEM
5. The model will be used considering gender, age, income, family size and need based on table 1.
6. Belief of HAS consists of 10 attributes (i) based on table 2.

Table 1. List of Market Segment

Moderator	Category	Description	Source
Gender	Male	Exploring gender differences and women as prospective user of HAS	Charlie et al. (2015)
	Female		
Age	25 or younger	Exploring the effect of age differences on HAS Buying Intention (BI)	Mahapatra & Gustavsson (2010)
	26 – 35		
	36 – 45		
	46 – 55		
	Older than 55		

Annual Household Income	Below IDR 36 Million (low income)	Consider low, middle and high income people as prospective user of HAS	Nikkei Asian Review (2015) Charlie et al. (2015)
	IDR 36 – 60 Million (low-middle income)		
	IDR 60 – 90 Million (middle income)		
	IDR 90 – 120 Million (middle – high income)		
	Above IDR 120 Million (high income)		
Family Size	1	Consider differentiated household with negotiated roles within distinct spaces of home as prospective HAS user	Charlie et al. (2015)
	2		
	3		
	4		
	5 or higher		
Need	Current home satisfaction	Considering the effect of satisfaction with the current home on HAS Buying Intention (BI)	Mahapatra & Gustavsson (2010)
	Uniqueness	Considering the effect of need for uniqueness on HAS Buying Intention (BI)	Hong & Tam (2006)

Table 2. List of Attributes to be Measured as Benefits and Sacrifices

Attribute No (i)	Attribute Name	Description	Source
1	Perceived Productivity (PP)	Measure belief towards HAS in increasing productivity	Mahapatra & Gustavsson (2010) Charlie et al. (2015)
2	Perceived Safety (PS)	Measure belief towards HAS in enhancing safety	
3	Perceived Enjoyment (PE)	Measure belief towards HAS in providing enjoyment	
4	Perceived Energy Saving (PES)	Measure belief towards HAS in energy saving	
5	Perceived Ubiquity (PU)	Measure belief towards HAS to provide home access anywhere and anytime	
6	Perceived Monetary Value (PM)	Measure belief towards HAS as an investment	
7	Perceived Cost (PC)	Measure belief towards the cost of buying HAS	Nazmiye et al. (2013) Mahapatra & Gustavsson (2010)
8	Perceived Privacy (PPR)	Measure belief towards HAS in violating privacy	
9	Perceived Lifestyle Changing (PL)	Measure belief towards HAS as lifestyle changer	
10	Perceived Unreliability (PR)	Measure belief towards HAS as reliable system	

In total, there are ten constructs represent the beliefs of HAS on each attribute (C1.1 – C1.10), one construct as the general belief on HAS (C2) and one construct as the buying intention of HAS (C3). However, constructs are not directly observed, a measurement model for each construct is needed (Hair et al. 2014). As explained by Hair et al. (2014), each

construct can be measured by multi-item / single item measures and reflective / formative measures. On this research, C1.1 – C1.10 and C3 are measured by multi-item measures to achieve better reliability. However, C2 is measured by single-item measures considering its homogeneity. All constructs are measured by reflective measures by designing the questionnaire as a reflection of construct to be measured. The type of measurement model of the constructs is shown on figure 3.

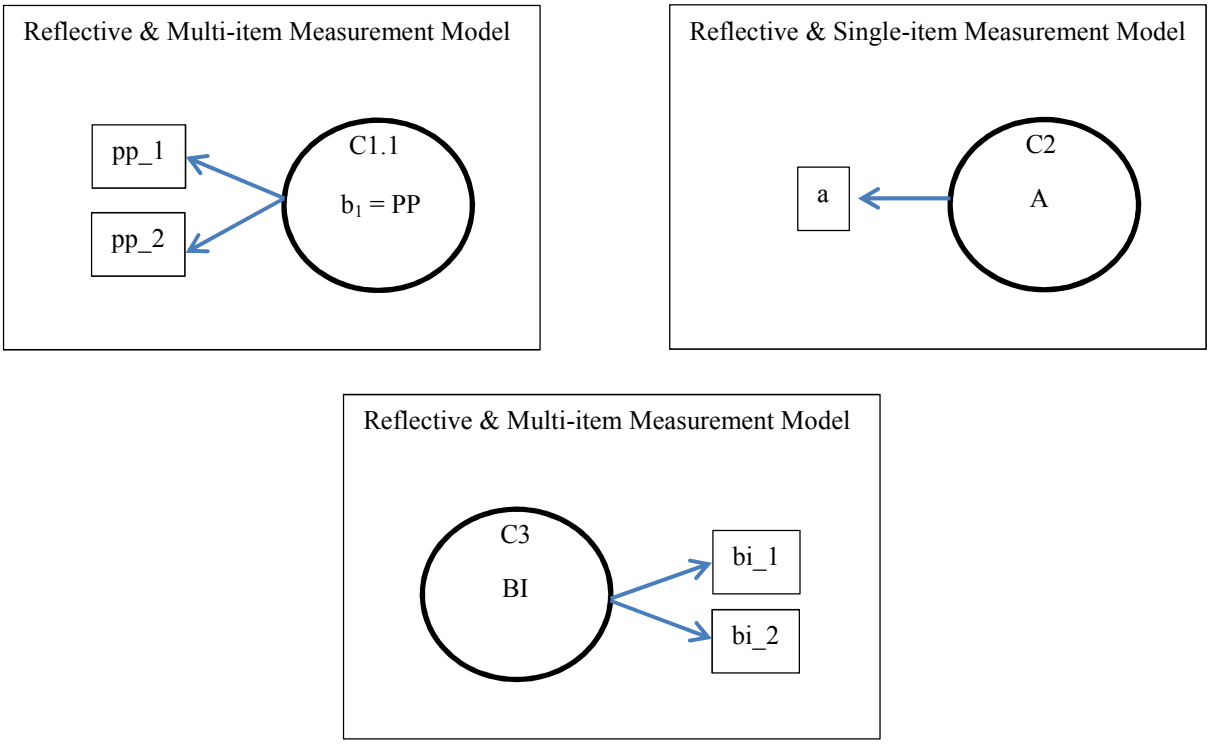

Figure 3. Type of Measurement Model for Each Construct

III.3. Data Collection

The assigned indicators which will be used to measure the construct was obtained from survey questionnaire. Considering around 250 million Indonesia populations, it is necessary to get the representative respondents as the sample for survey questionnaire. The sample size is determined based on Krejcie and Morgan (1970) sample size table. Based on the table, sample size of 384 people can represent 300 million people with 95% confidence level. Therefore, this research aims to achieve that sample size at minimum.

Questionnaire survey distribution was done in 2 ways: hardcopy (paper based) questionnaire and online survey. The questionnaire (both paper based and online) consists of 31 questions which can be finished within 5 – 10 minutes. The paper based questionnaire was distributed on residents of residential area in Bumi Serpong Damai (BSD) and Gading Serpong, Tangerang, greater Jakarta. People working in Jakarta, but living in surrounding

area of Jakarta is a potential customer considering that HAS can provide the ability to manage their home anywhere and anytime. Therefore, the residential area in Bumi Serpong Damai (BSD) and Gading Serpong, which located in Tangerang (surrounding area of Jakarta), was selected as the place to conduct the data gathering. Moreover, BSD and Gading Serpong which are privately developed Indonesian planned community can provide residential, commercial, and industrial properties within one region. Some residents in BSD and Gading Serpong have already used simple home automation system inside their home. Therefore, do the data gathering in BSD and Gading Serpong can increase the possibility to get more reliable data. In order to get as many respondents as possible snowball sampling was used. Some residents were asked to help distributing the questionnaire survey to their relatives, friends, or network. Some of them are very helpful and open for discussion. Some refused to provide any support for the research. Thus, from 400 paper based questionnaires which were distributed, 252 filled papers can be obtained (63% response rate). The online questionnaire was created by using Google Form and distributed through the mailing list of Bumi Serpond Damai resident's community and through friends, relatives, and networks as random Indonesian homeowners. The total respondents can be gathered are 500 respondents. Breakdown of respondents can be seen below:

1. Respondents from BSD and Gading Serpong residents (paper based): 252
2. Respondents from online survey: 248
3. Total respondent: 500

III.4. Survey Questionnaire

The survey questionnaire is designed to obtain the information of respondents and indicators data for each construct. The questions related with respondents' information are developed based on table 1 and an additional question to ask their familiarity with HAS as the control factor for analysis. However, in order to measure the need (satisfaction with the current home and uniqueness), a measurement model (assigned indicator) is again needed. The satisfaction is measured by single-item and reflective measures considering its homogeneity (Hair et al. 2014). On the other hand, uniqueness is measured by multi-items and reflective measures. Statements related with indicators data for satisfaction and uniqueness are shown in the table 3. Meanwhile, statements related with indicators data for each construct are shown in the table 4. Respondents are asked to choose their answer based on 5 options: "strongly disagree", "disagree", "neutral", "agree" and "strongly agree" to what extend are they agree with the given statement. To quantify the result gathered from the

respondents, their answer will be ranked from 1 to 5 depending on their answer. Generally, 1 represents “strongly disagree” and 5 represents “strongly agree”, except for questions related with the perceived sacrifices of HAS (Perceived Cost / Price, Privacy, Lifestyle and Unreliability). For those questions, 1 represents “strongly agree” and 5 represents “strongly disagree” (to measure the negative effect).

Table 3. List of Assigned Indicators to Measure Need

Need	Item No	Statement	Source
Uniqueness	U1	I am often on the lookout for new products or brands that will add to my personal uniqueness	Hong & Tam (2006)
	U2	I actively seek to develop my personal uniqueness by buying special products or brands	
Satisfaction with current home	S	I am satisfied with my current home	Hair et al. 2014

Table 4. List of Model Constructs and Assigned Indicators

Constructs	Item No	Statement	Source
Perceived Productivity (PP)	pp_1	I would find HAS to be useful in my daily life	Hong & Tam (2006)
	pp_2	Using HAS would help me accomplish things more quickly	
Perceived Safety (PS)	ps_1	I feel safe having HAS on my home	Belanche-Gracia et al. 2015
	ps_2	I think HAS provide the mechanism to ensure the safety of the residents	
Perceived Enjoyment (PE)	pe_1	I expect that using HAS would be enjoyable	Hong & Tam (2006)
	pe_2	I expect that using HAS would be comfortable	
Perceived Energy Saving (PES)	pes_1	I expect that using HAS would let me check the accuracy of my electricity usage	Krishnamurti et al. 2012
	pes_2	I expect that using HAS would help me save energy and reduce electricity bill	
Perceived Ubiquity (PU)	pu_1	I expect that I would be able to use HAS and get access to my home anytime and anywhere	Hong & Tam (2006)
	pu_2	I would find HAS to be easily accessible and portable	
Perceived Monetary Value (PM)	pm_1	I believe that in the future, home with HAS would provide a good value	Hong & Tam (2006)
	pm_2	HAS would offer a good value for the money	
Perceived Cost (PC)	pc_1	I believe that installing HAS would be costly	Nazmiye et al. 2013
	pc_2	I believe that HAS needs high maintenance cost	
Perceived Privacy (PPR)	ppr_1	Using HAS means giving my personal data to the wrong hands	Nazmiye et al. 2013
	ppr_2	I would find HAS providers selling my personal data	
Perceived Lifestyle Changing (PL)	pl_1	I believe that HAS is non-essential	Nazmiye et al. 2013
	pl_2	Using HAS would make me constantly worrying and feeling guilty	
Perceived Unreliability (PR)	pr_1	I believe that malfunction happens frequently in HAS	Nazmiye et al. 2013
	pr_2	Using HAS, I would find that break down of communications network will make other systems getting out of control	
Attitude towards HAS	A	To me, the advantages outweigh the disadvantages of the HAS	Michelsen & Madlener (2013)
Intention to buy HAS	bi_1	I intend to use HAS in the future	Hong & Tam (2006)
	bi_2	I expect to use HAS frequently in the future	

CHAPTER 4

IV. Data and Analysis

IV.1. Overall Data Analysis

After getting the data from 500 respondents, the next step to do is to filter those 500 respondents by excluding those who have very low level of familiarity with HAS (familiarity of HAS acts as control factor of the questionnaire). From 500 respondents, 60 people (12%) are not familiar at all with home automation system. Therefore, the total respondent to be analyzed is reduced to 440 respondents. Then, the next issue needed to be considered is the missing value as some respondents did not fill in certain questions in the questionnaire. To solve that problem, the missing value will be replaced by the mean value of the respective question result. Therefore, it will minimize the effect caused by the missing value.

IV.1.1. Reflective Measurement Model Analysis

Table 7 represents the 10 attributes of HAS perceived value, the general attitude towards HAS and the buying intention. The reliability and validity of each question (indicator) to represent its construct has to be measured by checking the estimated relationships between the indicator and its construct **(Outer Loading)**, **Composite Reliability** and **Convergent Validity (AVE)**. The resulted data can be found on the table 5 and 6.

Indicator's outer loading can be used to measure the indicator reliability of representing its construct. As explained by Hair Jr et al (2014), the acceptable value of outer loading should be higher than 0.708. Outer loading between 0.4 and 0.7 is considered to be removed only if its removal can improve its composite reliability and convergent validity AVE above the threshold, which is 0.708 for composite reliability and 0.5 for AVE. From table 5, it can be found that PL2 <- Lifestyle outer loading is 0.68, which is between 0.4 and 0.7. However, there is no need to remove it considering that its composite reliability and AVE have already above the threshold. Outer loading, composite reliability and AVE of General construct is 1. In that case, there is no need to measure single–item measurement model as it represents its construct 100% (outer loading = 1).

Table 5. Outer Loading

Indicator <- Construct	Outer Loading
A <- General	1
BI1 <- Buying Intention	0.92
BI2 <- Buying Intention	0.94
PC1 <- Cost / Price	0.83
PC2 <- Cost / Price	0.94
PL1 <- Lifestyle	0.96
PL2 <- Lifestyle	0.68
PPR1 <- Privacy	0.97
PPR2 <- Privacy	0.77
PR1 <- Unreliability	0.83
PR2 <- Unreliability	0.92

Indicator <- Construct	Outer Loading
PM1 <- Monetary Value	0.83
PM2 <- Monetary Value	0.84
PP1 <- Productivity	0.87
PP2 <- Productivity	0.84
PS1 <- Security	0.87
PS2 <- Security	0.89
PU1 <- Ubiquity	0.88
PU2 <- Ubiquity	0.83
PE1 <- Enjoyment	0.90
PE2 <- Enjoyment	0.90
PES1 <- Save Energy	0.84
PES2 <- Save Energy	0.87

Table 6. AVE and Composite Reliability

Construct	AVE	Composite Reliability
General	1	1
Buying Intention	0.86	0.93
Cost	0.79	0.88
Enjoyment	0.81	0.9
Lifestyle	0.69	0.82
Monetary Value	0.70	0.82
Privacy	0.77	0.87
Productivity	0.73	0.85
Unreliability	0.77	0.87
Save Energy	0.73	0.84
Security	0.77	0.87
Ubiquity	0.74	0.85

Another measurement needs to be done is the **discriminant validity** which measure to what extent a construct is truly distinct from other constructs by empirical standards (Hair Jr et al, 2014). In order to measure discriminant validity, the outer loading of the respective construct should be the highest compared to other constructs. List of outer loading of each respective construct and other constructs can be found on table 7.

Table 7. Outer Loading of each indicator related to its respective construct and other construct

Cross Loading	Buying Intention	Cost	Enjoyment	General	Lifestyle	Monetary Value	Privacy	Productivity	Reliability	Save Energy	Security	Ubiquity
A	0.45	0.09	0.30	1.00	0.11	0.42	0.04	0.36	0.05	0.29	0.32	0.21
BI1	0.92	0.002	0.45	0.42	0.15	0.39	0.11	0.41	0.02	0.31	0.39	0.31
BI2	0.94	0.00	0.49	0.42	0.08	0.48	0.11	0.51	0.07	0.39	0.43	0.30
PC1	0.02	0.83	0.01	0.05	0.39	0.16	0.33	0.04	0.49	0.12	0.09	-0.04
PC2	0.03	0.94	0.06	0.09	0.47	0.07	0.45	0.02	0.56	0.08	0.05	-0.15
PE1	0.45	0.05	0.90	0.28	0.15	0.38	0.14	0.58	0.13	0.37	0.40	0.35
PE2	0.47	0.03	0.90	0.27	0.19	0.40	0.24	0.53	0.12	0.35	0.48	0.36
PES1	0.34	0.04	0.33	0.20	0.12	0.34	0.04	0.40	0.07	0.84	0.33	0.38
PES2	0.31	0.13	0.35	0.29	0.12	0.42	0.03	0.38	0.16	0.87	0.45	0.28
PL1	0.11	0.47	0.16	0.14	0.96	0.15	0.49	0.11	0.49	0.15	0.23	0.06
PL2	0.11	0.36	0.20	-0.02	0.68	0.06	0.65	0.04	0.52	0.05	0.19	0.11
PM1	0.37	0.14	0.25	0.37	0.13	0.83	0.03	0.35	0.13	0.38	0.31	0.26
PM2	0.41	0.05	0.28	0.34	0.11	0.84	0.07	0.48	0.09	0.37	0.38	0.37
PP1	0.45	0.01	0.55	0.32	0.09	0.45	0.03	0.87	0.02	0.38	0.43	0.34
PP2	0.41	0.05	0.50	0.30	0.09	0.40	0.05	0.84	0.05	0.38	0.33	0.33
PPR1	0.13	0.42	0.20	0.06	0.56	0.06	0.97	0.04	0.53	0.04	0.20	0.06
PPR2	0.06	0.40	0.18	-0.02	0.52	0.04	0.77	0.04	0.50	0.02	0.08	0.05
PR1	0.003	0.52	0.13	0.06	0.55	0.06	0.54	0.01	0.8292	0.10	0.14	-0.02
PR2	0.07	0.53	0.11	0.03	0.45	0.16	0.47	0.05	0.9186	0.14	0.13	-0.09
PS1	0.35	0.04	0.49	0.30	0.23	0.36	0.17	0.39	0.11	0.33	0.87	0.31
PS2	0.42	0.08	0.41	0.26	0.22	0.36	0.15	0.39	0.16	0.47	0.89	0.35
PU1	0.31	-0.06	0.37	0.19	0.12	0.38	0.12	0.35	0.03	0.39	0.36	0.88
PU2	0.25	-0.15	0.29	0.16	0.005	0.27	-0.03	0.31	-0.15	0.25	0.28	0.83

The yellow color indicates that the outer loading of each indicator to its respective construct is the highest compared to other constructs. From table 5, 6 and 7, it can be concluded that the questionnaire questions which represent the 10 perceived value of HAS, general attitude towards HAS and buying intention are valid, reliable and distinct among other constructs.

IV.1.2. Structural Model Analysis

After the validity and reliability of the data can be determined, the research model described on figure 2 can be analyzed using those data. The more detailed research model is shown on figure 4 below.

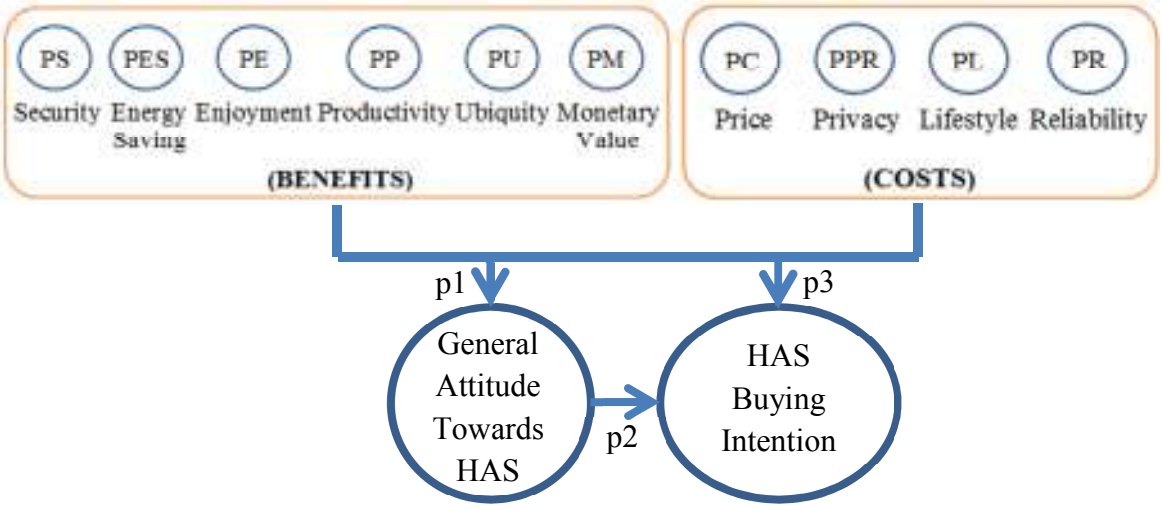

Figure 4. Estimation Model

In order to get the correct interpretation of path coefficient p1, p2 and p3, the **collinearity issue** has to be checked. It can be checked by measuring the **tolerance** and **VIF** of the 10 perceived value and general attitude towards HAS. With HAS buying intention as the dependent variable, the tolerance and VIF of the 10 perceived value and general attitude towards HAS can be found on table 8(a). With general attitude towards HAS as the dependent variable, the tolerance and VIF of 10 perceived value of HAS can be found on table 8(b).

Table 8. Tolerance and VIF with (a) HAS Buying Intention as Dependent Variable, (b) General attitude towards HAS as Dependent Variable

(a)	Collinearity Statistics	
	Tolerance	VIF
General	0.77	1.30
Enjoyment	0.53	1.90
Monetary Value	0.60	1.67
Productivity	0.52	1.94
Save Energy	0.64	1.56
Security	0.62	1.62
Ubiquity	0.69	1.44
Cost / Price	0.58	1.74
Privacy	0.53	1.89
Lifestyle	0.53	1.88
Unreliability	0.49	2.03

(b)	Collinearity Statistics	
	Tolerance	VIF
Enjoyment	0.52	1.73
Monetary Value	0.64	1.57
Productivity	0.52	1.92
Save Energy	0.64	1.56
Security	0.62	1.60
Ubiquity	0.70	1.44
Cost / Price	0.58	1.73
Privacy	0.53	1.89
Lifestyle	0.53	1.88
Unreliability	0.50	2.02

The acceptable value of tolerance and VIF is higher than 0.2 and less than 5 (Joseph F. Hair, Jr et al, 2014). Considering those thresholds, there is no collinearity issue detected. Therefore, the path coefficient and its level of significance can be measured. By using the PLS algorithm, the path coefficient of p1, p2, p3 and its significance level can be found on table 9.

Table 9. Path Coefficient and Significance Level (BI = Buying Intention)

Path	Path Coefficient	Standard Error	T Statistics
	O	STERR	|O/STERR|
Enjoyment -> General	0.05	0.06	0.82
Monetary Value -> General	0.28***	0.05	5.15
Productivity -> General	0.13***	0.06	2.22
Save Energy -> General	0.05	0.06	0.82
Security -> General	0.11**	0.06	1.99
Ubiquity -> General	-0.02	0.05	0.45
Cost -> General	0.07	0.07	1.03
Privacy -> General	-0.03	0.07	0.38
Lifestyle -> General	0.04	0.09	0.45
Unreliability -> General	-0.08	0.09	0.86

General -> BI	0.22***	0.05	4.20
Enjoyment -> BI	0.20***	0.06	3.43
Monetary Value -> BI	0.15***	0.06	2.69
Productivity -> BI	0.14**	0.06	2.18
Save Energy -> BI	0.06	0.05	1.22
Security -> BI	0.12**	0.05	2.18
Ubiquity -> BI	0.02	0.05	0.30
Cost -> BI	-0.03	0.05	0.48
Privacy -> BI	0.09*	0.05	1.69
Lifestyle -> BI	-0.02	0.05	0.38
Unreliability -> BI	-0.07	0.08	0.82

Note: *** significant at 1% level, ** significant at 5% level; * significant at 10% level

The simplified table of table 9 which list only the significant path coefficient is shown on table 10 below.

Table 10. Significant Path Coefficient

Path to General Attitude towards HAS	Path Coefficient	Standard Error	T Statistics	Significance Level (2-tailed test)		
	O	STERR	|O/STERR|	99%	95%	90%
Monetary Value -> General	0.28	0.05	5.15	***		
Productivity -> General	0.13	0.06	2.22		**	
Security -> General	0.11	0.06	1.99		**	

Path to Buying Intention (BI)	Path Coefficient	Standard Error	T Statistics	Significance Level (2-tailed test)		
	O	STERR	|O/STERR|	99%	95%	90%
General -> BI	0.22	0.053	4.20	***		
Monetary Value -> BI	0.21	0.054	3.96	***		
Enjoyment -> BI	0.20	0.057	3.43	***		
Productivity -> BI	0.17	0.068	2.51		**	
Security -> BI	0.14	0.054	2.60	***		
Privacy -> BI	0.09	0.053	1.69			*

Based on table 10, hypothesis 1a is supported on 3 perceived benefits: monetary value, productivity and security. Meanwhile, hypothesis 2a is not supported. Hypothesis 1b is supported on 4 perceived benefits: monetary value, enjoyment, productivity and security. Meanwhile, hypothesis 2b is supported only on privacy issue. General attitude towards HAS is statistically significant in influencing buying intention positively. Therefore, hypothesis 3 is supported.

Monetary value (investment) is the most significant factor to influence the general attitude towards HAS. The general attitude towards HAS itself influence HAS buying intention the most followed by monetary value. Therefore, monetary value is considered important factor to influence buying intention directly and indirectly with 99% confidence

level. Other important factors that influence general attitude towards HAS is the ability of HAS to improve productivity and security with 95% confidence level. Enjoyment is not significant in influencing general attitude towards HAS, however, it can directly influence the buying intention of HAS. It means that Indonesian people do not consider enjoyment as the important benefit of HAS in general. However, they still consider enjoyment important for them to improve their buying intention. It is the same as the privacy factor. Indonesian people normally do not consider privacy factor on their HAS perceived value. However, in terms of buying intention, they will start to consider the privacy issue with 90% confidence level.

In order to get more detailed analysis for managerial decision, the comparison between the path coefficient (importance) and the current perceived value of HAS (performance) need to be done for HAS buying intention. Such analysis is called Importance Performance Matrix Analysis (IPMA). Table 11 shows the comparison between the importance and the performance of 10 perceived value, general attitude towards HAS and buying intention.

Table 11. IPMA of HAS Buying Intention

	Importance	Performance (Index Values)	
		Percentage	Mean
Buying Intention		67.74%	3.71
General	0.22***	59.76%	3.39
Monetary Value	0.21***	62.92%	3.52
Security	0.14***	68.35%	3.73
Productivity	0.17**	68.90%	3.76
Enjoyment	0.20***	70.60%	3.82
Privacy	0.09*	53.59%	3.14
Save Energy	NS	67.40%	3.70
Ubiquity	NS	75.43%	4.02
Cost / Price	NS	33.62%	2.34
Lifestyle	NS	49.88%	3.00
Unreliability	NS	40.43%	2.62

Note: (*** = 99% confidence level, ** = 95% confidence level, * = 90% confidence level, NS = Not Significant)

Table 11 shows some findings as follow:

a. HAS performs the highest in providing ubiquity with 75.43% index value. However, ubiquity itself is not significant in improving HAS buying intention. It means that people perceive HAS to be able to provide ubiquitous computing very well. However, people's intention to buy HAS is not influenced by that feature. Other features, such as monetary value, security, productivity, enjoyment and privacy influence HAS

buying intention more significantly. In other words, ubiquity feature is only important in influencing HAS buying intention if it can improve other features. For example, allowing people to monitor their home anywhere and anytime can improve the security feature of HAS. In that case, ubiquity is important in influencing HAS buying intention positively.

b. HAS performs the lowest in terms of its cost / price. It means, HAS is considered expensive for Indonesian people. However, their willingness to buy is quite high as shown by 67.74% performance index.

c. Monetary value of HAS is considered important to improve HAS buying decision. However, its performance needs to be improved as it is still lower than the performance of security, productivity and enjoyment factor. It means that currently, most HAS service providers emphasize the benefits of HAS in providing security, improving productivity and living enjoyment. In order to improve HAS buying intention, it is better to put more emphasize on its monetary value, such as by providing certain investment opportunity calculation.

The PLS algorithm gives the coefficient of determination (r^2) of 0.23 for general attitude towards HAS and 0.42 for HAS buying intention. The r^2 of 0.23 can be considered as weak and the r^2 of 0.42 can be considered moderate. It indicates that there are other factors needed to explain the general attitude towards HAS and HAS buying intention.

IV.1.3. The Influence of Need for Uniqueness and Current Home Satisfaction

The need factor consists of the satisfaction with current home and the need for uniqueness. Their role as moderating effect on moderating the relationship between general attitude towards HAS and HAS buying intention is tested. Moreover, the direct relationship with HAS buying intention is also measured.

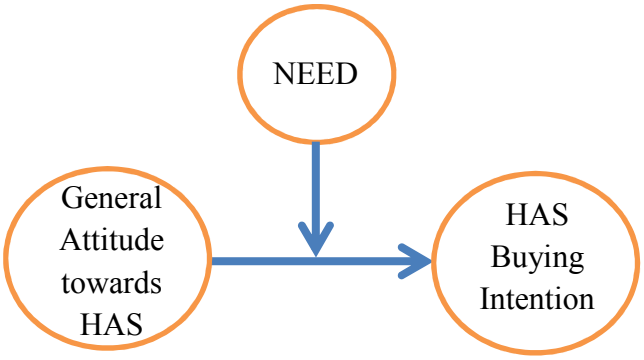

Figure 5. Need as moderating effect of General Attitude towards HAS and HAS Buying Intention relationship

Before testing both the satisfaction and uniqueness factor, the reflective measurement model has to be done and satisfy the threshold of validity and reliability measurement. The satisfaction factor is only represented by single questionnaire question as explained on section III.5. Therefore, it is not necessary to perform the reflective measurement model to check the validity and reliability of satisfaction indicator. On the other hand, the reflective measurement model of need for uniqueness has to be tested. The reflective measurement model of need for uniqueness is shown on table 12.

Table 12. Reflective Measurement Model of the Need for Uniqueness

Indicator <- Construct	Outer Loading	AVE	Composite Reliability
U1 <- Uniqueness	0.93	0.86	0.92
U2 <- Uniqueness	0.92		

Table 12 shows that the outer loading, AVE and composite reliability of Need for Uniqueness satisfy the acceptable threshold. In addition, the outer loading of U1 and U2 to represent Uniqueness are the highest among other constructs. Therefore, it also satisfies the discriminant validity. Following those results, the usage of satisfaction with current home and need for uniqueness as moderators between the relationship of general attitude towards HAS and HAS buying intention can be done. Table 13 shows the path coefficient of both satisfaction and uniqueness and their moderating effect.

Table 13. Path coefficient of satisfaction and uniqueness and their moderating effect

Path to HAS Buying Intention	Path Coefficient	Standard Error	T Statistics	Significance Level (2-tailed test)		
	O	STERR	|O/STERR|	99%	95%	90%
Satisfaction Moderating Effect	-0.01	0.15	0.09			
Uniqueness Moderating Effect	-0.03	0.14	0.20			
Satisfaction -> Buying Intention	-0.01	0.05	0.12			
Uniqueness -> Buying Intention	0.23	0.05	4.26	***		

Adding the effect of satisfaction and need for uniqueness increases HAS Buying Intention's r^2 from 0.42 to 0.47. However, as shown on table 13, only the path coefficient from need for uniqueness to HAS buying intention is significant (99% significance level). It shows a positive relationship between the need for uniqueness and HAS buying intention, which means hypothesis 4a is supported. In other words, the higher need of uniqueness of Indonesian people, the higher is their buying intention. Satisfaction with current home shows negative relationship with HAS buying intention. It means that, if people are satisfied with

the current home, their buying intention is lower. However, such conclusion only stands if the significance level is high. Based on the analyzed data, that relationship is not significant. Therefore, the satisfaction with current home does not reduce HAS buying intention, which shows that hypothesis 4b is not supported. The same conclusion can be drawn for the moderating effect of both satisfaction and need for uniqueness. The negative relationship with HAS buying intention means that the more satisfied people with their current home or higher need for uniqueness, the relationship of general attitude towards HAS to HAS buying intention is lower. In other words, if people are satisfied with their current home, they will consider the importance of general attitude towards HAS in their HAS buying intention less. Their buying intention may be more influenced by other factor, such as subjective norms (following other people). If the need for uniqueness is higher, people tend to consider the importance of general attitude towards HAS in their HAS buying intention less as they just think HAS as something unique without really think its benefits and sacrifices. However, as mentioned on table 13, the significance level of satisfaction and need for uniqueness to moderate the relationship between general attitude towards HAS and HAS buying intention is not significant.

IV.2. Analysis on Different Gender

IV.2.1. Analysis on Male

The same path analysis is done for male data. The sample size for male respondent is 267 respondents (60.7%) of 440 total respondents to be analyzed. That sample size meets the minimum requirement of the 10 times rule (Barclay, Higgins, & Thompson, 1995), which required the minimum sample size of 10 times the largest number of structural path directed at a particular construct. There are 11 structural path directed at HAS buying intention construct which is the largest number of structural path directed to a particular construct. Therefore, the minimum sample size requirement is 110.

Before starting to analyze the structural model, the reliability and validity of the male data need to be tested by doing the reflective measurement testing. All indicators and constructs fulfill the minimum threshold of validity and reliability measurement, except for Perceived Unreliability (PR) construct with 2 indicators, pr_1 and pr_2. In order to satisfy the validity and reliability measurement and achieve higher r^2, pr_2 is removed. Therefore, PR construct is only represented by single item (pr_1) for male analysis. No collinearity issue detected among the constructs. The PLS algorithm for male respondents give the coefficient of determination (r^2) of 0.203 for general attitude towards HAS and 0.415 for HAS buying

intention, which is slightly lower than the total respondents. The path coefficient and its significance level are shown on table 14. Path coefficients which are not displayed on the table are the not significant path.

Table 14. Male Significant Path Coefficient

Path to General Attitude towards HAS	Path Coefficient	Standard Error	T Statistics	Significance Level (2-tailed test)		
	O	STERR	|O/STERR|	99%	95%	90%
Monetary Value -> General	0.28	0.07	4.10	***		
Productivity -> General	0.15	0.08	2.00		**	

Path to Buying Intention (BI)	Path Coefficient	Standard Error	T Statistics	Significance Level (2-tailed test)		
	O	STERR	|O/STERR|	99%	95%	90%
General -> BI	0.24	0.07	3.33	***		
Security -> BI	0.20	0.07	2.97	***		
Monetary Value -> BI	0.20	0.07	2.86	***		
Productivity -> BI	0.19	0.09	2.18		**	
Enjoyment -> BI	0.17	0.07	2.37		**	

Based on the above table, hypothesis 1a is supported on 2 perceived benefits: monetary value and productivity. Meanwhile, hypothesis 1b is supported on 4 perceived benefits: security, monetary value, productivity and enjoyment. Both hypothesis 2a and 2b are not supported. It shows that the perceived sacrifices of HAS can't negatively influence the general attitude towards HAS and HAS buying intention for male. The same as the analysis on overall data, hypothesis 3 is also supported for male considering the significant influence of general attitude towards HAS on HAS buying intention.

The significant paths on male respondents are mostly the same as the total data. Only the path of security to general attitude towards HAS and privacy to HAS buying intention are differ from the total data. Both paths become insignificant for male respondents. It means that male value the monetary value and productivity improvement as the most important benefits of HAS. However, beside those 2 factors, they also consider enjoyment, security and general attitude towards HAS on their buying intention. Unlike the total data result, male does not consider privacy issue as important factor in influencing their buying intention. The IPMA will be explored on section IV.2.3. on comparison between total data, male and female.

IV.2.2. Analysis on Female

The sample size for female respondent is 173 respondents (39.3%) of 440 total respondents to be analyzed. It still satisfy the minimum sample size requirement of the 10 times rule (Barclay, Higgins, & Thompson, 1995), which requires minimum 110 respondents for PLS-SEM analysis. Before starting to analyze the structural model, the reliability and validity of the female data need to be tested by doing the reflective measurement testing. All indicators and constructs fulfill the minimum threshold of validity and reliability measurement. Moreover, no collinearity issue detected among the constructs. The PLS algorithm for female respondents give the coefficient of determination (r^2) of 0.305 for general attitude towards HAS and 0.498 for HAS buying intention, which is slightly higher than the total respondents. The path coefficient and its significance level are shown on table 15. Path coefficients which are not displayed on the table are the not significant path.

Table 15. Female Significant Path Coefficient

Path to General Attitude towards HAS	Path Coefficient	Standard Error	T Statistics	Significance Level (2-tailed test)		
	O	STERR	|O/STERR|	99%	95%	90%
Monetary Value -> General	0.28	0.09	3.09	***		
Save Energy -> General	0.18	0.09	1.90			*

Path to Buying Intention (BI)	Path Coefficient	Standard Error	T Statistics	Significance Level (2-tailed test)		
	O	STERR	|O/STERR|	99%	95%	90%
Enjoyment -> BI	0.37	0.11	3.46	***		
Save Energy -> BI	0.26	0.08	3.04	***		
Monetary Value -> BI	0.23	0.08	3.03	***		
Privacy -> BI	0.20	0.09	2.38		**	
General -> BI	0.19	0.08	2.44		**	

Based on the above table, hypothesis 1a is supported on 2 perceived benefits: monetary value and energy saving benefits of HAS. Meanwhile, hypothesis 2a is not supported. Hypothesis 1b is supported on 3 perceived benefits: enjoyment, energy saving and monetary value. Meanwhile, hypothesis 2b is supported only on privacy issue. The same as the analysis on overall data, hypothesis 3 is also supported for female.

Female shows different significant path coefficient compared to the total data. They consider the monetary value and energy saving as the important benefits of HAS. In terms of buying intention, they consider enjoyment as the most important factor. Unlike the total data or the male data, they do not consider security and productivity important to increase their

buying intention. However, privacy issue is considered important for them. The IPMA will be explored on section IV.2.3. on comparison between total data, male and female.

IV.2.3. Comparison between Total Data, Male and Female

The comparison between total data, male and female is done by comparing the IPMA for their buying intention among them. Table 16 shows the IPMA of total data, male and female.

Table 16. IPMA of Total Data, Male and Female

	Total	Male	Female	Total	Male	Female	Performance Female to Male
	Importance			Performance (%)			
Buying Intention				67.74	68.49	66.61	Lower***
Cost	-0.03	0.02	-0.07	33.62	33.28	34.11	Higher**
Enjoyment	0.20***	0.17**	0.37***	70.60	70.57	70.66	Higher***
General	0.22***	0.24***	0.19**	59.76	59.34	60.41	**NS**
Lifestyle	-0.02	-0.03	-0.05	49.88	48.98	50.77	**NS**
Monetary Value	0.21***	0.20***	0.23***	62.92	63.61	61.84	**NS**
Privacy	0.09*	0.06	0.20**	53.59	52.95	54.56	**NS**
Productivity	0.17**	0.19**	0.03	68.90	68.98	68.82	Lower***
Unreliability	-0.07	-0.10	-0.14	40.43	45.83	39.66	**NS**
Save Energy	0.06	-0.01	0.26***	67.40	67.93	66.63	Lower***
Security	0.14***	0.20***	-0.04	68.35	68.08	68.77	Higher***
Ubiquity	0.02	0.02	-0.03	75.43	76.08	74.45	Lower***

Note: (*** = 99% confidence level, ** = 95% confidence level, * = 90% confidence level, NS = Not Significant)

The performance of HAS comparison between male and female displayed on last column of table 16 is tested using Mann-Whitney test. Table 16 shows some findings as follow:

a. General attitude towards HAS, enjoyment and monetary value are all important in improving HAS buying intention
b. Productivity and security are important for male, whereas privacy and energy saving are important for female
c. Female consider HAS performance in terms of cost, enjoyment and security higher than male
d. Male consider HAS performance in improving productivity, energy saving and ubiquity higher than female
e. Female's HAS buying intention is lower than the male
f. In general, the attitude towards HAS between male and female is the same

The effect of satisfaction with current home and need for uniqueness is also measured on male and female. The significance level of the path coefficient on male and female is the same as the total data. It means that only hypothesis 4a, which states that the need for uniqueness is significant to positively improve HAS buying intention, is supported (hypothesis 4b is not supported). The index performance of satisfaction and need for uniqueness for male and female is shown on table 17.

Table 17. Performance of Satisfaction and Need for Uniqueness for Male and Female

	Total	Male	Female	Performance Female to Male
	Performance (%)			
Satisfaction	67.27	66.20	68.93	Higher***
Uniqueness	60.67	62.28	58.19	Lower*

Table 17 shows that female have higher satisfaction with their current home than male, whereas male have higher need for uniqueness than female.

IV.3. Influence of Age on HAS Buying Intention

The average respondents' age on this research is 35.01 years old. Therefore, in order to meet the sample size requirement, respondents are categorized into 2 groups. The first group is respondents with age 35 years old and younger. The other group is respondents with age above 35 years old. The first group (young group) consists of 261 respondents. The second group (old group) consists of 165 respondents. Therefore, the sample size of both group satisfy the minimum required sample size of the 10 times rule (Barclay, Higgins, & Thompson, 1995). The young group satisfies the reflective measurement model threshold and no collinearity issue detected. The old group also has no collinearity issue. However, it does not satisfy the minimum threshold of reliability and validity on Perceived Lifestyle (PL) with 2 indicators pl_1 and pl_2. Therefore, in order to satisfy the validity and reliability measurement and achieve higher r^2, pl_1 is removed. For age analysis, PL construct only represented by single item (pl_2). The path coefficient and significance level of both groups can be seen on table 18 and 19.

Table 18. Path Coefficient and Significance Level of Young Group (35 years old and below)

Path to General Attitude towards HAS	Path Coefficient	Standard Error	T Statistics	Significance Level (2-tailed test)		
	O	STERR	|O/STERR|	99%	95%	90%
Monetary Value -> General	0.26	0.07	3.65	***		
Productivity -> General	0.19	0.08	2.43		**	
Cost -> General	0.13	0.07	1.77			*

Path to Buying Intention (BI)	Path Coefficient	Standard Error	T Statistics	Significance Level (2-tailed test)		
	O	STERR	|O/STERR|	99%	95%	90%
General -> BI	0.24	0.06	3.86	***		
Productivity -> BI	0.23	0.09	2.70	***		
Monetary Value -> BI	0.22	0.07	3.11	***		
Enjoyment -> BI	0.20	0.07	2.87	***		
Security -> BI	0.16	0.06	2.58	***		
Privacy -> BI	0.13	0.07	2.02		**	

Table 19. Path Coefficient and Significance Level of Old Group (above 35 years old)

Path to General Attitude towards HAS	Path Coefficient	Standard Error	T Statistics	Significance Level (2-tailed test)		
	O	STERR	|O/STERR|	99%	95%	90%
Monetary Value -> General	0.26	0.10	2.56		**	
Security -> General	0.23	0.09	2.63	***		

Path to Buying Intention (BI)	Path Coefficient	Standard Error	T Statistics	Significance Level (2-tailed test)		
	O	STERR	|O/STERR|	99%	95%	90%
Enjoyment -> BI	0.34	0.10	3.58	***		
Monetary Value -> BI	0.26	0.08	3.23	***		
General -> BI	0.17	0.10	1.79			*

Table 18 and 19 show the difference between younger people and older people in terms of what they consider important to determine HAS buying intention and general attitude towards HAS. For younger people, hypothesis 1a is supported on monetary value and productivity. Meanwhile, hypothesis 1a is supported on monetary value and security for older people. Hypothesis 1b is supported on enjoyment and monetary value for older people, added by productivity and security for younger people. For younger people, Hypothesis 2a is supported on cost / price factor. Meanwhile, hypothesis 2b is supported on privacy issue. For older people, both hypothesis 2a and 2b are not supported. Hypothesis 3 is supported considering the significant influence of general attitude towards HAS on buying intention.

Younger people tend to consider the monetary value, productivity and cost affordability as the important benefit of HAS. On the other hand, older people consider the monetary value and security feature as the most important benefits of HAS. HAS buying intention of younger people is influenced by many factors: productivity, monetary value, enjoyment, security, privacy and general attitude towards HAS. On the other hand, older people consider fewer factor as their important consideration of HAS buying intention, which are enjoyment, monetary value and general attitude towards HAS. IPMA of both groups is shown on table 20.

Table 20. IPMA based on Age

	≤ 35 years old	> 35 years old	≤ 35 years old	> 35 years old	Performance Comparison (Mann-Whitney)
	Importance		Performance (%)		
Buying Intention			67.73	68.65	Higher***
Cost	-0.03	0.12	31.20	36.76	**NS**
Enjoyment	0.20***	0.34***	69.20	73.35	Higher***
General	0.24***	0.17*	57.72	63.33	Higher***
Lifestyle	0.02	-0.16	48.50	61.43	**NS**
Monetary Value	0.22***	0.26***	61.50	65.60	**NS**
Privacy	0.13**	0.15	51.89	57.53	**NS**
Productivity	0.23***	-0.10	68.03	70.65	Higher***
Unreliability	-0.10	-0.17	40.34	43.41	**NS**
Save Energy	0.03	0.11	65.57	70.90	**NS**
Security	0.16***	0.03	65.93	72.56	**NS**
Ubiquity	-0.03	0.12	76.31	74.99	Lower***

Note: (*** = 99% confidence level, ** = 95% confidence level, * = 90% confidence level, NS = Not Significant)

Table 20 shows that younger people consider more factors on their HAS buying intention than the older people. Therefore, their buying intention is lower as they consider a lot of things before buying. Perceived enjoyment and productivity of HAS are higher for older people. Moreover, the general attitude towards HAS is also higher for older people. Only the factor of ubiquity is lower for older people compared to the younger one. It may be because of lack of information about the ubiquity of HAS as the emerging technology.

IV.4. Influence of Income on HAS Buying Intention

According to Charlie W et al (2015) and their article about smart homes and their users, potential users may include low and middle income household, as well as high income technophiles. Therefore, it means that all income segments can be the potential users of smart homes or HAS. In order to test that statement, the path analysis will be done among 3 different income categories (Low, middle and high). As mentioned on table 1, the annual household income is categorized into 5 categories. In order to achieve proper comparison between low, middle and high income and fulfill the minimum sample size requirement, the comparison will be done on the combination of first and second group as low income group; second, third and fourth group as middle income group; and fourth and fifth group as high income group.

The sample size of low income group is 188 respondents, middle income group consists of 178 respondents and the high income group consists of 167 respondents. All three groups satisfy the minimum required sample size. Before analyzing the path coefficient and significance level, reflective measurement model and collinearity issue have to be tested. Low and high income group satisfy the threshold of reliability and validity measurement. No collinearity issue detected on both groups. However, middle income group has not met the reliability and validity threshold on Perceived Privacy (PPR), Perceived Unreliability (PR) and Perceived Lifestyle (PL). Therefore, all those constructs will be represented by single item. PPR is represented by ppr_2, PR by pr_1 and PL by pl_1. After changing the indicators for those 3 constructs, the reliability and validity threshold can be fulfilled and no collinearity issue detected on that group. Therefore, the structural model path analysis can be done for all the 3 groups. Table 21, 22 and 23 show the result for all groups. IPMA between all the 3 groups will be shown on table 24.

Table 21. Path Coefficient and Significance Level of Low Income Group

Path to General Attitude towards HAS	Path Coefficient	Standard Error	T Statistics	Significance Level (2-tailed test)		
	O	STERR	|O/STERR|	99%	95%	90%
Monetary Value -> General	0.21	0.09	2.32		**	
Security -> General	0.15	0.08	1.93			*
Path to Buying Intention (BI)	Path Coefficient	Standard Error	T Statistics	Significance Level (2-tailed test)		
	O	STERR	|O/STERR|	99%	95%	90%
General -> BI	0.28	0.07	4.29	***		
Enjoyment -> BI	0.23	0.09	2.69	***		
Monetary Value -> BI	0.21	0.07	2.84	***		

Table 22. Path Coefficient and Significance Level of Middle Income Group

Path to General Attitude towards HAS	Path Coefficient	Standard Error	T Statistics	Significance Level (2-tailed test)		
	O	STERR	|O/STERR|	99%	95%	90%
Monetary Value -> General	0.34	0.08	4.08	***		
Security -> General	0.18	0.08	2.37		**	
Path to Buying Intention (BI)	Path Coefficient	Standard Error	T Statistics	Significance Level (2-tailed test)		
	O	STERR	|O/STERR|	99%	95%	90%
Enjoyment -> BI	0.25	0.09	2.86	***		
Monetary Value -> BI	0.24	0.07	3.23	***		
General -> BI	0.17	0.09	1.94			*
Security -> BI	0.17	0.08	2.10		**	

Table 23. Path Coefficient and Significance Level of High Income Group

Path to General Attitude towards HAS	Path Coefficient	Standard Error	T Statistics	Significance Level (2-tailed test)		
	O	STERR	|O/STERR|	99%	95%	90%
Monetary Value -> General	0.28	0.09	3.00	***		
Productivity -> General	0.27	0.11	2.46		**	

Path to Buying Intention (BI)	Path Coefficient	Standard Error	T Statistics	Significance Level (2-tailed test)		
	O	STERR	|O/STERR|	99%	95%	90%
Productivity -> BI	0,27	0,11	2,35		**	
Monetary Value -> BI	0,19	0,10	1,83			*
Security -> BI	0.19	0.11	1.74			*

Table 24. IPMA based on Income

	Low Income	Middle Income	High Income	Low Income	Middle Income	High Income
	Importance			Performance (%)		
Buying Intention				69.15	69.54	67.28
Cost	-0.03	0.001	0.04	31.24	33.82	36.88
Enjoyment	0.23***	0.25**	0.17	70.67	71.38	71.12
General	0.28***	0.17*	0.13	63.50	59.97	56.63
Lifestyle	0.08	0.01	-0.13	55.05	59.69	65.06
Monetary Value	0.21***	0.24***	0.19*	65.12	63.5	61.00
Privacy	0.17	-0.01	0.005	50.33	53.53	55.88
Productivity	0.07	0.04	0.27**	69.65	69.77	68.36
Unreliability	-0.25	-0.14	-0.05	40.67	45.46	42.27
Save Energy	0.05	0.08	0.08	67.84	68.56	67.45
Security	0.13	0.17**	0.19*	68.87	68.89	68.38
Ubiquity	0.08	0.02	-0.01	75.16	76.75	76.32

Note: (*** = 99% confidence level, ** = 95% confidence level, * = 90% confidence level)

The significance comparison between the performances on each income category will be done by Kruskall-Wallis test for 3 categories of income. However, the significance comparison between the performances on 2 income categories will be done by Mann-Whitney test. Table 25 shows the performance comparison of each income category.

Table 25. Performance Comparison based on Income

	Performance (%)			Performance Rank (95% confidence level)		
	Low Income	Middle Income	High Income	Low Income	Middle Income	High Income
Buying Intention	69.15	69.54	67.28	2	1	3
Cost	31.24	33.82	36.88	**NS**		
Enjoyment	70.67	71.38	71.12	3	1	2
General	63.50	59.97	56.63	1	2	3
Lifestyle	55.05	59.69	65.06	**NS**		

Monetary Value	65.12	63.5	61.00	**NS**		
Privacy	50.33	53.53	55.88	**NS**		
Productivity	69.65	69.77	68.36	1		2
Unreliability	40.67	45.46	42.27	**NS**		
Save Energy	67.84	68.56	67.45	2	1	3
Security	68.87	68.89	68.38	2	1	3
Ubiquity	75.16	76.75	76.32	3	1	2

Note: (Rank 1 is higher than rank 2 and 3; Rank 2 is higher than rank 3; NS = Not significantly different)

Based on the above tables, there are some findings can be analyzed. Hypothesis 1a is supported on monetary value and security for both low income and middle income category. Meanwhile, the high income category support hypothesis 1a on monetary value and productivity. Hypothesis 1b is supported on enjoyment and monetary value for low income category; enjoyment, monetary value and security for middle income category; and productivity, monetary value and security for high income category. Both hypothesis 2a and 2b are not supported for each income category. Meanwhile, hypothesis 3 is supported for low and middle income category.

All of income category can be the potential user of HAS. Low income category has the highest general attitude towards HAS among other groups and consider it the most important attribute for their buying intention. Middle income category has the highest buying intention among other groups. The high income category may become the potential user of HAS considering their capability to afford HAS technology. Moreover, as mentioned on section IV.1.3 about the positive and significant influence of need for uniqueness, the high income technophiles can be the potential user of HAS.

IV.5. Influence of Family Size on HAS Buying Intention

Charlie W et al (2015) also mentioned about women, children and families as the prospective user of smart home rather than unitary households or individual users. Therefore, this research tries to explore the influence of family size on HAS buying intention. It is done by categorizing the respondents into 2 categories: small family consists of 1 – 3 family members and big family consists of 4 or more family members. The first group has 167 respondents and the second group has 231 respondents. The small family group has no collinearity issue and satisfies the validity and reliability checking. However, the big family group does not satisfy the validity and reliability checking on Perceived Lifestyle (PL) construct. Therefore, PL will only be represented by single indicator, which is pl_1. After

doing that change, the validity and reliability measurement can be fulfilled and no collinearity issue detected on that group. The structural model path analysis result and its significance level are shown on table 26 and 27. Table 28 shows the IPMA based on family size category.

Table 26. Path Coefficient and Significance Level of Small Family

Path to General Attitude towards HAS	Path Coefficient	Standard Error	T Statistics	Significance Level (2-tailed test)		
	O	STERR	|O/STERR|	99%	95%	90%
Monetary Value -> General	0.23	0.09	2.64	***		
Productivity -> General	0.21	0.11	1.92			*
Path to Buying Intention (BI)	Path Coefficient	Standard Error	T Statistics	Significance Level (2-tailed test)		
	O	STERR	|O/STERR|	99%	95%	90%
Security -> BI	0.27	0.09	3.08	***		
Productivity -> BI	0.22	0.10	2.07		**	
Monetary Value -> BI	0.20	0.08	2.50		**	

Table 27. Path Coefficient and Significance Level of Big Family

Path to General Attitude towards HAS	Path Coefficient	Standard Error	T Statistics	Significance Level (2-tailed test)		
	O	STERR	|O/STERR|	99%	95%	90%
Monetary Value -> General	0.28	0.09	3.19	***		
Security -> General	0.14	0.08	1.85			*
Path to Buying Intention (BI)	Path Coefficient	Standard Error	T Statistics	Significance Level (2-tailed test)		
	O	STERR	|O/STERR|	99%	95%	90%
General -> BI	0.33	0.06	5.17	***		
Monetary Value -> BI	0.27	0.08	3.56	***		
Enjoyment -> BI	0.22	0.08	2.88	***		

Table 28. IPMA based on family size

	Small Family	Big Family	Small Family	Big Family	Performance Comparison (Mann-Whitney)
	Importance		Performance (%)		
Buying Intention			67.07	70.15	Higher***
Cost	-0.001	-0.06	32.65	34.28	**NS**
Enjoyment	0.11	0.22***	70.14	72.34	Higher***
General	-0.02	0.33***	56.33	62.94	Higher***
Lifestyle	-0.09	0.06	51.90	43.64	**NS**
Monetary Value	0.20**	0.27***	59.33	65.42	**NS**
Privacy	0.15	0.01	55.62	52.59	**NS**
Productivity	0.22**	0.02	67.98	70.53	Higher***
Unreliability	-0.03	-0.08	39.62	41.71	**NS**
Save Energy	0.11	-0.01	66.03	68.96	Higher**

Security	0.27***	0.04	65.95	70.43	Higher**
Ubiquity	-0.07	0.11	74.54	76.32	Higher**

Note: (*** = 99% confidence level, ** = 95% confidence level, * = 90% confidence level, NS = Not Significant)

Based on table 28, hypothesis 1a is supported on monetary value and productivity for small family. Meanwhile, it is supported on monetary value and security for big family. Hypothesis 1b is supported on security, productivity and monetary value for small family. Meanwhile, it is supported on monetary value and enjoyment for big family. Both hypothesis 2a and 2b are not supported for small and big family. On the other hand, hypothesis 3 is supported only for big family.

Big family has higher HAS buying intention than the small family. Therefore, big family can be the prospective user of HAS. For big family, factors that can improve HAS buying intention is general attitude towards HAS, monetary value and enjoyment. On the other hand, security, productivity and monetary value are the important factor for small family to increase HAS buying intention.

CHAPTER 5

V. Discussion

This research aims to identify customer perceived value of ubiquitous home services providing Home Automation System (HAS) in Indonesia. There are 10 attributes which can influence the general attitude towards HAS and HAS buying intention to be tested by testing the first and second hypothesis.

Hypothesis 1a. Beliefs on the potential benefits of HAS will be associated with positive attitude towards HAS.

Among 6 attributes which represent the potential benefits of HAS, 3 of them (monetary value, productivity and security) will be associated with positive attitude towards HAS in general. However, for female respondents, HAS potential benefit to provide energy saving will also be associated with positive attitude towards HAS. It shows that hypothesis 1a is accepted on monetary value, productivity and security attributes of HAS in general and energy saving attribute of HAS for Indonesian female. However, it is rejected on enjoyment and ubiquity attributes of HAS. In other words, the potential benefits of HAS as an investment, increasing productivity and security can improve the positive attitude towards HAS for Indonesian people and the potential benefits of HAS in saving energy can improve the positive attitude towards HAS for Indonesian female.

Hypothesis 1b. Beliefs on the potential benefits of HAS will be associated with higher intention to buy HAS.

In general, among 6 attributes which represent the potential benefits of HAS, 4 of them (monetary value, enjoyment, productivity and security) will be associated with higher intention to buy HAS. However, for female respondents, HAS potential benefit to provide energy saving also leads to higher HAS buying intention. Only ubiquity cannot be considered statistically significant in influencing HAS buying intention. Therefore, hypothesis 1b is accepted on monetary value, enjoyment, productivity, security attributes of HAS in general and energy saving attribute of HAS for Indonesian female. However, it is rejected on ubiquity attribute of HAS.

Hypothesis 2a. Beliefs on the potential sacrifices of HAS will be associated with negative attitude towards HAS.

In general, among the 4 attributes which represent the potential sacrifices of HAS none of them will be associated with negative attitude towards HAS. However, price / cost attribute of HAS will be associated with negative attitude towards HAS for young people category (under 36 years old). In other words, expensive price can negatively influence general attitude towards HAS and cheaper price can positively influence general attitude towards HAS. Therefore, hypothesis 2a is only accepted on price / cost attribute of HAS for young Indonesian people.

Hypothesis 2b. Beliefs on the potential sacrifices of HAS will be associated with lower intention to buy HAS.

Among 4 attributes which represent the potential sacrifices of HAS, only the privacy issue of HAS will be associated with lower intention to buy HAS. It shows that Indonesian people are concern about their privacy on their buying decision. Therefore, hypothesis 2b is only accepted on privacy issue of HAS.

Hypothesis 3. Positive attitude towards HAS will be associated with higher intention to buy HAS.

Based on the analyzed data, it can be concluded that positive attitude towards HAS will be associated with higher intention to buy HAS. Therefore, hypothesis 3 is accepted.

Hypothesis 1a and 1b

Both hypothesis 1a and 1b are accepted on monetary value, productivity and security attributes of HAS in general and energy saving attribute of HAS for female respondents. Considering that hypothesis 3 is accepted, it shows that those attributes have the indirect (mediated by general attitude towards HAS as described on hypothesis 3) and direct relationship with HAS buying intention. However, considering that hypothesis 1a is rejected on enjoyment attribute of HAS, but hypothesis 1b is accepted on that attribute, it can be concluded that general attitude towards HAS cannot mediate enjoyment to increase HAS buying intention. In other words, enjoyment only have direct relationship with HAS buying intention.

Hypothesis 2a and 2b

Hypothesis 2a is only accepted on price / cost attribute of HAS for younger Indonesian people. Considering that hypothesis 3 is accepted, it shows that the general attitude towards HAS can mediate the price / cost to negatively influence HAS buying intention for younger Indonesian people. Therefore, price / cost of HAS can indirectly influence HAS buying intention negatively for younger Indonesian people. However, hypothesis 2b is only accepted on privacy issue. Therefore, privacy issue has direct influence on HAS buying intention. In other words, HAS buying intention can be directly influenced negatively by privacy issue and indirectly influenced negatively by price / cost for younger Indonesian people, mediated by general attitude towards HAS.

Hypothesis 4a. Higher need for uniqueness will be associated with higher intention to buy HAS.

Based on the analyzed data, higher need for uniqueness will be associated with higher buying intention to buy HAS with 99% confidence level. Therefore, hypothesis 4a is accepted. However, its role as a moderating effect on moderating the relationship between general attitude towards HAS and HAS buying intention is not statistically significant.

Hypothesis 4b. Higher satisfaction with the current home will be associated with lower intention to buy HAS

Based on the analyzed data, the satisfaction level is not statistically significant in influencing HAS buying intention. Its role as moderating effect on moderating the relationship between general attitude towards HAS and HAS buying intention is also not statistically significant. In other words, higher satisfaction with the current home will not be associated with lower buying intention to buy HAS. Therefore, hypothesis 4b is rejected.

Hypothesis 4

Based on the above findings, hypothesis 4a is accepted. However, hypothesis 4b is rejected. It shows that the need for uniqueness outweighs the satisfaction with current home for Indonesian people. In other words, even though people are satisfied with what they have now, if they have high need for uniqueness, they have higher intention to buy.

Considering HAS as ubiquitous home services, it has the highest performance in terms of providing ubiquity. However, ubiquity is found to be not statistically significant in influencing the buying intention. This information may be used for input in developing other ubiquitous service which categorized into private, generality and life category. Considering its private category, not only the technology itself is important, but also how the ubiquitous technology can produce a profit and sustain in the long term. That is why the factor of monetary value is found important in influencing the buying intention. Customers' perceived value of the ubiquitous service in general is also important considering the life category as the business will deal with the end users. This research can only achieve around 0,4 coefficient of determination for HAS buying intention (according to Joseph F. Hair, Jr et al (2014), it is considered around moderate result). It indicates that there are other factors can influence HAS the buying intention, such as the subjective norms which are not covered on this research. Therefore, further research can be done in measuring the effect of subjective norms in influencing HAS buying intention. The same framework can also be used to do the research on other type of ubiquitous services in order to get the comparative result between each category of ubiquitous service.

Managerial Implication

Based on the obtained data, among the 4 significantly important factors which can influence HAS buying intention positively (monetary value, enjoyment, productivity and security), monetary value has the lowest performance. Therefore, it is advisable for HAS providers' management to improve the performance of HAS services on its ability in providing investment opportunity. It can be done by providing prospective customers with the comparison data in monetary value of home without HAS and home with HAS installed. Therefore, the real benefit of HAS in terms of monetary value can properly offered by service providers and enjoyed by users.

HAS buying intention can also be influenced positively by the need for uniqueness, which is found to be higher in the male respondents. That finding may explain the other finding on the performance of HAS buying intention which is found to be higher on male than female. However, unlike the research about the adoption of innovative heating systems done by K. Mahapatra and L Gustavsson (2010), satisfaction with current home does not significantly influence HAS buying intention.

In terms of age, Indonesian people on the age above 35 years old are found to have higher HAS buying intention than the younger one. They also consider less important factors

on their buying intention, which are the general attitude towards HAS, monetary value and enjoyment. Therefore, Indonesian people on the age above 35 years old can be a potential HAS buyer. If HAS providers want to target the younger market, beside the 3 important factors mentioned before, they also have to consider security and productivity features as well as warranty of keeping users' privacy.

In accordance with Charlie et al. (2015), Indonesian people with any income level can be the potential HAS users. To target the low income segment, HAS service providers can rely on improving the performance of HAS monetary value in order to improve the general attitude towards HAS and in the end improve the buying intention. The middle income segment is shown to have the highest buying intention compared to the low and high income. Therefore, targeting the middle income segment is also important. The high income segment has the lowest buying intention among the other groups. However, high income segment has the ability to afford HAS in the higher price. Given that someone on this group has high need for uniqueness (high income technophile), his / her willingness to spend money for HAS can provide good opportunity for HAS business. Again, in accordance with Charlie et al. (2015), bigger family size can also be the potential HAS users as families with more than 3 members have higher buying intention than family with 1 – 3 members.

Concluding Remark

Ubiquitous computing has been long developed and its realization in the form of U-services is now underway. There are a lot of u-services, designed for their specific purposes, currently available. However, research on understanding customer value in designing proper u-service and be more appealing to the users is yet to be determined. Identifying perceived customer value which constitutes beliefs is very important as it can be associated with attitude and leads to behavior intention. By analyzing behavior intention, proper u-service can be designed to target the correct market. Home Automation System (HAS) is one type of u-services available. That service is also available in Indonesia as one of the emerging countries. By using Theory of Reasoned Action that suggest the importance of identifying perceived benefits and sacrifices of HAS and Structural Equation Modeling (SEM), HAS perceived benefits and sacrifices in Indonesia are being analyzed. The research shows that the significant perceived benefits of HAS in Indonesia are investment in HAS (monetary value), productivity, security and enjoyment. Meanwhile, the significant perceived sacrifices which can reduce HAS buying intention in Indonesia are the price (for younger people) and privacy issue. In addition, HAS perceived benefit to provide energy saving is also found to be

important for female. Therefore, to target female customers, HAS providers should emphasize their service on energy saving. As one type of u-services, HAS can provide ubiquity that enable users to access their home anywhere and anytime. However, users do not consider it important in deciding to buy HAS. Therefore, HAS providers should consider to design their service more in improving productivity, security and enjoyment instead of ubiquity. They also need to provide their prospective customers with information about future investment possibility in HAS. The need for uniqueness can be the external factor in increasing HAS buying intention and outweighs the satisfaction with the current home. Users with higher need for uniqueness (technophiles) can be the prospective target market. Another prospective target market of HAS are people on the age above 35 years old and big families as they have higher HAS buying intention. HAS providers can emphasize their service on the ability to provide home enjoyment and monetary value as their significant HAS benefit. In accordance with Theory of Reasoned Action, general attitude towards HAS can influence HAS buying intention positively. Therefore, research on other type of u-services can be done the same way by measuring the general attitude towards u-service. General attitude towards u-service can be measured by identifying the perceived benefits and sacrifices of u-services. It can also be expanded by including other factors, such as subjective norms and perceived behavioral control in influencing general attitude towards u-service on further research.

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Appendix

Various types of u-services

Technology	Description
Administration	To improve convenience of public service for companies and citizen (e.g., media board, community portal, online administration, u-public information management)
Traffic	To support traffic control and provide various transportation information (e.g., automated traffic control, offering transportation information, traffic signal control, parking management, bus information service)
Health / Welfare	To enable citizen experience convenience anywhere in their daily life (e.g., u-health [hospital, first aid, health management], remote health check, u-social welfare service, u-life management center service)
Environment	To preserve natural environment and save energy resources (e.g., air pollution control, soil contamination control, water contamination control)
Security / Safety	To maintain security life and prevent inhabitant from various disaster (e.g., crime prevention, child protection, disaster management, safety monitoring, earthquake / tidal wave forecast and warning system)
Facilities	To manage and sustain establishments like street, bridge, and building, etc. (e.g., road lamp management, water pipe leak management, underground facility location detection, building automation)
Education	To establish educational environment providing learning contents, facilities, and so on (e.g., remote education, learning aide service, intelligent classroom)
Leisure / Tour	To provide various multimedia channel and tour-information for citizen's enjoyment (e.g., tourist information, interactive media board, online reservation schedule management, u-exhibition service, u-foreigner mobile assistance)
Logistics	To support management logistics information and monitoring location by using ubiquitous infrastructure such as RFID (e.g., RTLS or real-time location system of containers, advanced information exchange system)
Business	To promote work environment by ICT technology and support business intelligent (e.g., u-conference service, u-work center service, digital ads / information, information exchange system)

Source: C.S. Leem & B.G. Kim (2012)

Classification standards of u-services

Criteria	Definition	Characteristic	Description
Service Operation	Classification according to whether the applicable service is provided free as public service or whether it is provided as chargeable service in the private service sector	Public	Public service provided without levying special cost
		Commercial	Commercial service incurring additional cost according to the purpose of individual use
City Function	Classification according to whether the service is generally provided regardless of regions or whether the service is specialized to a particular region	Generality	Services provided to strengthen the basic function regardless of the types or characteristics of cities
		Specialty	Services provided to strengthen the characteristics of the applicable city by reflecting the functions inherent to the city
Utilization Object	Classification according to whether the applicable service refers to living convenience or to improvement of industrial and business environment	Life	Service to raise the efficiency of the individuals' life, aiming to promote living convenience
		Industry	Service aiming at industrial development through making business efficient or improving business environment

Source: C.S. Leem & B.G. Kim (2012)

Analysis of the current u-city service strategies in South Korea

Service Operation	Service Function	Utilization Object	Case
Public	Generality	Life	U-administration, water pipe leak management, underground facility location detection
Public	Generality	Industry	U-sports complex, facility monitoring, outdoor advertisement management, employee information
Public	Specialty	Life	U-Wonju street, health center, culture and tour information, u-land mark, water screen, CPTED-based security
Public	Specialty	Industry	U-museum, one-click business support, remote livestock management
Private	Generality	Life	U-health care, child safety service, smart card system, home automation, home security
Private	Generality	Industry	Auto logistics, auto delivery, business support portal, u-work center
Private	Specialty	Life	Video telephony medical support, online education network, private security
Private	Specialty	Industry	U-business support, local industry support, u-port system

Source: C.S. Leem & B.G. Kim (2012)

Home Automation System (HAS) Questionnaire

1. **Gender:** (a) Male (b) Female
2. **Year of Birth:** _____
3. **Household Income / Year:**
   (a) Below Rp. 36,000,000
   (b) Rp. 36,000,000 – Rp. 60,000,000
   (c) Rp. 60,000,000 – Rp. 90,000,000
   (d) Rp. 90,000,000 – Rp. 120,000,000
   (e) Above Rp. 120,000,000
4. **Total family members living at home (including me)** _____

HAS = Home Automation System -> Home equipped with integrated system to control electronics appliances, such as lights, TV, CCTV, Alarm, Door Lock, Motion sensor, etc

Example: Light control and door lock from Smartphone

To what extend do you agree with the statement below:

Section 1

	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
		1	2	3	4	5
1	I am familiar with HAS	☐	☐	☐	☐	☐
2	I feel safe having HAS on my home	☐	☐	☐	☐	☐
3	I think HAS provide the mechanism to ensure the safety of the residents	☐	☐	☐	☐	☐
4	I expect that using HAS would be enjoyable	☐	☐	☐	☐	☐
5	I expect that using HAS would be comfortable	☐	☐	☐	☐	☐
6	I would find HAS to be useful in my daily life	☐	☐	☐	☐	☐
7	Using HAS would help me accomplish things more quickly	☐	☐	☐	☐	☐
8	I expect that using HAS would let me check the accuracy of my electricity usage	☐	☐	☐	☐	☐
9	I expect that using HAS would help me save energy and reduce electricity bill	☐	☐	☐	☐	☐
10	I expect that I would be able to use HAS and get access to my home anytime and anywhere	☐	☐	☐	☐	☐
11	I would find HAS to be easily accessible and portable	☐	☐	☐	☐	☐
12	I believe that in the future, home with HAS would provide a good value	☐	☐	☐	☐	☐
13	HAS would offer a good value for the money directly	☐	☐	☐	☐	☐

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Section 2

	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
		5	4	3	2	1
1	I believe that installing HAS would be costly	☐	☐	☐	☐	☐
2	I believe that HAS needs high maintenance cost	☐	☐	☐	☐	☐
3	Using HAS means giving my personal data to the wrong hands	☐	☐	☐	☐	☐
4	I would find HAS providers selling my personal data	☐	☐	☐	☐	☐
5	I believe that HAS is non-essential	☐	☐	☐	☐	☐
6	Using HAS would make me constantly worrying and feeling guilty	☐	☐	☐	☐	☐
7	I believe that malfunction happens frequently in HAS	☐	☐	☐	☐	☐
8	Using HAS, I would find that break down of communications network will make other systems getting out of control	☐	☐	☐	☐	☐

Section 3

	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
		1	2	3	4	5
1	To me, the advantages outweigh the disadvantages of the HAS	☐	☐	☐	☐	☐
2	I intend to use HAS in the future	☐	☐	☐	☐	☐
3	I expect to use HAS frequently in the future	☐	☐	☐	☐	☐
4	I am often on the lookout for new products or brands that will add to my personal uniqueness	☐	☐	☐	☐	☐
5	I actively seek to develop my personal uniqueness by buying special products or brands	☐	☐	☐	☐	☐
6	I am satisfied with my current home	☐	☐	☐	☐	☐

Thank you

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