Journal of Theoretical and Applied Information Technology
15th June 2023. Vol.101. No 11

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

PROPOSE A MODEL OF CONTINUANCE INTENTION TO USE IOT SMART HOME IN MALAYSIA

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ABSTRACT

The Internet of Things technology for smart home (IoTsh) are homes equipped with communication networks, systems, and sensors that can be used for controlling, monitoring, and scheduling enabling hardware IP devices according to user needs. The use of IoTsh can improve self-management, improve social care systems, and provide a better lifestyle. Although there are many IoTsh advantages, existing studies only focus on IoTsh acceptance and adoption. Nevertheless, studies regarding the intention to continually use IoTsh remain scarce, which calls for further investigation. To address this gap, this study proposes an integrated model for the purpose of understanding the intention of continuous usage of IoTsh among Malaysian users, as well as for investigating factors that impact or prevent the continuance intention of using IoTsh. The model combines three information system theories as the underlying theories, namely the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2), Expectation-Confirmation Model (ECM), and Hofstede's theory. The proposed model provides important insights for IoTsh providers, manufacturers and governments on continuance intention to use IoTsh, understanding the users' desires and subsequently designing their services.

Keywords: *Continuance Intention, ECM, Hofstede, Iot Smart Home, UTAUT2*

1. INTRODUCTION

A network comprising home appliances, vehicles, physical devices, and other objects equipped with network connectivity, sensors, software, and electronics is the Internet of Things (IoT). Data collection and exchange are enabled through these objects. IoT operates by integrating multiple components, such as sensors, microcontrollers, communication modules, and cloud platforms, to create a connected system. Sensors collect data and transmit it to the microcontroller, which processes the data and sends it to the cloud for storage and analysis. From there, the data can be accessed and acted upon by users and applications through a network-connected device, such as a smartphone or computer. According to [1], the increasing number of IoT active devices connected worldwide is predicted to reach 30.9 billion in 2025. The potential applications of IoT are vast, ranging from smart home and health care to agriculture, transportation, and manufacturing. The growth of IoT has been driven by advances in technology, such as the miniaturization of sensors and the widespread availability of low-cost wireless connectivity, making it possible to embed sensors and connectivity into a wide range of devices. IoT is a constantly evolving field, and nowadays, the integration of artificial intelligence (AI) with more IoT devices provides the intelligence and decision-making capabilities that allow these devices to perform complex tasks and respond to changing environments, thus expanding the potential for connected devices to transform and improve our lives.

Smart home is an important domain in IoT applications [2]. Nikou [3], defined the Internet of Things technology for smart home (IoTsh) as household-useable digital devices. In other words, IoTsh is a network where digital data delivery, storage, and retrieval between the virtual and physical worlds in real time can be achieved through the combination of analytics, computing, communication, and sensing. Moreover, IoTsh also enables adaptability and interactivity between IoTsh devices. Furthermore, it also offers multifunctionality, real-time service, and the capacity to deliver alerts and notifications. The worldwide annual growth rate (CAGR) for the IoTsh

market is forecast to increase at a rate of 12.47% from 2022 to 2027, and in 2027 is expected to generate a market value of USD222.9 billion and 672.6 million active IoTsh users [4]. This demonstrates that the market for smart home has bright future prospects [6-8]. As a result, more major ICT companies, including Amazon, Google, Apple, Siemens, Philips, LG, Bosch, and Samsung, are racing to develop IoTsh devices. Aside from established ICT companies that produce IoTsh devices, there are also startup companies that make IoTsh devices. Canary is a New York-based startup that specializes in home security and currently ranks first among IoT-based home automation companies.

The COVID-19 pandemic that occurred in 2020 contributed to the rise in IoTsh usage. This is because individuals spend more time at home due to lockdown restrictions and utilize IoTsh to work or study remotely. Home automation using IoT devices that have been programmed to satisfy the requirements of individual users is amongst the applications of IoTsh. Controlling, monitoring, and scheduling lighting, temperature, pet and plant care, and other IoTsh equipment in the home via mobile applications, remote controls, or voice are some of the advantages of home automation. Home automation can provide convenient controls [9], improve quality of life, and increase user satisfaction [10]. Currently, the total energy consumption used by the residential sector globally is 20% and will increase to 60% by 2040 due to population growth, improved living standards, and economic development [11]. Therefore, the use of IoTsh devices for energy management can solve problems related to energy efficiency. These devices can help users to determine the electricity consumption at home, provide the ability to schedule IoTsh devices, and reduce energy bills. Additionally, IoTsh is used for Ambient Assistant Living (AAL). The use of IoTsh to help aging people, which is an AAL service, is necessary due to the expected increase in people aged 60 and above by 2050 that will contribute to the population of 2.1 billion [12]. Therefore, IoTsh is needed for elderly people to achieve independent living and a safe environment [5].

To date, prior IoTsh studies only focus on acceptance [3],[10], [14-22], adoption [23-27], and resistance [28-29]. Although these studies explain why users accept, use, or reject IoTsh, they do not provide a clear picture of user perceptions after using IoTsh. The acceptance and adoption of IoTsh are important, however the implementation of IoTsh may become unsuccessful due to the reluctance of users to continue their usage of IoTsh. Therefore, in order to ensure IoTsh's success, it is crucial to make sure that the current users continue using IoTsh. According to Bhattacherjee [30], the intention of continuous usage of IoTsh is dependent on the time and direct experience of using IoTsh. For this reason, there may be differences in perception among users, which will influence the decision to continue using or stop using IoTsh. Relatively few studies have examined the continuance intention of IoTsh among end users [31]. Hence, post-adoption studies are important to ensure the sustainability of the IoTsh industry in developing countries, particularly in Malaysia.

The empirical studies using UTAUT 2 for explaining the continuance intention of using information system (IS) technologies [32] is lacking, where there are no previous studies in the IoTsh context. Additionally, IoTsh faces challenges such as security and privacy concerns [33-34]. Data containing sensitive information may be collected by IoTsh devices, such as health conditions and financial status [35]. IoTsh also brings risks such as psychological issues [29], performance [25],[29],[36], and time [25] issues. However, the prior studies on IoTsh privacy concern and perceived risk are only concerning the acceptance and adoption of IoTsh and involves potential users but not real users. Thus, it is critical that these studies consider privacy and security concerns as well as IoTsh risk after the user has experienced using IoTsh. This is because the greater the security and privacy concern and risk perception of IoTsh, the lower the intention of continuous usage of IoTsh among the users. At the same time, there are differences between one country and another [37]. Therefore, the prior post-adoption model is not suited for use in Malaysia due to the differences in culture, economics, government policy, people, and other aspects. Recognizing the significance of this situation, this study explores the differences in the continuance intention of using IoTsh between actual users with low uncertainty avoidance and high uncertainty avoidance.

This studies' main purpose is to investigate factors contributing to the continuance intention of using IoTsh. There are six sections in this paper. After Introduction, Section 2.1 investigates the initiatives carried out by Malaysia to promote the adoption of IoTsh, the current adoption of IoTsh in Malaysia, and the impact of the use of IoTsh on Malaysia's policy. Meanwhile, a brief overview of UTAUT2, ECM, and Hofstede's theory is included in Section 2. The model developed based on the integration of the prior IoTsh adoption factors, Expectation-Confirmation Model (ECM), new additional factors, and uncertainty avoidance, which is one of the factors in the Hofstede theory that acts

as a moderator, is presented in Section 3. Section 4 describes in detail the hypotheses for this study. Discussion, limitations, and future work are presented in Section 5. Finally, Section 6 concludes the paper.

2. LITERATURE REVIEW

2.1 Malaysia's progress in IoT smart home

Malaysia is located in South East Asia and is considered a developing country. The estimated population in Malaysia was 32.6 million in 2021, which increased to 32.7 million in 2022 [38]. The population according to age in 2022 can be divided into three groups, namely 0-14 years with a population of 7.6 million (23.2%), 15-64 years with a population of 22.7 million (69.55%), and Malaysian citizens aged 65 and above with a population of 2.4 mil-lion (7.3%) and a median age of 30.4 years. Malaysia has experienced rapid urbanization, with 24.4 million (75.1%) Malaysians living in cities compared to only 8.1 million (24.9%) living in rural areas [39]. The IoTsh market for Malaysia is predicted to grow at a CAGR of 15.11 percent between 2022 and 2027, with a market value of $581.7 million in 2027 and 2.3 million active IoTsh users by 2027 [13]. IoTsh equipped with various IoT-enabled devices can automate various household systems such as lighting, heating, and cooling. Additionally, the adoption of IoTsh can improve living conditions, improve the quality of life, enhance sustainability through the reduction of the carbon footprint of households, and promote responsible energy consumption through systems that monitor and regulate energy usage. Thus, realizing the advantages of IoTsh, Malaysia has made significant progress in encouraging the adoption of future technology in the domestic environment.

The government has been actively promoting the adoption of IoTsh in the country, with initiatives such as the five-year plan (2019-2023) with the aim to increase high-speed internet access using fiber optic connectivity in Malaysia that is known as the National Fiberization and Connectivity Plan (NFCP) [40]. It will be easy for users to connect and manage their smart home devices remotely with high-speed internet. The use of fiber optic connectivity also known as fiber internet is more reliable and faster than traditional copper-based internet connections. Hence, it allows for more efficient communication between devices, which can improve the performance of IoTsh systems. Additionally, in Malaysia, there are also other initiatives carried out by government agencies such as the Malaysian Communications and Multimedia Commission (MCMC) to promote IoTsh. MCMC has the responsibility for developing regulations and standards for IoTsh, encouraging the development of new and innovative IoTsh technologies, providing educational resources to users and industry stakeholders, and working with industry partners such as manufacturers, service providers, and research institutions for promoting IoTsh development and growth in Malaysia [41]. MCMC encourages competition among service providers to provide the best price for IoTsh services, which in turn will make them more affordable for users and encourage more Malaysians to adopt and subsequently have the continuance intention to use IoTsh.

Recent statistics revealed that the percentage of individual internet users in Malaysia for 2021 was 96.8%, up from 89.6% in 2020 and 98.7% of individuals in Malaysia used mobile phones in 2021 compared to 98.2% in 2020 [42]. These statistics show that Malaysian users have a readiness to adopt and a subsequent continuance intention to use IoTsh devices. This is because for users to use IoTsh services, IoT devices need to be connected to the internet for the controlling, monitoring, and scheduling process using mobile phones. Although the Malaysia government has implemented initiatives and programs under government agencies and Malaysian has a high readiness with regard to mobile phone and internet usage, the IoTsh penetration in Malaysia is still low. Malaysia's IoTsh penetration in 2027 is expected to hit only 26.0% compared to those of other developing countries, which are 41.8% (Romania), 41.7% (Argentina), and 34.0% (China) [4, 13]. The slow adoption rate in Malaysia becomes the motivation that drives studies in exploring the success factors [43-45] and IoTsh adoption barriers [46] to ensure that the adoption of IoTsh in this country can be improved.

However, the study of IoTsh adoption in Malaysia only contributes to the present phenomenon. Therefore, an investigation of the continuance intention to use IoTsh services among actual Malaysian users is urgently needed to identify drivers and hindrances to the sustainability of IoTsh. This is because consistent usage of IoTsh among individuals has an impact on the Malaysian government policy. First, the National Energy Policy 2022-2040, particularly the Low Carbon Nation Aspiration 2040, assures environmental sustainability through the implementation of household energy efficiency [47]. Second, the National Fourth Industrial Revolution (4IR) Policy aims to increase healthy life expectancy from 67 years in 2019 to 72 years by 2030 for a better quality of life index by

using IoTsh [48]. Third, smart living that including IoTsh usage is one of the key pillars of Malaysia's smart cities [49] with the targets to improve urban safety and fulfill the Shared Prosperity Vision 2030 to create the sustainable cities [50].

2.2 IS adoption theories

2.2.1 Unified theory of acceptance and use of technology 2 (UTAUT2)

Figure 1 shows UTAUT2 which is an extended version of UTAUT and it was developed by [51] in 2012. UTAUT2 focuses on technology acceptance among individuals, while UTAUT focuses on technology acceptance among organizations. The UTAUT2 model was used to investigate the acceptance of mobile internet among individuals in Hong Kong, and it is a combination of numerous theories, including the Motivational Model, Diffusion of Innovation (DOI) Theory, Theory of Reasoned Action (TRA), Social Cognitive Theory (SCT), Theory of Planned Behavior (TPB), Technology Acceptance Model (TAM), model of personal computer use, and a combination of TPB and TAM. UTAUT2 consists of seven independent variables that affect use behavior and behavioral intention namely price value, habit, hedonic motivation, facilitating conditions, performance expectancy, social influence, and effort expectancy. Age, experience, and gender serve as moderators in UTAUT2. Unlike the previous UTAUT model, the voluntariness of use is not a moderator in UTAUT2. Venkatesh et al. [51] highlight that the use of various variables extends the unification of theory and increases the variance of the model. This is statistically proven, with an increase of 18% in the behavioral intention variance from UTAUT's 56% to UTAUT2's 74%. There is also a 12% increase in the variance of use behavior (actual use), which rises from 40% to 52% when using UTAUT2. The advantages of UTAUT2 are this model is holistic and focuses on the acceptance of technology among users [16],[52].

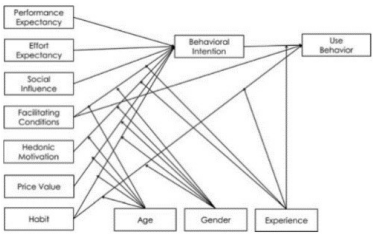

Figure 1: UTAUT 2 model

2.2.2 Expectation-Confirmation Model (ECM)

The ECM is shown in Figure 2 and it was developed by [30] to measure user satisfaction based on the usefulness and validation of the innovation, which leads to the continuous use intention of the IS innovation. ECM, also known as the post-adoption model, is used to assess improvements in the areas of productivity, experience that meets expectations, enjoyment in using the technology, and intention to continue using the IS innovation in the future. This is due to the fact that user perceptions may change over time as a result of design modifications and the addition of new features. In IS, ECM is often used to study long-term technology success and post-adoption issues [32], [68-76].

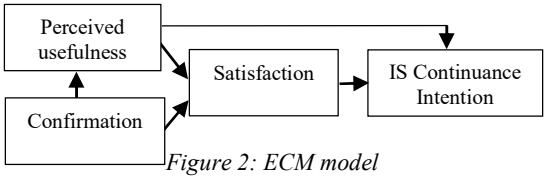

Figure 2: ECM model

2.2.3 Hofstede's Cultural Dimension

Individualism versus collectivism, power distance, masculinity versus femininity, and uncertainty avoidance are the four cultural dimensions identified by Hofstede [37]. The fifth dimension, which is specific to Asian countries and influenced by Confucian philosophy, is short-term versus long-term orientation [56] and it was introduced due to the result of the first four dimensions being focused on European countries. Hofstede's Cultural Dimensions, as shown in Figure 3, are used to understand cultural characteristics and their impact on the adoption [57], [62] and continuance intention [58],[61] of using IS innovation. Although Hofstede's dimensions are often used for cross-country studies [59-60], it is also suitable for the study of individual continuance intentions [61]. This is due to the fact that each country usually consists of people with different cultural backgrounds [62]. Therefore, to understand the continuance intention of using IS innovations, one must first understand the individual behavior as there are differences in the way of feeling, thinking, and acting between one individual and another.

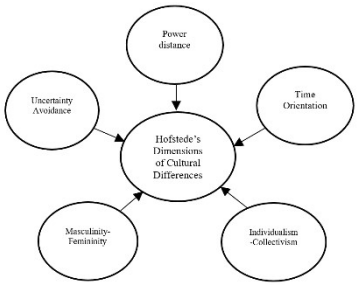

Figure 3: Hofstede model

3. METHODOLOGY

This study aims to integrate theoretical and empirical findings based on past studies related to IS for the sustainability of IoTsh. The three research questions upon which this study is based are as follows:

RQ1: What are the key factors that can result in the continuance intention of IoTsh users?
RQ2: What is the driving moderator behind the continuance intention of IoTsh users?
RQ3: What is the suggested model for the continuance intention of users using IoTsh?

After defining the theoretical basis for the study, the role of the factors that affect the continuance intention of IoTsh is determined, focusing on a list of key factors from previous IoTsh adoption studies as shown in Table 1. The perceived ease of use and usefulness from TAM [55] are the two most frequently used factors in previous IoTsh studies [3], [5],[10], [18], [22], [25], [53]. However, in this study, effort expectancy, which has a similar meaning to perceived ease of use, is used. Factors from previous IoTsh adoption studies are selected to assess the role of preliminary adoption in influencing the continuance intention of using IoTsh, including the factors from UTAUT2, namely habit, price value, facilitating conditions, and effort expectancy [16]. Additionally, previous studies highlighted trust [10], [18], [22],[26], [52], [54] and the challenges faced by IoTsh, such as perceived risk [18], [25-26] and privacy concerns [15], [22], [27]. However, all these factors were only tested for acceptance and adoption of IoTsh, while involving potential users but not actual users. In addition, previous studies focused on privacy concerns and ignored the security concerns of IoTsh. Therefore, it is imperative for the current study to consider all these factors after the users have experienced using IoTsh and examine both privacy and security concerns together.

The next process is to combine ECM factors that were neglected by previous studies with factors from previous IoTsh studies. Post-adoption of IoTsh which is examined using ECM, is the intention of individual to continue using IoTsh and consists of performance expectancy, confirmation, and satisfaction. In the study's next stage, two additional factors that have not been considered by existing studies on IoTsh, namely characteristics of IoT and electronic word of mouth influence, are incorporated with factors from previous IoTsh studies and ECM. The results of the combination of factors are depicted in Figure 4.

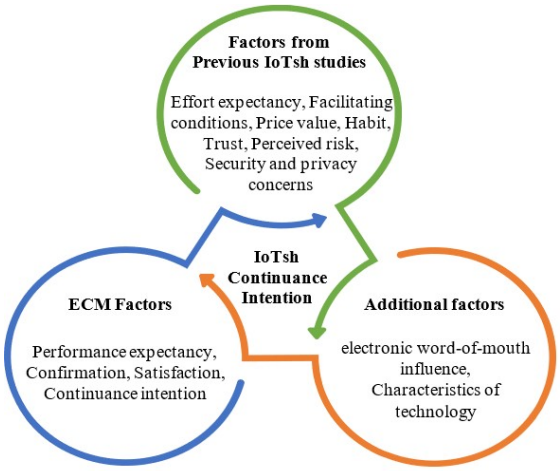

Figure 4: The proposed factor for the continuance intention of using IoTsh

Table 1: List of factors from previous investigations of IoTsh adoption

References	Perceive Usefulness	Perceive ease of use	Performance Expectancy	Effort Expectancy	Facilitating conditions	Price value	Habit	Trust	Perceived Risk	Privacy Concerns
[3]	√	√	-	-	-	-	-	-	-	-
[5]	√	√	-	-	-	-	-	-	-	-
[10]	√	√	-	-	-	-	-	√	-	-
[14]	-	-	√	√	√	-	-	-	-	-
[15]	√	-	-	-	-	-	-	-	-	√
[16]	-	-	√	√	√	√	√	-	-	-
[18]	√	√	-	-	-	-	-	√	√	-
[22]	√	√	-	-	-	-	-	√	-	√
[25]	√	√	-	-	-	-	-	-	√	-
[26]	-	-	-	-	-	-	-	√	√	-
[27]	-	-	√	√	-	-	-	-	-	√
[52]	-	-	√	√	√	√	-	√	-	-
[53]	√	√	-	-	-	-	-	-	-	-
[54]	-	-	√	√	√	-	-	√	-	-
Current study	-	-	-	√	√	√	√	√	√	√

Studies on IS focus heavily on the cultural values in technology adoption [57],[62-63]. However, Hofstede's theory is less used for studying

the continuance intention of using the IS technology [58],[61] and prior studies overlooked the moderation role of individual-level cultural dimension on the continuance intention of using IoTsh. To overcome this gap, this study employs one of Hofstede's theoretical factors [37], namely uncertainty avoidance, as the moderator for explaining how the differences between high and low uncertainty avoidance of IoTsh users will affect IoTsh continuance intention's relationship with effort expectancy, electronic word of mouth influence, and the characteristics of IoT.

In the following stage of the study, a literature review is done to show the generalization of proposed factors for continuance intention across various IS technologies. Table 2 reveals that no empirical studies have ever combined the proposed factors from these studies into a single model. As these factors have not been previously addressed, the present literature gap will be filled. Therefore, the integrated model made up of the combination of factors is developed, as seen in Figure 5.

4. RESEARCH HYPOTHESES

4.1 Performance expectancy

The extent to which users expect benefit when using IoTsh is referred as performance expectancy [51]. In prior studies, performance expectancy had been tested and confirmed as a factor of the users' long-term technology usage intentions in various IS domains [32], [65], [73]. The definition of performance expectancy in this study is IoTsh's usefulness in daily life by helping users to complete tasks at home quickly and thus increasing user productivity. According to existing studies [16], [54], the most important factor with regard to users' IoTsh adoption is performance expectancy. Tam et al. [32] discovered that performance expectancy positively impacted the satisfaction and continuous usage of IS innovation. In addition, when users believe that using IoTsh can improve the efficiency of performing tasks at home, their continuance intention to use IoTsh increases. The proposed hypotheses as a result of the preceding discussion are:

H1a: Performance Expectancy has a positive impact on the satisfaction of IoTsh's user

H1b: Performance Expectancy has a positive effect on continuance intention to use IoTsh

4.2 Effort expectancy

Effort expectancy is defined as the extent to which users think ease is associated with using IoTsh without complexity [51]. It is equivalent to TAM's perceived ease of use [55]. In this study, its definition is referring to it should be easy for users to learn IoTsh with clear and understandable IoTsh operations and easy for users to become proficient in using IoTsh devices and services. Prior studies indicated that the intention of using IoTsh was not significantly impacted by effort expectancy [16]. Nevertheless, there was also research that found that effort expectancy impacted the behavioral intention of using IS technologies for mobile banking [75] and mHealth [74]. Prior studies also showed that the continuance intention of using mobile apps [32] and web-based learning [76] were significantly impacted by effort expectancy. Therefore, this study believes that if IoTsh is user-friendly, there will be an increase in the users' intention to using it continuously. The formulated hypothesis is:

H2: Effort Expectancy has a positive effect on continuance intention to use IoTsh

4.3 Facilitating conditions

Facilitating conditions are the degree to which users believe IoTsh is supported by existing technical infrastructure and organization [51]. In this study, facilitating conditions are defined as technical assistance by IoTsh providers that can help users to continue using IoTsh. When users receive real-time service support, they will continue to use IoTsh. According to [65], the continued usage of IS is influenced by facilitating conditions. In addition, the users must have the required resources, such as a stable Wi-Fi connection, to continue using IoTsh. Furthermore, user knowledge and skills influence their decision to continue using IoTsh, which include installing and updating the IoTsh system, changing the password, and connecting a device to the server. In summary, access to technical support from the provider, good Wi-Fi coverage, as well as knowledge and skills related to the handling of IoTsh all result in a stronger intention to continue using IoTsh. Thus, this study's proposed hypothesis is:

H3: Facilitating Conditions has a positive impact on continuance intention to use IoTsh

4.4 Price value

Price value means the extent to which users think that there are benefits derived from the costs incurred in the use of IoTsh [51]. This study identifies price value as a significant factor for individuals, as they must incur monetary costs when using IS innovation. However, when the benefits achieved by users outweigh the expenditures spent, the intention to continue using IoTsh will rise. Additionally, IoTsh's quality is crucial to its adoption. According to [25], if the quality of a device or service is poor, users tend to avoid it. IoTsh

provides value to the user because the system can be designed according to the needs and preferences of the user. Prior studies on IoTsh indicated that the intention of using IoTsh was positively affected by price value [52]. The formed hypothesis is:

H4: Price Value has a positive impact on continuance intention to use IoTsh

4.5 Habit

Habit refers to routine behavior of individuals that develop over time [77]. In this study, habit refers to behavior from the past, reflex, and automatic behavior. Users' attitudes will change into automatic behaviors as a result of past behaviors [78]. Automatic behaviors of the users will boost the continuance intention of using IoTsh. According to prior studies, the behavioral intentions of using health information applications were positively affected by habits [79]. Moreover, it was confirmed that habit was positively affected the continuance intention of using IS [32]. Therefore, the habit of using IoTsh in daily life will encourage its use and subsequently, its continued use to facilitate home management. The developed hypothesis is:

H5: Habit has a positive impact on continuance intention to use IoTsh

4.6 Confirmation

The users' perceptions of how much the IoTsh usage expectations match the actual performance are referred to as confirmation [30]. Confirmation is one of the ECM constructs that directly affects the perceived usefulness, which is also referred to as performance expectancy, and satisfaction. Confirmation in this study is based on user experience, functionality, and meeting user demands. IoTsh experience is defined as the experience of users in obtaining the expected benefits from IoTsh usage. Previous studies showed that experience is the primary factor for continuous usage of IS services by users [80-81]. If IoTsh users have a positive experience and the best functionality is provided, their demands are met. Thus, they are most likely to continue using IoTsh. This will ultimately be instrumental to IoTsh users' satisfaction. Studies [32], [65] had discovered that IS users' performance expectancy and satisfaction was positively impacted by confirmation. In accordance with the preceding discussions, the proposed hypotheses are:

H6a: Confirmation has a positive impact on the performance expectancy of IoTsh's user

H6b: Confirmation has a positive impact on the satisfaction of IoTsh's user

4.7 Satisfaction

Satisfaction's definition is the extent of the users' confirmation that IoTsh meets expectations [30]. Satisfaction is a positive feeling toward IS devices or services. Oliver [82] discovered that satisfaction is a vital factor to ensuring the continuance intention of using IS technology. In [32], [66-68], it was found that satisfaction positively impacted the continuance intention of using IS devices or services. In this study, satisfaction refers to the use of IoTsh is a wise decision and brings a feeling of satisfied as well as pleasure to the user. Nonetheless, a previous study found that satisfaction had no effect on user continuation of IS innovation [83]. However, the current study believes that IoTsh users who are highly satisfied will be pleased and believe that they have made the right decision. Hence, they will continue to use IoTsh. Based on the foregoing arguments, the proposed hypothesis is:

H7: Satisfaction has a positive impact on continuance intention to use IoTsh

4.8 Trust

Trust is the level of confidence of users with regard to the other party's ability to manage IS innovation [84-85]. This study divides trust into three types, namely trust in service providers, the government, and manufacturers. Trust in the IoTsh provider is present if users trust that the IoTsh provider will handle data confidentially. In addition, users believe that the IoTsh provider possesses sufficient knowledge and skills to ensure that the devices or services function optimally and are error-free [86]. Meanwhile, the definition of trust in the government is when users believe that the Personal Data Protection Act (PDPA) of 2010 ensures that there is a high priority on the privacy protection of IoTsh users [87]. It had been demonstrated [18] that the intention of using IoTsh was significantly and positively affected by trust. Cirne et al. [88] highlight that one of the most significant issues in the IoT industry is the absence of official security regulations, which leads to IoT manufacturers not installing security mechanisms on IoTsh devices. In order to prevent malicious activities from taking place as connectivity expands, security protection is essential. Therefore, trust in the manufacturer is defined as the users' confidence that the IoTsh devices with security certification have been thoroughly evaluated by security professionals in an independent laboratory prior to use. In addition, if the users' trust in manufacturers is at a high level, they will perceive that the use of IoTsh is risk-free, thereby increasing their satisfaction and boosting the

intention of continuous use of IoTsh. Consequently, the formed hypotheses are:

H8a: Trust IoTsh has a positive impact on the satisfaction of the IoTsh's user

H8b: Trust IoTsh has a positive impact on continuance intention to use IoTsh

4.9 Perceived risk

The users' exposure to psychological risk [29], [89], performance risk [25-26],[29], [89], and time risk [25], [89] is the perceived risk. Psychological risk happens when users fear that they have lost control of their home as a result of using IoTsh. On the other hand, performance risk occurs when IoTsh fails to function as expected and incorrectly processes instructions, thereby failing to deliver the desired benefits. According to empirical investigations [29], psychological risk and performance risk positively and significantly affected the resistance to using IoTsh. Martins et al. [89] confirmed that performance risk positively influenced the perceived risk, and subsequently, the intention of using IS was negatively influenced by perceived risk. Moreover, users are likely to be exposed to time risk. Time risk represents the amount of time lost while attempting to resolve an IoTsh error. Hubert et al. [25] demonstrated that the overall risk was positively affected by time, whereas the intention of using smart home applications was negatively affected by the overall risk. Users will trust IoTsh if the perceived risk can be reduced. Hence, it can be argued that smaller perceived risk will lead to greater trust and longer-term willingness to use IoTsh. The proposed hypotheses are as follows:

H9a: Perceived Risk has a negative impact on the trust of the IoTsh's user

H9b: Perceived Risk has a negative impact on continuance intention to use IoTsh

4.10 Security and Privacy Concerns

The extent to which IoTsh users are worried that their data will be violated is known as security and privacy concerns [5]. Concerns about security and privacy are top priorities in IoTsh [24]. In this study, security concerns are divided into three categories: security flaws, smartphone security, and hacking activities. Concerns about privacy have two dimensions: the fear of spying via connection and data collection. The IoTsh devices are vulnerable to a wide range of attacks [36]. In the most scenario, hackers enter through gateway routers. A non-transparent data collection process increases user concerns. This is due to the users are unaware regarding for what purpose data is being collected, how to delete the data, or where the data is stored. An AI assistant is an example of fear of spying via a home connection. This is due to the fact that it must be left on all day in order to assist the users with their daily tasks. However, it raises privacy concerns, such as constant listening and unintentional recording [91]. The study in [90] showed that trust was negatively impacted by privacy concerns' four dimensions (secondary use, errors, improper access, and collection), and subsequently, trust negatively impacted the usage intention of location-based services. Therefore, the greater the users' security and privacy concerns, the lower the trust and intention of continuous usage of IoTsh. Therefore, the developed hypotheses are:

H10a: Security and privacy concerns has a negative impact on the trust of the IoTsh's user

H10b: Security and privacy concerns has a negative impact on continuance intention to use IoTsh

4.11 Characteristics of IoT

Characteristics of IoT are described as providing ubiquitous, compatibility, and energy-efficient services. IoTsh offers ubiquitous services and its main goal is user comfort. As a result, a variety of IoTsh devices comprised of ubiquitous sensors are linked to the internet in order to communicate effectively, perform tasks, and provide services at any time [92]. Compatibility, which is also known as interconnectivity and interoperability, is defined as the ability to connect with other IoT devices that use the same protocols regardless of the brand or manufacturer in order to exchange data. The wireless communication protocols for IoTsh devices include a number of different options, including ZigBee, Zwave, Bluetooth, and Wi-Fi. Nowadays, the most commonly used IoT communication protocols are Bluetooth and Wi-Fi. In IoTsh studies, compatibility has emerged as one of the factor domains. Existing studies [3], [25] discovered that the intention of using IoTsh was positively and significantly affected by compatibility. Additionally, energy efficiency is an important characteristic of IoT devices [93], especially for users that use IoTsh frequently or continuously, as it can help to reduce energy costs and environmental impact. IoTsh devices that are designed to be energy-efficient typically have low power consumption, have automatic shut-off, and are put in sleep mode when not in use. The derived hypothesis is thus:

H11: Characteristics of IoT has a positive impact on continuance intention to use IoTsh

4.12 Electronic word of mouth influence

The degree to which IoTsh users are influenced by comments, information, and recommendation

from social media network is the definition of electronic word of mouth influence [94-95], [97]. According to [96-97], a comment (either positive or negative) by actual or potential users of certain devices or services on social media network is considered electronic word-of-mouth (eWoM). The popularity of social media network has been increasing recently. IoTsh users normally rely on reviews, information, and recommendations from other IoTsh users about devices or services rather than IoTsh providers [95]. Ma et al. [58] found that satisfaction was positively impacted by eWoM, and the continuance intention of using cross-border shopping websites was positively impacted by satisfaction. However, eWoM's effects in the IoTsh context have not been looked into in previous studies. This study assumes that the intention to continue using IoTsh will be higher if there are more positive comments, benefits, and recommendations about IoTsh. Thus, the formulated hypothesis is:

H12: electronic word of mouth influence has a positive impact on continuance intention to use IoTsh

4.13 Moderator

4.13.1 Uncertainty avoidance

Uncertainty avoidance is included as a moderator to gain an understanding of culture's role among individuals. Prior studies identified that a crucial moderating variable in IS studies was uncertainty avoidance [98-99]. The degree to which users feel vulnerable to unpredictable situations involving IoTsh is the definition of uncertainty avoidance [37]. In this study, uncertainty avoidance refers to actions that require detailed rules and well-structured instruction in operating IoTsh. High uncertainty avoidance results in individuals tending to avoid making changes when using IoTsh in order to avoid unknown situations and reduce anxiety resulting from uncertainty [100-101]. In contrast, individuals with low uncertainty avoidance have a high tendency to master new devices or services and seeking problem-solving strategies when confronted with unfamiliar situations [59], [100]. Therefore, this study argues that there is a moderating effect of uncertainty avoidance on the relationship between effort expectancy and continued intention to use IoTsh. A simple process to control, monitor, and schedule IoTsh can attract users who have high uncertainty avoidance because they tend to have high stress and anxiety. This differs from low uncertainty avoidance users, who are more innovative, less stressed, and less anxious. This study assumes that low uncertainty avoidance results in users relying less on the ease of use in driving their continuance intention of using IoTsh. Besides that, empirical testing of the role of uncertainty avoidance as a moderator has yet to be conducted between the characteristic of IoT and continuance intention of using IoTsh. There is a high possibility that non-complicated instructions for using IoTsh devices are very useful for users with high uncertainty avoidance. For example, when adding new IoTsh devices, users with high uncertainty avoidance need detailed instructions to ensure that the newly added IoTsh devices are compatible with the existing IoTsh devices at home. Additionally, uncertainty avoidance's moderating effect on electronic word of mouth influence's relationship with the continuance intention to use IoTsh is examined in this study. Therefore, this study predicts that to reduce uncertainty when facing problems while using IoTsh, users can refer to individuals on social media to ask for opinions or ask for solutions. Hence, uncertainty avoidance's role as moderator is hypothesized as follows:

H13a: Uncertainty avoidance positively moderates the effect of effort expectancy on continuance intention to use IoTsh

H13b: Uncertainty avoidance positively moderates the effect of characteristics of IoT on continuance intention to use IoTsh

H13c: Uncertainty avoidance positively moderates the effect of electronic word of mouth influence on continuance intention to use IoTsh

5. DISCUSSION, LIMITATION AND FUTURE WORK

A crucial contribution of this study to the domain of IS sustainability is the proposal of a model comprising factors that impact the continuance intention of using IoTsh in Malaysia. The proposed factors include those extracted from the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2), Expectation-Confirmation Model (ECM), and Hofstede's theory (Culture), as well as electronic word of mouth influence, security and privacy concerns, trust, and perceived risk. In addition, factors that specifically reflect the case of IoTsh devices, such as the characteristics of IoT, are integrated into the proposed model. A total of thirteen hypotheses are derived from the proposed combinational model.

The drawback of this study is that the factors only involve three theories and models from IS theories. Therefore, this current study provides an opportunity for future works to add factors from other IS theories to enhance the proposed model's

applicability. The second constraint is that the focus is only on the IoTsh field. Future studies can be carried out to test the same model for different IoT applications or IS fields in order to increase its generalizability. The next limitation is that the proposed model has yet to be validated at the present time. It is suggested for future work to use multivariate statical analysis like structural equation modeling (SEM) for the purpose of investigating reliability and validity, as well as to measure the influence of the relationship between two or more factors found in the model.

6. CONCLUSION

The IoT industry has caused a major change in user lifestyles, especially in the smart home sector. Therefore, an integrated model comprising factors that affect the continuance intention of using IoTsh is proposed in this study. It comprises factors from different perspectives, including factors from technology acceptance and adoption theories (effort expectancy, facilitating conditions, habit, price value), factors from barriers to IoTsh adoption (security and privacy concerns, perceived risk), and factors derived from the impact of beliefs in IoTsh (trust). In addition, factors from the expectation-confirmation model (ECM) (satisfaction, performance expectancy, confirmation) are also included in this model. Furthermore, there are additional factors that earlier studies on IoTsh have not considered, namely factors related to social media network influence (electronic word of mouth influence) and factors related to IoTsh technology (characteristics of IoT). Also included in the model is a factor from Hofstede's theory, namely uncertainty avoidance, which acts as a moderator. The contribution of this study has developed a comprehensive model for IoTsh users to determine the factors that influence their continuance intention of using IoTsh. In addition, this study is needed to advance knowledge among IoTsh stakeholders for ensuring continuance intention of using IoTsh among existing users, increasing the use of IoTsh among new users, as well as formulating strategies for the dissemination of IoTsh to ensure that the IoTsh market can grow rapidly and mature in Malaysia.

REFERENCES:

[1] L. S. Vailshery, "Internet of Things (IoT) and non-IoT active device connections worldwide from 2010 to 2025," 2022. Retrieved February 10, 2023, from https://www.statista.com/statistics/1101442/iot-number-of-connected-devices-worldwide

[2] Z. A. Almusaylim and N. Zaman, "A review on smart home present state and challenges: linked to context-awareness internet of things (IoT)," *Wireless Networks,* vol. 25, no. 6, pp. 3193-3204, 2019.

[3] S. Nikou, "Factors driving the adoption of smarthome technology: An empirical assessment," *Telematics and Informatics*, vol. 45, 2019.

[4] Statista, "Smart Home - Worldwide," Retrieved February 11, 2023, from https://www.statista.com/outlook/dmo/smart-home/worldwide

[5] D. Pal, S. Funilkul, V. Vanijja, and B. Papasratorn, "Analyzing the Elderly Users' Adoption of Smart-Home Services," *IEEE Access*, vol. 6, pp. 51238-51252, 2018.

[6] E. Park, S. Kim, Y. S. Kim, and S. J. Kwon, "Smart home services as the next mainstream of the ICT industry: determinants of the adoption of smart home services," *Universal Access in the Information Society,* vol. 17, no. 1, pp. 175-190, 2018.

[7] D. C. Khedekar, A. C. Truco, D. A. Oteyza, and G. F. Huertas, "Home Automation—A Fast - Expanding Market," *Thunderbird International Business Review*, vol. 59, pp. 79-91, 2017.

[8] Y. Kim, Y. Park, and J. Choi, "A study on the adoption of IoT smart home service: using Value-based Adoption Model," *Total Quality Management and Business Excellence*, vol. 28, no. 9-10, pp. 1149-1165, 2017.

[9] H. Yang, W. Lee, and H. Lee, "IoT Smart Home Adoption: The Importance of Proper Level Automation," *Journal of Sensors*, pp. 1-11, 2018.

[10] P. Pliatsikas and A. A. Economides, "Factors Influencing Intention of Greek Consumers to Use Smart Home Technology," *Applied System Innovation*, vol. 5, no. 26, pp. 1-17, 2022.

[11] W. Ji and E. H. W. Chan, "Critical factors influencing the adoption of smart home energy technology in china: A guangdong province case study," *Energies*, vol. 12, no. 21, pp. 1-24, 2019.

[12] R. Creaney, L. Reid, and M. Currie, "The contribution of healthcare smart homes to older peoples' wellbeing: A new conceptual framework," *Wellbeing, Space and Society*, vol. 2, pp. 1-8, 2021.

[13] Statista, "Smart Home - Malaysia," 2022. https://www.statista.com/outlook/dmo/smart-

home/malaysia?currency=usd (accessed Feb. 10, 2023).

[14] M. Arar, C. Jung, J. Awad, and A. H. Chohan, "Analysis of smart home technology acceptance and preference for elderly in dubai, uae," *Designs*, vol. 5, no.70, pp. 1-19, 2021.

[15] N. Guhr, O. Werth, P. P. H. Blacha, and M. H. Breitner, "Privacy concerns in the smart home context," *SN Applied Sciences*, vol. 2, no. 2, pp. 1-12, 2020.

[16] P. Baudier, C. Ammi, and M. Deboeuf-Rouchon, "Smart home: Highly-educated students' acceptance," *Technological Forecasting and Social Change*, vol. 153, pp. 1-19, 2020.

[17] S. F. Hussin, M. F. Abdollah, and I. Ahmad, "Acceptance of IoT Technology for Smart Homes: A Systematic Literature Review," *Lecture Notes in Networks and Systems,* 550 LNNS, pp. 187-202, Springer, 2023.

[18] A. Shuhaiber and I. Mashal, "Understanding users' acceptance of smart homes," *Technology in Society*, vol. 58, pp. 1-9, 2019.

[19] J. E. Klobas, T. McGill, and X. Wang, "How perceived security risk affects intention to use smart home devices: A reasoned action explanation," *Computers and Security* vol. 87, pp. 1-13, 2019.

[20] A. Shuhaiber, I. Mashal, and O. Alsaryrah, "Smart homes as an IoT application: Predicting attitudes and behaviours," *Proceedings of IEEE/ACS International Conference on Computer Systems and Applications, AICCSA AICCSA*, pp. 1-7, 2019.

[21] X. Wang, T. J. McGill, and J. E. Klobas, "I Want It Anyway: Consumer Perceptions of Smart Home Devices," *Journal of Computer Information Systems*, vol. 60, no. 5, pp. 437-447, 2018.

[22] E. D. T. Jaspers and E. Pearson, "Consumers' acceptance of domestic Internet-of-Things: The role of trust and privacy concerns," *Journal of Business Research*, vol. 142, pp. 255-265, 2022.

[23] S. Chang and K. Nam, "Smart home adoption: The impact of user characteristics and differences in perception of benefits," *Buildings*, vol. 11, no. 9, pp. 1-17, 2021.

[24] S. Mamonov and R. Benbunan-Fich, "Unlocking the smart home: exploring key factors affecting the smart lock adoption intention," *Information Technology and People*, vol. 34, no. 2, pp. 835-861, 2021.

[25] M. Hubert, M. Blut, C. Brock, R. W. Zhang, V. Koch, and R. Riedl, "The influence of acceptance and adoption drivers on smart home usage," *European Journal of Marketing.*, vol. 53, no. 6, pp. 1073-1098, 2019.

[26] R. Mulcahy, K. Letheren, R. McAndrew, C. Glavas, and R. Russell-Bennett, "Are households ready to engage with smart home technology?," *Journal of Marketing Management.*, vol. 35, no. 15-16, pp. 1370-1400, 2019.

[27] S. Mamonov and M. Koufaris, "Fulfillment of higher-order psychological needs through technology: The case of smart thermostats," *International Journal of Information Management*, pp. 1-14, 2020.

[28] D. Pal, X. Zhang, and S. Siyal, "Prohibitive factors to the acceptance of Internet of Things (IoT) technology in society: A smart-home context using a resistive modelling approach," *Technology in Society*, vol. 66, pp. 1-16, 2021.

[29] A. Hong, C. Nam, and S. Kim, "What will be the possible barriers to consumers' adoption of smart home services?," *Telecommunications Policy*, pp. 1-15, 2020.

[30] A. Bhattacherjee, "Understanding information systems continuance: an expectation confirmation model," *MIS quarterly,* vol. 25, no. 3, pp. 351-370, 2001.

[31] W. Gu, P. Bao, W. Hao, and J. Kim, "Empirical examination of intention to continue to use smart home services," *Sustainability*, vol. 11, pp. 1-12, 2019.

[32] C. Tam, D. Santos, and T. Oliveira, "Exploring the influential factors of continuance intention to use mobile Apps: Extending the expectation confirmation model," *Information Systems Frontiers*, vol. 22, no. 1, pp. 243-257, 2020.

[33] Y. Khan, M. B. M. Su'ud, M. M. Alam, S. F. Ahmad, N. A. Salim, and N. Khan, "Architectural Threats to Security and Privacy: A Challenge for Internet of Things (IoT) Applications," *Electronics* vol. 12, no. 1, pp. 1-20, 2023.

[34] A. Aldahmani, B. Ouni, T. Lestable, and M. Debbah, "Cyber-security of embedded IoTs in smart homes: challenges, requirements, countermeasures, and trends," *IEEE Open Journal of Vehicular Technology* vol. 4, pp. 281-292, 2023.

[35] C. Perera, R. Ranjan, L. Wang, S. U. Khan, and A. Y. Zomaya, "Big data privacy in the internet of things era," *IT Professional*, vol. 17, no. 3, pp. 32-39, 2015.

[36] R. Heartfield, G. Loukas, S. Budimir, A. Bezemskij, J. R. J Fontaine, A. Filippoupolitis, and E. Roesch "A taxonomy of cyber-physical

threats and impact in the smart home," *Computers and Security*, vol. 78, pp. 398-428, 2018.

[37] G. Hofstede, "Culture's consequences: international differences in work-related values," *Sage Publication*, 1980.

[38] Department of Statistics Malaysia (DOSM), "Population size and annual population growth rate," Retrieved February 13, 2023, from https://www.dosm.gov.my/v1/index.php?r=column/pdfPrev&id=dTZXanV6UUdyUEQ0SHNWOVhpSXNMUT09

[39] Department of Statistics Malaysia (DOSM), "Key Findings of Population and Housing Census of Malaysia 2020: Urban and Rural," Retrieved February 13, 2023, from https://www.dosm.gov.my/v1/index.php/index.php?r=column/cthemeByCat&cat=509&bul_id=ZFRzTG9ubTkveFR4YUY2OXdNNk1GZz09&menu_id=L0pheU43NWJwRWVSZklWdzQ4TlhUUT09

[40] MyGovernment, "The National Fiberisation and Connectivity Plan (NFCP) 2019-2023," Retrieved February 13, 2023, from https://www.malaysia.gov.my/portal/content/30736 (accessed Feb. 12, 2023).

[41] MCMC, *Technical Report, Internet of Things (IoT): Technical Regulatory Aspects & KeyChallenges*.Retrieved February 13, 2023, fromhttps://www.mcmc.gov.my/skmmgovmy/files/20/203a1c3e-3284-4186-ba8f-8cb3df165efd/files/assets/basic-html/page-1.html#

[42] Department of Statistics Malaysia (DOSM), "ICT Use and Access by Individuals and Households Survey Report, Malaysia,2021," Retrieved February 15, 2023, from https://www.dosm.gov.my/v1/index.php?r=column/cthemeByCat&cat=395&bul_id=bCs4UlNSQktybTR3THZ3a0RzV2RkUT09&menu_id=amVoWU54UTl0a21NWmdhMjFMMWcyZz09#(accessed Feb. 12, 2023).

[43] N. T. Wei, A. S. Baharudin, L. A. Hussein, and M. F. Hilmi, "Factors affecting user's intention to adopt smart home in Malaysia," *International Journal of Interactive Mobile Technologies.*, vol. 13, no. 12, pp. 39-54, 2019.

[44] Z. A. Rasyidah, A. H. Hariati, M. Rosadah, and M. R. Maryanti, "Perceptions on smart home concept among the millennials in Johor," *IOP Conference Series: Materials Science and Engineering*, vol. 849, no. 1 pp. 1-9, 2020.

[45] Z. Z. Mohamad, S. U. Meor Musa, R. Abdul Razak, T. Ganapathy, and N. A. Mansor, "Internet of things: the acceptance and its impact on well-being among millennials," *International Journal of Services Technology and Management.*, vol. 27, no. 4/5/6, pp. 265-279, 2021.

[46] S. Aziz and S. N. C. M. Nasir, "Internet of things (IoT) and smart home technology in Malaysia: Issues and challenges for research in adoption IoT and latest technology for home building," *Proceedings of 8th International Conference on Advanced Materials Engineering & Technology (ICAMET 2020)*, pp. 1-8, 2021.

[47] Economic Planning Unit, "National Energy Policy 2022-2040," Retrieved February 16, 2023, from https://www.epu.gov.my/sites/default/files/2022-09/NationalEnergyPolicy_2022_2040.pdf

[48] Economic Planning Unit, "National Fourth Industrial Revolution (4IR) Policy," Retrieved February 16, 2023, from https://www.epu.gov.my/sites/default/files/2021-07/National-4IR-Policy.pdf

[49] Ministry of Housing and Local Government , "Executive Summary Malaysia Smart City Framework," Retrieved February 17, 2023, from https://www.kpkt.gov.my/kpkt/resources/user_1/GALERI/PDF_PENERBITAN/FRAMEWORK/FRAMEWORK_SMART_CITY_EXECUTIVE_SUMMARY.pdf

[50] Ministry of Housing and Local Government (KPKT), "Malaysia Smart City Handbook," Retrieved February 18, 2023, from https://www.kpkt.gov.my/kpkt/resources/user_1/GALERI/PDF_PENERBITAN/FRAMEWORK/Malaysia_Smart_City_Handbook_21062021_Final.pdf

[51] V. Venkatesh, J. Y. L. Thong, and X. Xu, "Consumer Acceptance and Use of Information Technology: Extending the Unified Theory of Acceptance and Use of Technology," *MIS Q.*, vol. 36, no. 1, pp. 157-178, 2012.

[52] M. Q. Aldossari and A. Sidorova, "Consumer Acceptance of Internet of Things (IoT): Smart Home Context," *Journal of Computer Information Systems*, vol. 60, no. 6, pp. 507-517, 2020.

[53] A. Al-Husamiyah and M. Al-Bashayreh, "A comprehensive acceptance model for smart home services,"*International Journal of Data and Network Science*, vol. 6, no. 1, pp. 45-58, 2021.

[54] D. Pal, S. Funilkul, N. Charoenkitkarn, and P.Kanthamanon, "Internet-of-Things and

Smart Homes for Elderly Healthcare: An End User Perspective," *IEEE Access*, vol. 6, pp. 10483-10496, 2018.

[55] F. D. Davis, R. P. Bagozzi, and P. R. Warshaw, "User Acceptance of Computer Technology: A Comparison of Two Theoretical Models," *Management Science*, vol. 35, no. 8, pp. 982-1003, 1989.

[56] G. Hofstede, "Dimensionalizing Cultures: The Hofstede Model in Context," *Online Readings In Psychology And Culture.*, vol. 2, no. 1, pp. 1-26, 2011.

[57] G. Baptista and T. Oliveira, "Understanding mobile banking: The unified theory of acceptance and use of technology combined with cultural moderators," *Computers in Human Behavior* vol. 50, pp. 418-430, 2015.

[58] Y. Ma, A. Ruangkanjanases, and S. C. Chen, "Investigating the impact of critical factors on continuance intention towards cross-border shopping websites," *Sustainability.*, vol. 11, pp. 1-17, 2019.

[59] H. Hoehle, X. Zhang, and V. Venkatesh, "An espoused cultural perspective to understand continued intention to use mobile applications: A four-country study of mobile social media application usability," *European Journal of Information Systems*, vol. 24, no. 3, pp. 337-359, 2015.

[60] Y. Zhang, Q. Weng, and N. Zhu, "The relationships between electronic banking adoption and its antecedents: A meta-analytic study of the role of national culture," *International Journal of Information Management* vol. 40, pp. 76-87, 2018.

[61] F. Sharmin, M. T. Sultan, D. Wang, A. Badulescu, and B. Li, "Cultural dimensions and social media empowerment in digital era: Travel-related continuance usage intention," *Sustainability* vol. 13, no. 19, pp. 1-21, 2021.

[62] R. Sharma, G. Singh, and S. Sharma, "Modelling internet banking adoption in Fiji: A developing country perspective," *International Journal of Information Management.*, vol. 53, pp. 1-13, 2020.

[63] M. Al-Okaily, A. Lutfi, A. Alsaad, A. Taamneh, and A. Alsyouf, "The Determinants of Digital Payment Systems' Acceptance under Cultural Orientation Differences: The Case of Uncertainty Avoidance," *Technology in Society*, vol. 63, pp. 1-15, 2020.

[64] D. Herdiana, A. Subiyakto, and A. B. A. Rahman, "System Continuance Success of the Local Electronic Government in Indonesia," *ICIC Express Letters. Part B Appications*, vol. 13, no. 10, pp. 1001-1008, 2022.

[65] X. F. Tian and R. Z. Wu, "Determinants of the Mobile Health Continuance Intention of Elders with Chronic Diseases: An Integrated Framework of ECM-ISC and UTAUT," *International Journal of Environmental Research and Public Health*, vol. 19, pp. 1-19, 2022.

[66] Y. Liu, Q. Li, T. Edu, and I. C. Negricea, "Exploring the Continuance Usage Intention of Travel Applications In the Case of Chinese Tourists," *Journal of Hospitality & Tourism Research,* pp. 1-27, 2020.

[67] A. V. Prakash, S. Das, and K. R. Pillai,"Understanding digital contact tracing app continuance: Insights from India: Understanding Contact Tracing App Continuance," *Health Policy Technology*, vol. 10, pp. 1-9, 2021.

[68] D. M. Nguyen, Y. T. H. Chiu, and H. D. Le, "Determinants of continuance intention towards banks' chatbot services in vietnam: A necessity for sustainable development," *Sustainability*, vol. 13, no. 14, pp. 1-24, 2021.

[69] A. A. Rabaa'i and S. A. ALMaati, "Exploring the Determinants of Users' Continuance Intention to Use Mobile Banking Services in Kuwait: Extending the Expectation-Confirmation Model," *Asia Pacific Journal of Information Systems*, vol. 31, no. 2, pp. 141-184, 2021.

[70] W. Liu, "An empirical investigation of the older adults' continuance intention towards SNSs," *International Journal of Services Operations and Informatics*, vol. 8, no. 2, pp. 136-149, 2016.

[71] S. H. Kim, J. H. Bae, and H. M. Jeon, "Continuous intention on accommodation apps: Integrated value-based adoption and expectation-confirmation model analysis," *Sustainability*, vol. 11, no. 6, pp. 1-17, 2019.

[72] Y. Zhao and F. Bacao, "What factors determining customer continuingly using food delivery apps during 2019 novel coronavirus pandemic period?," *International Journal of Hospitality Management*, vol. 91, pp. 1-12, 2020.

[73] S. W. Lee, H. J. Sung, and H. M. Jeon, "Determinants of continuous intention on food delivery apps," *Sustainability*, vol. 11, pp. 1-15, 2019.

[74] G. M. A. A. Quaosar, M. R. Hoque, and Y. Bao, "Investigating factors affecting elderly's intention to use m-health services: An

empirical study," *Telemedicine and E-Health*, vol. 24, no. 4, pp. 309-314, 2018.

[75] E. M. Abu-Taieh, I. AlHadid, S. Abu-Tayeh, R. Masa'deh, R.S. Alkhawaldeh, S. Khwaldeh, and A. Alrowwad, "Continued Intention to Use of M-Banking in Jordan by Integrating UTAUT, TPB, TAM and Service Quality with ML," *Journal of Open Innovation Technology, Market, and Complexity*, vol. 8, pp. 1-29, 2022.

[76] C. M. Chiu and E. T. G. Wang, "Understanding Web-based learning continuance intention: The role of subjective task value," *Information & Management*, vol. 45, no. 3, pp. 194-201, 2008.

[77] M. Limayem, S. G. Hirt, and C. M. Cheung, "How habit limits the predictive power of intention: The case of information systems continuance," *MIS Quarterly: Management Information Systems*, vol. 31, no. 4, pp. 705-737, 2007.

[78] S. J. Barnes, "Understanding use continuance in virtual worlds: empirical test of a research model," *Information Management*, vol. 48, no. 8, pp. 313-319, 2011.

[79] I. B. Hassan, M. A. A. Murad, I. El-Shekeil, and J. Liu, "Extending the UTAUT2 Model with a Privacy Calculus Model to Enhance the Adoption of a Health Information Application in Malaysia," *Informatics*, vol. 9, pp. 1-27, 2022.

[80] K. M. Lin, "E-Learning continuance intention: Moderating effects of user e-learning experience," *Computers and Education*, vol. 56, no. 2, pp. 515-526, 2011.

[81] N. Mohamed, R. Hussein, N. H. A. Zamzuri, and H. Haghshenas, "Insights into individual's online shopping continuance intention," *Industrial Management & Data Systems*, vol. 114, no. 9, pp. 1453-1476, 2014.

[82] R. L. Oliver, "A cognitive model of the antecedents and consequences of satisfaction decisions," *Journal of Marketing Research*, vol. 17, no. 4, pp. 460-469, 1980.

[83] M. Al-Emran, I. Arpaci, and S. A. Salloum, "An empirical examination of continuous intention to use m-learning: An integrated model," *Education and Information Technologies*, vol. 25, no. 4, pp. 2899-2918, 2020.

[84] L. Gao, K. A. Waechter, and X. Bai, "Understanding consumers' continuance intention towards mobile purchase: A theoretical framework and empirical study - A case of China," *Computers in Human Behavior*, vol. 53, pp. 249-262, 2015.

[85] E. M. Schomakers, H. Biermann, and M. Ziefle, "Users' Preferences for Smart Home Automation - Investigating Aspects of Privacy and Trust," *Telematics and Informatics*, vol. 64, pp. 1-16, 2021.

[86] S. Cannizzaro, R. Procter, S. Ma, and C. Maple, "Trust in the smart home: Findings from a nationally representative survey in the UK," *PLoS One*, vol. 15, no. 5, pp.1-30, 2020.

[87] B. K. Cheryl and B. K. Ng, "Protecting the Unprotected Consumer Data in Internet of Things: Current Scenario of Data Governance in Malaysia," *Sustainability*, vol. 14, pp. 1-25, 2022.

[88] A. Cirne, P. R. Sousa, J. S. Resende, and L. Antunes, "IoT security certifications: Challenges and potential approaches," *Computers and Security*, vol. 116, pp. 1-15, 2022.

[89] C. Martins, T. Oliveira, and A. Popovič, "Understanding the internet banking adoption: A unified theory of acceptance and use of technology and perceived risk application," *International Journal of Information Management*, vol. 34, pp. 1-13, 2014.

[90] T. Zhou, "The impact of privacy concern on user adoption of location-based services," *Industrial Management and Data Systems*, vol. 111, no. 2, pp. 212-226, 2011.

[91] A. Karale, "The Challenges of IoT Addressing Security, Ethics, Privacy, and Laws," *Internet of Things*, vol. 15, pp. 1-20, 2021.

[92] D. G. Lokhande and S. A. Mohsin, "Internet of things for ubiquitous smart home system," i*1st International Conference on Intelligent Systems and Information Management, ICISIM 2017*, pp. 314-320, 2017.

[93] I. Machorro-Cano, G. Alor-Hernández, M. A. Paredes-Valverde, L. Rodríguez-Mazahua, J. L. Sánchez-Cervantes, and J. O. Olmedo-Aguirre, "HEMS-IoT: A big data and machine learning-based smart home system for energy saving," *Energies*, vol. 13, pp. 1-24, 2020.

[94] H. P. Shih, K. H. Lai, and T. C. E. Cheng, "Informational and relational influences on electronic word of mouth: An empirical study of an online consumer discussion forum," *International Journal of Electronic Commerce*, vol. 17, no. 4, pp. 137-166, 2013.

[95] H. J. Jeong and D. M. Koo, "Combined effects of valence and attributes of e-WOM on consumer judgement for message and product The moderating effect of brand community type," *Internet Research*, vol. 25, no. 1, pp. 2-

29, 2015.

[96] T. Hennig-Thurau, K. P. Gwinner, G. Walsh, and D. D. Gremler, "Electronic word-of-mouth via consumer-opinion platforms: What motivates consumers to articulate themselves on the Internet?," *Journal of Interactive Marketing*, vol. 18, no. 1, pp. 38-52, 2004.

[97] Y. K. Liao, W. Y. Wu, T. Q. Le, and T. T. T. Phung, "The Integration of the Technology Acceptance Model and Value-Based Adoption Model to Study the Adoption of E-Learning: The Moderating Role of e-WOM," *Sustainability*, vol. 14, pp.1-16, 2022.

[98] K. A. Alshare and A. A. Mousa, "The moderating effect of espoused cultural dimensions on consumer's intention to use mobile payment devices," *35th International Conference on Information Systems(ICIS 2014*), pp. 1-15, 2014.

[99] F. O. Bankole and O. O. Bankole, "The effects of cultural dimension on ICT innovation: Empirical analysis of mobile phone services," *Telematics and Informatics 34*, vol. 34, no. 2, pp. 490-505, 2017.

[100] G. J. Udo, K. K. Bagchi, and P. J. Kirs, "Exploring the role of espoused values on e-service adoption: A comparative analysis of the US and Nigerian users," *Computers in Human Behavior*, vol. 28, no. 5, pp. 1768-1781, 2012.

[101] A. Tarhini, K. Hone, X. Liu, and T. Tarhini, "Examining the moderating effect of individual-level cultural values on users' acceptance of E-learning in developing countries: a structural equation modeling of an extended technology acceptance model," *Interactive Learning Environments*, vol. 25, no. 3, pp. 306-328, 2017.

Journal of Theoretical and Applied Information Technology
15th June 2023. Vol.101. No 11

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

Table 2: Previous studies that applied proposed factors for continuance intention in various IS technology

Ref	Application context	Factors												Moderator
		Performance Expectancy	Effort Expectancy	Facilitating conditions	Price value	Habit	Trust	Perceived Risk	Security Privacy concerns	electronic word of mouth influence	Characteristics of IoT	Confirmation	Satisfaction	Uncertainty Avoidance
[32]	Mobile Apps	√	√	√	√	√	-	-	-	-	-	√	√	-
[64]	e-Government	√	√	√	-	-	-	-	-	-	-	√	√	-
[65]	mHealth	√	√	√	-	-	-	-	-	-	-	√	√	-
[66]	Travel Applications	√	-	-	-	-	√	√	-	-	-	√	√	-
[67]	Digital Contact Tracing	√	-	-	-	-	√	-	-	-	-	√	√	-
[68]	Chatbot	√	-	-	-	-	√	-	-	-	-	√	√	-
[69]	m-banking	√	√	√	-	-	√	-	-	-	-	√	√	-
[70]	Social Network Services	√	√	-	-	-	-	-	-	-	-	√	√	-
[71]	Accommodation Applications	√	-	-	-	-	-	-	-	-	-	√	√	-
[72]	Food Delivery Applications	√	√	-	-	-	√	-	-	-	-	√	√	-
Current study	IoT smart home	√	√	√	√	√	√	√	√	√	√	√	√	√

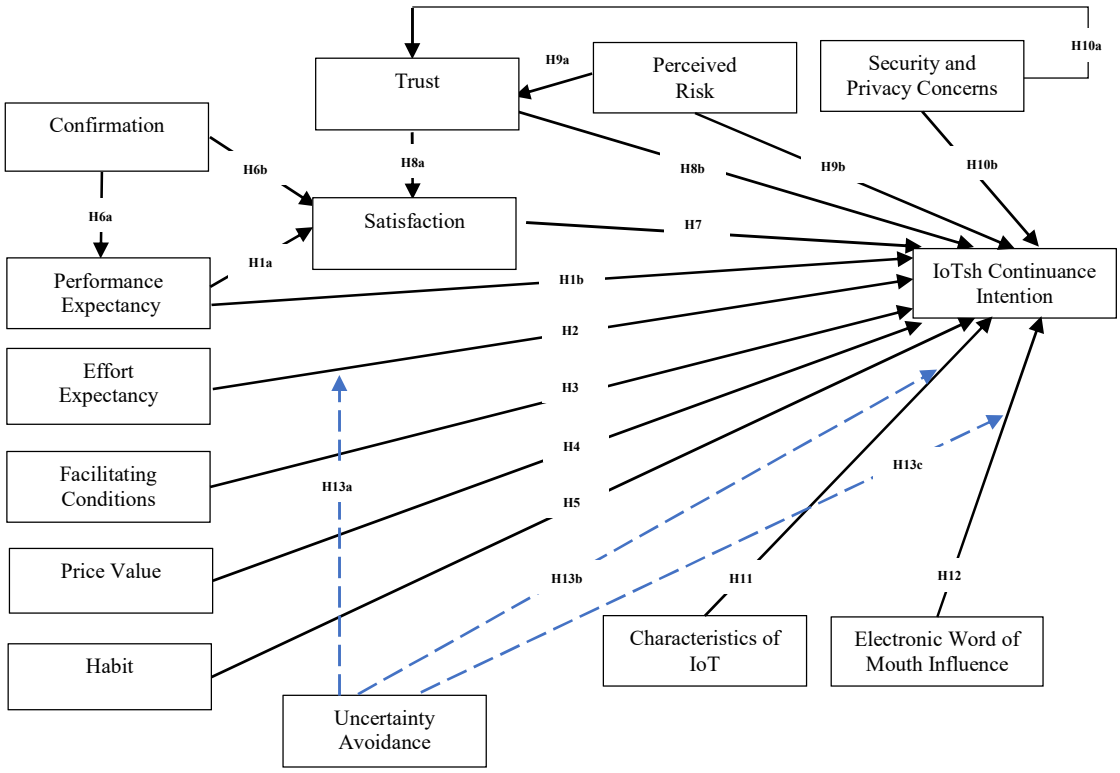

Figure 5: The proposed model