User adoption of Smart Homes Technology in Malaysia: Integration TAM 3,TPB, UTAUT 2 and extension of their constructs for a better prediction

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Abstract: *Smart homes technology has been presented as a key means by which households can optimize their use of energy-consuming appliances. This study therefore aims to propose a research framework that integrates the technology acceptance model (TAM), theory of planned behaviour (TPB), UTAUT 2 and other constructs to enrich literature and capture some perceptions of individual users of smart homes technology. Individually, the frameworks of TAM 3and TPB are insightful to comprehending the adoption of smart home technology but a bit parochial in their constructs and so, can rarely provide deep explanation about what motivates individual to adopt technology. This paper reviewed, synthesized and extended the constructs of these models in an integrated framework. The proposed integrated framework led to 14 propositions to promote and facilitate future research, and to guide explanation and prediction of SHT adoption. The introduced constructs in the integrated framework (e.g. automation, mobility, perceived security and hedonic motivation) inculcates technical systems and improve the theoretical base of adoption.*

Keywords: *Adoption, Hedonic Motivation, Smart Homes,TPB, Perceived Security*

I. Introduction

Smart Home Technology (SHT) has started to attract the attention of users especially in developed and European world with the advent of internet and global policy initiatives of government that are mandating or encouraging energy efficiency and climate change. The SHT allows residence of users to be equipped with a series of gadgets, domestic appliances, linking sensors, and other devices, which can be controlled, accessed or monitored remotely (Baltaozkan et al., 2014) thereby providing required services that can meet the needs of its users (Chan et al., 2008).Smart home service users can easily access the system, control smart appliances such as air conditioners, heaters, washing machines etc.and ensure the safety of home and family (Yang and Lee, 2017, ITU, 2010). Against the ''traditional home'' appliances which are often operated manually through switch-button, and with very limited controls that also pose some level of difficulty for the users , the SHT provides convenience, comfort, security, and quality home environment (Balta-Ozkan et al., 2013).It is a new avenue through which the critical role of energy, itsgrowing relationship between consumers and their energy utilities, can be ascertained (van Hoof and Kort, 2009; Wong et al., 2005) and createsflexible opportunities for consumers to interact with technology while a bigger market is exploding for the manufacturers of SHT and marketers alike.

In view of its growing benefits, it has been forecasted that its market will have multiplied threefold by the year 2020 (M2M, 2013; Marketsandmarkets, 2011) while recently, Marketsandmarkets, (2015) further predicted that thismarket will grow exponentially between 2015 and 2020 reaching a value of US$58.68 billion at 17% annual growth. This trend of growth has been noticed as organizations such as Amazon, Samsung Electronics and Google, have started to commercialize smart home services and products since the beginning of 2014 thereby taking the advantage of this enormous emerging market (Yang and Lee, 2017).

Despite the positive benefits of SHT, and its emerging market opportunities, evidence has shown that its rate of adoption among individual users is generally low,especially in developingcountries of Asia such as Malaysia, Singapore, China, South Korea, Thailand and Indonesia (Leeraphong et al., 2015; Yang and Lee, 2017). Even though it has been projected that the revenue growth in these Asian countries will be stable over the coming years, it is obvious that the SHT is not widely accepted when compared with European nations and America. For instance, while it is projected that SHT revenue will reach $9.23 billion by 2020 in Asian countries, market share and revenue growth in America and European nations will be$22.4 billion and $13.81 billion, respectively (RnRMarketResearch.com, 2014). Specifically, the rate of adoption among individual users

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in Malaysia is critically low when compared with some other selected countries of Asia. For instance, recent reports indicate that Malaysians are highly reluctant in adopting SHT and similar internet of things (IoT) and which accounts for abysmal-low generated revenue of $34 million USD against$2071m, $72m, $38m, $37m for China, Indonesia, Philippines and Singapore respectively (Statista, 2017).

Consequently, failing to largely adopt SHT by Malaysians has some negative influence on the policy initiative of the government to ensure that the environment is sustained while Malaysia joins the leagues of developed nations in year, 2020 by becoming one of the top 20 most liveable countries in the world and to achieve a high income nation by increasing the country's Gross National Income (GNI) per capita that will be more than RM48,000 (Yau et al., 2016). A number of factors have been generally identified to be the cause of low rate of adoption of SHT in developing countries such as Malaysia, and especially, among individual users and organizations.

For instance, while some academic scholars from other developing countries identified unavailability of facilitated related technologies and its pending commercialization (Yang and Lee, 2017), a few others argued that lack of awareness, high price, and complexity of the systems restrict the market growth of SHT. Recently, Yang and Lee (2017) extended TPBby arguing that attitude, subjective norms and perceived behavioral control are the major determining factors of users intention toward SHT as Balta-Ozkan et al. (2014) proposed interoperability, reliability, costs, usability and privacy and security as major factors determining the adoption of SHT. Practically, i-Control Networks (2015) opined that simplicity, ease of use and awareness are the factors propelling adoption of SHT as security remains a great impediment. A critical review of these studies indicate that no consensus has been reached among scholars about the specific factors that can be used to predict adoption of SHT especially that largest percentage of previous studies seem to emanate from engineering or technological scholars (e.g., Kuhnel*et al.*, 2011; Li and Yu, 2011; Reinisch*et al.*, 2011). Therefore, more and specific studies that consider the acceptance or behavior of users are very important for the successful growth and rapid diffusion of smart home technology(Yang and Lee, 2017).

Unfortunately however, most acceptance studies on the adoption of SHT have majorly focused on the perception of elderly or senior citizens (e.gAdair et al., 2013; Coughlin et al., 2007; Wong and Leung, 2016) in view of the fact that continuous rises in life expectancy correspondingly increase public pension expenditure and place a significant strain on the available care facilities and resources (Department of Economic and Social Affairs Population Division, 2002; Legislative Council, 2013) while very limited studies have been conducted among other working class citizens. Recent findings indicate that there is a continuous rise in the level of excitement about the smart home with millennials (79%) as overall 50% of the entiresurveyed populationare also willing to adopt this technology (i-Control Networks, 2015).This study answers the clarion call of Yang and Lee (2017) that opined that the general perception studies need to be conducted as such would not only encourage adoption of SHT among the elderly and technology savvy, but by a majority of other consumers (Kolodinsky, Hogarth and Hilger, 2004).

Meanwhile, an overview of previous studies on the adoption of information system generally indicated that populartheories/models have been used. Recently, scholars have usedtheory of reasoned action (TRA) (Fishbein&Ajzen, 1975), Diffusion of information theory (DOI) (Rogers, 1983), technology acceptance models (TAM) (Davis, 1989; Venkatesh&Bala, 2008), theory of planned behaviour (TPB) (Ajzen, 1985, 1991), the social cognitive theory (Bandura, 1997), the perceived credibility model (PC) ,and universal theory of acceptance and use of technology (UTAUT) (Venkatesh*et al.* 2003; Venkatesh et al., 2012). Considering acritical analysis of these models, it has beenshown that the TAM (Davis, 1989) and TPB (Ajzen, 1985, 1991) have been largely used generally and especially in the field of IS marketing and consumer behavior. According to Google Scholar citation, Davis (1989) original TAM has been cited 32,192 times as at 2016 while TPB (Ajzen, 1985, 1991) has also been cited 49,338 times making the two models to be the most used and robust models among others . However, the need to cover deficiencies in the two models has made revised versions and extensions of these models to be advanced. Recently, TAM 3 (Venkatesh&Bala, 2008) has been proposedas the latest models and proved to be robust in predicting adoption behavior (Mitzner et al., 2016) while TPB has equally been extended by various scholars in order to cover the deficiencies in the original models. Despite the extension of these models, experience has shown that they are rarely combined for the purpose of explaining adoption of IS such as SHT. Moreover, there is substantial argument among scholars who positioned that the core constructs of TAM and TPB only may not be enough to explain acceptance of new technology (Gangwaret al. 2015; Kim and Garrison, 2009). This therefore implies that integration of other constructs such as perceived security, trust, mobility and automationthat have been empirically verified by other scholars (e.g., Yang and Lee, 2017) with selected constructs of TAM 3 and TPB will be robust in predicting of SHT adoption, especially in the context of a developing country, like Malaysia.

Up till date, very limitedSHTadoption studies have been conducted in developing countries generally and in particular in Malaysia (e.g.,Gao and Bai, 2014; Yau et al., 2016). Most previous studies were conducted in developed and other emerging countries, while IT adoption researchers have argued that results of studies

from one region may not be directly or necessarily applicable to other regions (Dewanand Kraemer, 2000) as level of technology usage and exposure for developing countries, differedsignificantly from those of developed nations (Tan, et al., 2007). It therefore implies that strong empirical and academic studies that explain the adoption of SHT in Malaysia is serious lacking (Al-Momani et al., 2016) and this research intends to fill this gap. Importantly, this study is quite different from the previous studies as it will be the first of its kind to combine some selected constructs of TAM 3, TPB, UTAUT2 and other constructs in a model to explain the adoption of SHT among young millenials and other active working class in Malaysia.

II. Literature Review and Conceptual Framework

Smart Homes Adoption

Smart homes being one of IoT is assisting a large number of users and householders to have access to new form of services through which their needs, requirements and preferences are met. Through the ability to control all devices and appliances within a home from a single control unit remotely or manually, smart homes might allow consumers to control and manage their energy use more efficiently whilst increasing their comfort and convenience for a variety of household activities. Even though the benefits of SHT have been widely acknowledged, its adoption which refers to the level of usage (Mann andSahni, 2012; Rogers, 2003) among Malaysians is still very low (Yauet al, 2016) compared to other Asian countries such asChina, Philippine, Indonesia and Singapore (i-Control Networks, 2015). While the majority of previous studies conducted both in developed and developing nations concentrated on the adoption of SHT by elderly or senior citizens, studies among young technology savvy and active working class are sparsely available. Aside, results of previous studies have not been consistent especially in the domain of IT/IS marketing and which signifies that much still needs to be done in order to elicit more understanding about factors that can be used to predict adoption effectively. Moreover, research on SHT adoption has largely ignored the potency of the characteristics of SHT. For instance, the effect of utility orientation such as automation, interoperability and mobility has been emphasized by previous studies, (Yang and Lee, 2017), factors relating to intrinsic values such as hedonism, and other technological factors such as computer self-efficacy, computer anxiety, and other marketing concepts of trust, attitude, subjective norm have only been considered by a few authors (e.g Yang and Lee, 2017). Notably too, where these factors are considered, consensus has not been reached as per findings of the previous studies.

Computer Self-efficacy

Self-efficacy originates from social cognitive theory of Bandura, (1986). Individual self-efficacy influences the kind of behavior people exhibit, the quantity of energy they are ready to deploy, and the time they are willing to devote in order to overcome certain challenges (Bandura, 1986). It is the belief that individual holds concerning his/her prowess to execute a given task (Huffman, et al, 2013; Ozturk, et al, 2016). According to Bandura's theory, individuals with high self-efficacy are more likely to view difficult tasks as something to be mastered rather than something to be avoided. Computer self-efficacy which is one of the variables of TAM 3 is therefore defined as ''the degree to which an individual believes that he or she has the ability to perform a specific task/job using the computer'' (VenkateshandBala, 2008). This is in line with the position of Bandura (1982) that defined self-efficacy as the "generative capability in which cognitive, social and behavioral sub-skills must be organized into integrated courses of action to serve innumerable purpose" (Bandura, 1982). While previous studies have established relationship between computer self-efficacy and adoption of IT/IS based services (Adesina and Ayo, 2010; Ozturk et al., 2016); the nature of the relationship is still a subject controversy. For instance, while a number of studies found significant and positive relationship (Alalwan et al, 2016; Sharma et al., 2016), others reported negative relationship (Oztruk et al., 2016). These inconsistences indicate that the research is inconclusive while a contingent variable is required to resolve the conflicts. The following proposition is hereby formulated:

P1: There is a relationship between self-efficacy and adoption of SHT among individuals in Malaysia

Computer Anxiety

Anxiety is regarded as a major determinant of intention to adopt IT/IS based services and is in line with social cognitive theory (Yang and Forney, 2013; Compeau& Higgins 1995). Individual phobia to use ICT is specially based on the state of mind of consumer concerning his/her willingness and capacity to use the technology (Yang and Forney, 2013). Computer anxiety being one of the constructs of TAM3 is defined as the degree of "an individual's apprehension, or even fear, when she/he is faced with the possibility of using computers"(Venkatesh&Bala, 2008, p.279). Given that SH is a contemporary innovation that is facilitated by technology and can be operated on the motion with greater amount automation, the degree of anxiety that may be associated with it may be high than whenusing traditional appliances. This is justified as computer anxiety is conceptualized as those beliefs that can inhibit forming a positive discernment of ease of use of IT technology such as SHT (Venkatesh, 2000). A number of studies have identified lack of security as one of the paramount

factors that can cause anxiety in using IT/IS based services (Celik, 2016; Leung andDickinger, 2017). Recently, Leung and Dickinger (2017) argue that even though online buying and purchasing is now a common phenomenon among travellers in the tourism industry; many of these users still give priority to the 'webrooming' mode where they search for a product online but go to physical store to buy it as a result of the anxiety of online payment security, privacy infringement and other potential risks (Brown, Muchiraand Gottlieb, 2007). A study conducted in Malaysia found that SMEs are anxious to adopt e-commerce because of lack of online security and cyber law to shield their transactions (Lin, Tan, andBaharudin, 2013). Notably, while a number of studies found significant and negative relationship between anxiety and SHT and other IT/IS based services (Celik, 2016; GuptaandArora, 2017), some other studies reported contrary findings (Yang & Forney, 2013). Besides, scholars have not reached agreement on the role of anxiety. While some few scholars use it as exogenous variable (e.gCelik, 2016), others use it as a contingent construct. These controversies require further investigation. The following proposition is hereby formulated:

P2: There is a negative relationship between Computer Anxiety and adoption of SHT among individuals in Malaysia

Attitude

One of the major constructs of TBP is attitude towards behavior (Ajzen, 1985). It shows that an individual's beliefs that his behavior will result to certain outcomes as such outcomes could be favorable or otherwise based on personal evaluation (Aboelmaged and Gebba, 2013). In line with Au and Enderwick (2000) attitude towards adoption is regarded as the cognitive process which depicts the prospective adopters' positive or negative affection about accepting a foreign technology such as smart homes (Yang and Lee, 2017). However, the more positive the attitude, the stronger the behavioral intention and which may lead to corresponding or desired behavior (Aboelmaged and Gebba, 2013) as a number ofscholars have concluded thatadoption of new technology behaviour is a complex phenomenon that requires distinct models in different contexts (Shen et al. 2010). Applying this in the context of SHT, adoption of new technology depends on users' attitudes towards mobile services (Sohail andAl-Jabir, 2014). This has been confirmed by a number of past studies that found positive relationship between attitude and intention to adopt new technology (Ho Cheong and Park 2005; Hsiao, 2013). However, some other studies found insignificant relationship between attitude and adoption intention (). In this regard, a number of external variables have been identified as major determinants of attitude towards adoption of smart homes and other related IT/IS based services. The following proposition is hereby formulated:

P3: There is a positive relationship between attitude and adoption of SHT among individuals in Malaysia

Subjective Norm

Subjective norm which is one of the constructs of TPB (Ajzen, 1985) refers to the degree to which an individual thinks that referent group influences his/her decision. Such influence which is felt on the belief, attitude and behaviors of the individual, comprises of three major processes of conformance, identification and internalization (Kelman, 1958; Wang, Meister, and Gray, 2013). An individual conforms to the opinion of others based on the objective that either a reward will be earned or punishment will be avoided. Identification shows the degree to which an individual conceives himself/ herself as being defined by the referent's group characteristics while internalization shows to what extent he/she incorporates and assimilates peoples' opinion into their own beliefs (Dholakia, Bagozzi, and Pearo, 2004; Zhou and Li, 2014). This therefore shows that the decision to use or keep using SH depends on the power of influence of others. This is important especially where such system is still deemed to be new to some segment of the society while limited information is directly available from the provider of such system (Yang, et al., 2017). Subjective norm has been found to significantly and positively influence adoption in various studies. However, a number of other studies found no relationship with adoption (e.g Pham et al, 2013). These inconsistencies require further investigation (Ndubisi and Sinti, 2006). The following proposition is hereby formulated.

P4: There is a positive relationship between mobility and adoption of SHT among in individual in Malaysia.

Perceived Behavioral Control (PBC)

PBC is a new construct that determines behavioral intention (Yang et al., 2017). The PBC was introduced for the purpose of removing the limitation that is associated with the TRA by embedding behavior over which people are lacking volitional control (Ajzen, 1991). PBC reflects the perception of an individual with regards to the difficulty or ease that is associated with the execution of a particular behavior (Al-Smadi, 2012). And in the field of IT adoption, it was defined as the internal and external inhibitions that a person may confront while executing certain activities such as SHT (Yang et al., 2017) A number of past studies have recently established PBC-intention relationship (Deng et al., 2014; Lu et al, 2014; Wunderlich et al., 2012; Taylor and Todd, 1995). Deng *et al.* (2014), and Lu *et al.* (2014) showed that PBC positively influenced the

intention to use mobile data services. Wunderlich*etal.* (2012) suggested that the higher the PBC, the higher the continuing usage of smart meters. However, a number of studies found non- significant and positive relationship (e.g Al-Smadi, 2012) suggesting a further research in this regard. The following proposition is presented.

P5: There is a positive relationship between perceived behavioral control and adoption of SHT among in individual in Malaysia

Perceived Security

Perceived security is one of the factors that determines either positive or negative attitude of users towards IT adoption. Evidence has shown that consumers are averse to accepting or to using technology without first establishing that the issue of security and privacy is well addressed (Susanto et al., 2012; Zhou, 2011).Kalakota and Whinston (1997) in this regard defined security risk as a "circumstance, condition, or event with the potential to cause economic hardship to data or network resources in the form of destruction, disclosure, modification of data, denial of service, and/or fraud, waste, and abuse." Since smart home systems is configured to collect data about the lifestyles of its residents with respectto energy usage, movement, and purchase preferences for the purpose of supporting them effectively, the residents may be wary about the safety of their personal data (Balta-Ozkan*et al.*, 2014; Yang and Lee, 2017). In this study, therefore, security/privacy risk refers to smart home service users'fear that their personal data would be compromised or that their SHT systems would be hacked by criminals. Previous studies found that security/privacy risk negatively influenced attitudes toward the use IT/IS such as online banking and smart meter adoption (Chou and Yutami, 2014; Herrero, Urueña, Torres, and Hidalgo, 2017). The following proposition is hereby formulated:

P6: There is a positive relationship between Perceived Security and Attitude to adopt SHT among individuals in Malaysia

Automation

Automationis a rarely used concept among IT/IS marketing scholars (e.g. Yang and Lee, 2017)as its acclaimed benefits have been widely acknowledged in aviation, manufacturing, medicine and shipping (Parasuraman and Rilley, 1997). According to Parasurama and Rilley, (1997 p. 231), automation is the "execution by a machine agent (usually a computer) of a function that was previously carried out by a human".Importantly, it extends the cognitive and physical capacity of human to accomplish what might not be possible ordinarily especially when its configuration considers the features of the joint cognitive system that surface from the combination of humans and automation (Lee, 2008).This study defines automation as smart home service execution without human intervention (Yang and Lee, 2017). Recently, automation has gained wider acceptance especially in smart homes adoption as a result of its improved simplicity and affordability via wider connectivity and full integration of homes appliances and computer devices (Luor*et al.*, 2015; Noh and Kim 2010; Yang and Lee, 2017). In line with this, it has been opined that artificial-intelligence could makesmart homes to function effectivelyby assisting the residents of such homes to achieve their long-standing dream or objective of safety, convenience lower cost and so on while using their appliances (Augusto and Nugent, 2006; Yang, 2017). Luor*et al.* (2015) established the relationship between the automation of smart home and residents' attitudes to it. The following proposition is hereby formulated:

P7: There is a positive relationship between automation and attitude to adopt SHT among individuals in Malaysia

Mobility

Mobility is regarded as the ability of users to access mobile gadgets such as smartphones, mobile phones and laptops while on the go (Choi *et al.*, 2014; Lyytinen and Yoo, 2002; Yang and Lee, 2017). In line with Park and Joon (2013), mobility in a mobile communication environment is the capacity to have ubiquitous access to mobile services through wireless networks. Since the mobility has become imperative due to the function it performs, especially in the use of internet, transmission of data, and execution of mobile applications (Yang and Lee, 2017), a number of studies have examined its impact in different platforms. Huang and Lin (2007) for instance, revealed that perception of mobility is a significant determinant of perceived usefulness in adopting mobile-learning services.Gunawardana and Ekanayaka (2009) reported a positive relationship between perceived mobility of mobile learning (m-learning) and attitudes of users while Choi et al. (2014) examined the relationship between mobility and consumers' attitudes toward mobile recommendation systems and verified that mobility was positively associated with attitude. Furthermore, Park and Joon Kim (2013) established the mobility of long-term evolution (LTE) services as a significant determinant of perceived usefulness and system/service quality.Moreover, mobile devices seem to be an important interactive user interface for smart home systems, with an increasing number of sensors and multi-touch screens (Kuhnel*et al.*, 2011). Koskela and Vaananen-Vainio-Mattila (2004) argued that users preferred a remote control for instant control in a smart home over lamps, curtains, and information appliances. Roduner*et al.* (2007) suggested that user interfaces on a

mobile device were an optimal solution for operating a range of home appliances. The following proposition is formulated.

P8: There is a positive relationship between mobility and attitude to adopt smarthome services.

Trust

Trust is an important concept of marketing that is regarded as a catalyst for seller–buyer relationships as it assists in reducing vulnerability or uncertainty (Morgan and Hunt, 1994). Viewing from economic perspective, it is regarded as a concept that diminishes cost of transaction in an exchange (Balaji and Khong, 2015) while it decreases the perception of risk and facilitates smooth marketing relationship (Chiou and Shen, 2012). Due to the higher level of uncertainty that is common in the online environment, trust is majorly considered as more significant in online than brick and mortal platforms (Chen and Barnes, 2007). Moreover, customers may experience risk from technological infrastructure, such as SH and from actors involved in the general online platform (Grabner-Kräuter and Faullant, 2008). Importantly, in the IS/IT field, trust has been identified as an important concept that influences consumer behavior. For instance, Gefen (2000) argued that trust was highly instrumental in the acceptance of online technology. Keen *et al.* (1999)opined that trust has a strategic implication in the consumer–marketer e-commerce relationships. Recently, Hsu *et al.* (2014) reported that trust positively influences perceived quality and satisfaction in online group-buying transactions. Researchers have also integrated trust with the TPB, finding that trust was an important antecedent of subjective norm, and PBC in online services (Lee, 2009; Wu and Chen, 2005; Yang et al., 2017). The following proposition is hereby formulated:

P9a: There is a positive relationship between trust and subjective norm among individual in Malaysia

P9b: There is a positive relationship between trust and perceived behavioral control among individual in Malaysia

Hedonic Motivation

Hedonic motivation is an intrinsic rather than extrinsic factor that makes user of information system to be cognitively attached to the platform. In the last three decades, the core constructs of TAM (perceived usefulness and perceived ease of use) have been applied by many studies. However, arguments from recent scholars opined that even though these constructs are in the domain of cognition, they emphasize utility (Salimon et al., 2017) while intrinsic factors such as hedonic motivation has been largely ignored (Lowry et al, 2012; Ndubisi and Sinti, 2006). Hedonic motivation is defined by Venkatesh et al, (2012, pp.161) as ''the fun or pleasure derived from using a technology''. This definition has been supported by a number of scholars who regarded hedonic motivation (otherwise known as entertainment value, fun, and enjoyment) as the performance of certain transaction without any form of benefit other than the process of performing it (Moon and Kim, 2001). Even though a number of studies across several fields have recognized the role of hedonic motivation as a predictor variable or mediating variable (e.g., Bruner and Kumar, 2005; ChtourouandSouiden, 2010; Kulviwat et al., 2007; Pagani, 2004); its moderating influence especially in SHadoption is hardly come by. Thus, using this intrinsic factor will help in reducing the inherent weaknesses of TAM and TPB which has led to involuntary bias in adoption literature toward cognitive beliefs (Bagozzi, 2007).The following propositions are formulated.

P10a: Hedonic motivation moderates relationship between self-efficacy and adoption of SHT among individual in Malaysia

P10b: Hedonic motivation moderates the relationship between computer anxiety and adoption of SHT among individual in Malaysia

P10c: Hedonic motivation moderates the relationship between attitude and adoption of SHT among individual in Malaysia

P10d: Hedonic motivation moderates the relationship between subjective norm and adoption of SHT among individual in Malaysia

P10e: Hedonic motivation moderates the relationship between perceived behavioral control and adoption of SHT among individual in Malaysia

Based on the problem statement, literature review and hypotheses development, the proposed conceptual framework (fig. 1) of the study is presented below:
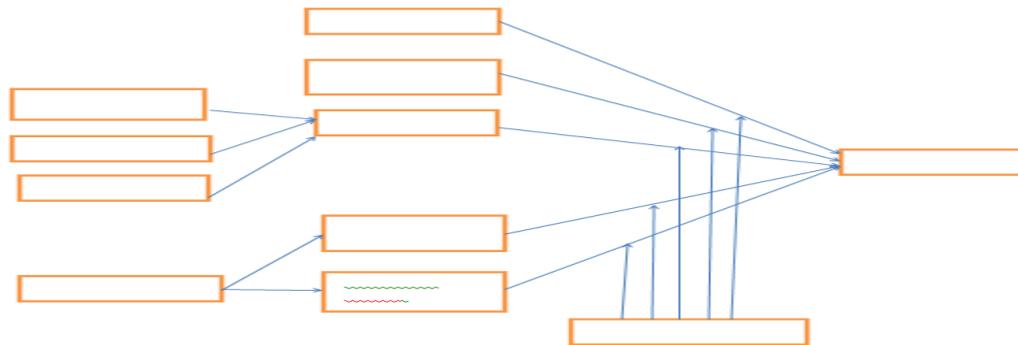
Figure 1: Proposed conceptual framework

III. Methodology

This study will use Smart PLS-SEM 3 for the data analysis and to empirical examine SH adoption in Malaysia. The PLS-SEM is designed to predict variance in DV and has the objective of testing the relationship among the exogenous, endogenous and moderating variable of the study.

As part of the methodology, the study would also conduct important performance analysis (IPMA) which most previous studies do not consider at the detriment of both academic scholars and practitioners. In totality, this research will be conducted using quantitative design by following a survey and by adapting or modifying existing items that have been validated by the previous studies.

Data Collection/Analysis

The unit of analysis of the study is individual and which indicates that data will be collected from young and active working individual against aged and senior citizens that most of the previous studies used and this will be in line with the approach of Yang and Lee, (2017). The nature of the study would be cross sectional and which implies that the researchers would collect data once using questionnaire survey (Sekaran, 2006). As initially stated, PLS-SEM will be used to analyse data for the purpose of testing the propositions and achieving research objectives as most past studies majorly used qualitative approach while their result cannot be generalized.

Impact on Society, Economy and Nations

Based on the academic research and industrial evidence, it seems obvious that the rate of adoption of SHT in Malaysia is very low and signifies that the environment may not be sustained and this goes against the policy and yearning of government. From marketing perspective, this reinforces the need for the service provider to come up with marketing strategies that will enable them to reach out to millions of customers who have inertia for the adoption of SHT. The result of this study will therefore help these companies to reenergize in order build and competitive advantage through which they will be able to compete favorably both at the local and global scenes.

Moreover, since Malaysia is planning to become high-income nation by 2020, and one of the best smart countries (cities) in the world through which foreign direct investors can be attracted, this study will enable individual to buy into such a big vision. For instance, the Malaysian government has outlined the Greater Kuala Lumpur (KL) area as one of twelve National Key Economic Areas of the Economic Transformation Program (ETP) with the objective of transforming the capital through the use of technology. Based on the likely results of this study, the country will be realizing its objectives, with meaningful impacts on the Malaysian economy.

IV. Contributions and Conclusions

The novelty of this study lies in its implications and contributions to the body of knowledge, industrial practices and policy making. Academically, this study due to the weaknesses in TAM and TPB has extended the two theories by considering other rear IT and marketing variables that could enhance the predictive power of these models. It therefore implies that this study is one of the pioneer IT marketing studies that would develop holistic framework that can be used to predict adoption of SHT in Malaysia and developing countries generally (Yang, 2017). Since SH is its early year of diffusion especially in developing countries, a study of this nature differs from others that are either technical/engineering (Perumal*et al.*, 2008; Wu *et al.*, 2007), concentrated on a specific device such as meter and energy management (Balta-Ozkan*et al.*, 2014; Chou and Yutami, 2014) or are qualitative nature (Chan *et al.*, 2009; Ehrenhard*et al.*, 2014). Even though many of the previous studies have used TPB to predict adoption of IT/IS adoption, the study that extend TAM and TPB to predict SHT adoption is

very rare or seems not to exit. This study in particular will be using hedonic motivation as a moderator since most studies in developing countries have ignored this concept. Aside, the use of rear variables such as mobility, and automation are major extension and making important contribution especially in the adoption of smart home and will be an important contribution to the new theory development. Notably too, most previous studies on SH/IT adoption are being conducted in western countries and newly industrialized nations, in this regard, the study will be filling a knowledge gap since Malaysia requires its own unique study due to its peculiarity of a developing region. This is very sacrosanct and in line with the argument of Poong, Yamaguchi and Takada (2016), who assert that different nations yield different outcomes with respect to information system strategies since the strategies deployed in developed nations may not be directly applied to regions. Therefore, this research would assist in elicit understanding about SH and its strategic value among individuals, and academics in developing countries generally, particularly in Malaysia.

Identification of those factors that can be used to effectively predict the adoption of SHT would be a great contribution and would assist SHT service provider greatly. Such factors would help the service providers to improve performance since the companies will be able to expand their scope, increase customer base, and augment their revenue per a customer. This can be achieved as the increase the adoption of SHT would cut across and not among senior citizens and elderly only. Asides, it will also assist the SHT providers and marketers to know factors to leverage on in order to increase the rate of adoption as they would be able to focus on developing mobility-related services that enable people to access SH services while on the move using mobile devices based on control and monitoring functions. Further, the study would practically assist service providers to cooperate with mobile application companies, operating system developers, and mobile device manufactures in order to develop novel and desirable applications or to enhance the ease of customer contact through preloaded applications. Furthermore, the conceptual framework would shed appropriate light that will practically assist Malaysians to embrace SHT as experience has shown that the phobia for technology adoption is quite common even though technology is almost a common house commodity especially in the developed world.

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