

Behavioral Intention to Use Wellness Wearables: A Conceptual Model Development

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Abstract

Wearable Technology is going to be the biggest buzzword and the next generation of digital revolution in the near future. Wearables have changed the focus of the healthcare industry to prevention programs in order to encourage individuals to be more active and to take the responsibility of their own health. Although, the intention of consumers to use wellness wearables has been growing rapidly, the number of individuals who refuses continued use of such devices increases day-by-day. Diffusion and innovation of new technology could be more efficiently gained by consumer's adoption. So, it is extremely important for providers and designers to understand the impact of positive and negative factors on consumers' intention to use wellness wearables. Moreover, a unified framework is required for better understanding of individuals' behavioral intention for using wellness wearables. Thus, the goal of this study is to identify the potential factors that influence consumers' willingness to use wellness wearables as well as proposing a unified framework based on Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) and Value-based Adoption Model (VAM) with two extra factors, perceived trust and perceived health increase. The findings of this article improves the theoretical understanding of the engaged factors in the proposed research model of the study.

Keywords: *Wellness Wearable Technology, Behavioral Intention, Unified Theory of Acceptance and Use of Technology, Value-based Adoption Model.*

1. Introduction

Recently, Internet of Things (IoT) raises potential challenges that could assist to achieve considerable benefits in different domains such as transportation, agriculture, and healthcare [1], [2]. Within the context of IoT, wearable technology has attained a special state of general public awareness. Specifically, those wearable devices that assist individuals to pursue a healthy lifestyle. Figure 1 presents some examples of wellness wearables and their positions on human's body. Moreover, wellness wearables reporting daily activities, such as step counter, sleep patterns, caloric intake, calories burned, heart rates, blood pressure, and body temperature [3]. Although wellness wearables are going to dominate the majority of marketplace in the near future, there is little studies about the motivation and barriers of accepting these high-tech products from consumers'

perspective [4]. Moreover, attracting and keeping customers to use wellness wearables is a key challenge among business managers. However, most previous studies toward consumers' adoption of wearables have tested a limited number of key factors from the technical viewpoint [5]. So, a unified and comprehensive framework is needed to explain the behavioral intention of consumers toward using wellness wearables [4].



Figure 1. Wellness Wearables Examples Adopted from [6]

Hence, the objective of this study is to propose a unified framework by integrating UTAUT2 and VAM with two extra factors of perceived health increase and perceived trust. The remain part of this article is structured as follows: Section two describes the present literature about wearable technologies. Section three presents the justifications of proposing the conceptual research model. Section four describes the development of hypotheses and the motivations of proposing them. Section five explains the developed measurement instrument. The last section presents the conclusion and future direction.

2. Literature Review

Since, wearables have dominated at the marketplace recently, their features have brought so many new challenges that need to be explored. Kim and Shin [7] investigated the intention of individuals to continue the usage of smartwatches based on Technology Acceptance Model (TAM) with extra factors of subcultural and costs. Moreover, Prayoga & Abraham [8] investigated the influential factors towards users intention to use smart health devices according to TAM. The findings of their study determined usefulness as the most important factor of users' intention in the domain of health products. Miller [9], examined the perceived usefulness of fitness trackers through a single case study. The findings show that self-tracking wearables in the therapy of medical setting can be helpful for individuals. Most of the previous studies have used the basic TAM with some extra factors for investigating behavioral intention of users towards using wearables. As it will be discussed in the next section, TAM was developed for applying in organizational setting. Therefore, this study integrated UTAUT and VAM with two extra factors of perceived health increase and perceived trust for examining behavioral intention of consumers towards using wellness wearables.

3. Conceptual Research Model

A large extend of previous studies considered TAM [10] and UTAUT [11] to examine behavioral adoption and intention of using new technologies [11]. Venkatesh et al. [12] and Kim et al. [13] suggested

that these two theories may be more appropriate for examining the adoption and intention behavior of staffs in organizations. Because, organizations are responsible for providing technologies and paying the costs rather than employees. Therefore, costs could have a significant effect on users' intention to use new technologies [12], [13]. Since, the primary TAM and UTAUT only consider the perceived benefit factors and ignore the perceived monetary factors and nonmonetary factors [14]. Hence, the extended UTAUT, UTAUT2, has revealed a higher predictive power [12], which determines the efficiency of the model. On the other hand, perceived value seems to be the most proper factor for evaluating technology acceptance behavior, since it measures factors of benefits and sacrifices [13]–[15]. In addition, many researches in the area of marketing and IS have examined perceived value as a potential factor in the field of Mobile Internet (M-Internet) [13] and Internet of Things [14]. Moreover, Kim et al. [13] developed VAM to describe the adoption of Mobile-Internet by individuals. The results of their research confirmed that the perceived value of individuals for applying M-Internet is a key factor of their intention to use this technology. Many previous studies have validated VAM in behavioral intention studies [7]. However, trust related constructs are mentioned as significant variables in predicting technology acceptance behavior, which are not considered in many technology acceptance models [16]. Therefore, the aim of this paper is to integrate the UTAUT2 and VAM models with two additional factors, perceived health increase and perceived trust. The proposed research model of this study is presented in Figure 2.

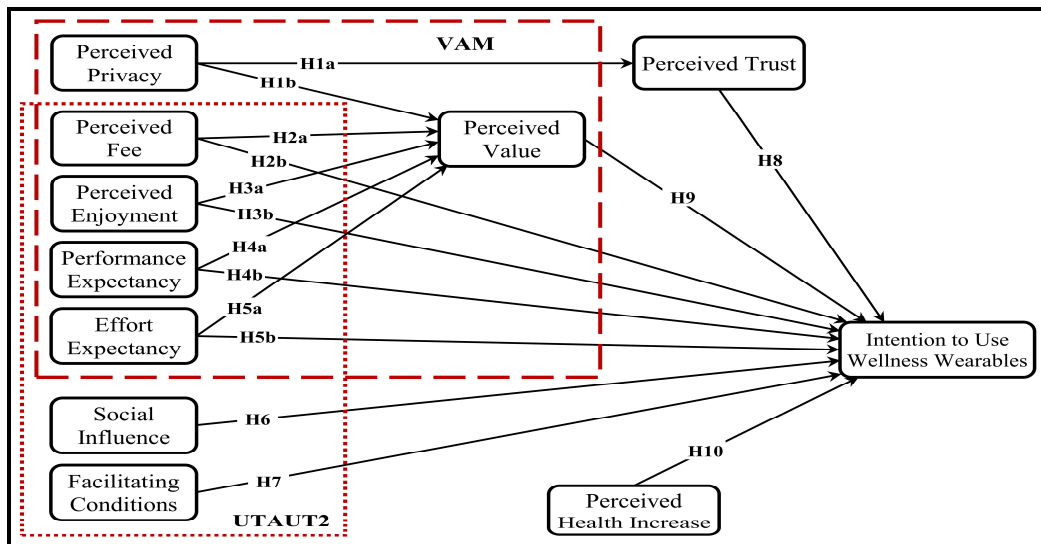


Figure 2. Proposed Research Model

4. Motivation of Hypothesis

4.1 Perceived Privacy (PP)

PP refers to individuals' concern towards significant losses of confidential and personal information by using wellness wearables [14]. Scholars have indicated privacy concerns to be the main hinder of full adoption of online services [17], [18]. Disclosure of smart wearables data will expose private information and personal habits. The illegal access to this sensitive data may influence the privacy of wearables' consumers [19]. Most wellness wearables collect the individual's location, sleep patterns, and heart beat which may be abused by the hackers [17]. In addition, previous researches had shown that privacy issues negatively affects trust [18] and perceived value [14]. Since, most wellness wearables collect data regarding

the personal habits and location information the following hypothesizes are proposed:

H1a. Perceived privacy of wellness wearables will have a negative influence on the perceived value of using such devices.

H1b. Perceived privacy of wellness wearables has a positive influence on perceived trust of using such devices.

4.2 Perceived Fee (PF)

PF has defined as the amount of monetary expenses that should be lost (sacrificed) in order to achieve the wellness wearable devices [14]. Many scholars indicate the potential effect of perceived fee on the technology acceptance in various domain such as Internet of Things [14] and wearables [20]. Since, consumers deal with the monetary expenses of using technologies, it may influence on their intention behavior. Additionally, individuals compare the benefits of applying a technology with the expenses of using it. If the perceived costs of using a technology becomes greater than the perceived benefits, individuals may be less willing to adopt or use it [21]. Yang et al. [20] claimed that the expense and maintenance costs of wearable devices are a key obstacle of using them. They indicated financial risk is a monetary sacrifice that may be caused by purchasing or maintaining wearables which have a negative relationship with consumers' perceived value. Thus, we hypothesize as follows:

H2a. Perceived fee has negative effect on perceived value.

H2b. Perceived fee has a negative effect on intention to use wellness wearables.

4.3 Perceived Enjoyment (PEJ)

PEJ refers to a degree to which an individual believes that applying wellness wearables can be caused pleasure and satisfaction [14]. The significant of enjoyment for examining the intrinsic motivations of people in using consumers' products has been identified by many researchers [12]. Venkatesh et al. [12] extended the UTAUT model with extra factors of hedonic motivation to explain the perceived intrinsic of consumers more clearly. Moreover, in an experimental study carried out by Kim et al. (2007) [13] the correlation between enjoyment perception and perceived value was examined in the context of M-Internet. Also, Hsu and Lin [14] identified perceived enjoyment as a principle factor of perceived value in the domain of IoT. Therefore, this study proposed the followings hypothesizes:

H3a. The perceived enjoyment of wellness wearables will positively affect customers' perceived value.

H3b. The perceived enjoyment of wellness wearables will positively affect consumers' intention to use wearables.

4.4 Performance Expectancy (PE)

PE has defined as a degree to which an individual believes that using wellness wearables will help him to achieve profits in the life performance [11][12]. Prior researches confirmed perceived usefulness and performance expectancy as key determinants of behavioral intention to adopt new technologies in various context such as IoT [22], [23]. Moreover, many IS scholars supported the potential relationship of perceived usefulness and perceived value [13], [14]. Venkatesh et al. [11] indicated that performance expectancy is the strongest predictor of behavioral intention to use new technology in contrast with perceived usefulness. Thus, this study considered performance expectancy as one of the principal variables of behavioral intention to use wellness wearables and perceived value of wellness wearables. So, the following hypotheses are assumed:

H4a. Performance expectancy of wearables will positively influence the consumers' intention to use

wellness wearables.

H4b. Performance expectancy of wellness wearables will positively influence perceived value of wearables.

4.5 Effort Expectancy (EE)

EE has defined as a degree of ease associated with the use of wellness wearables [12]. Prior studies specified that perceived ease of use and effort expectancy are significant variables of behavioral intention to use new technologies [22], [23]. Researchers claimed that users are willing to adopt smart technologies according to the simplicity of using them [23]. Balaji and Roy [24] indicated that if user perceive smart technology as a device that is easy to use, he/she has more willingness to use and interact with such technology. On the other hand, Kim and his teammates [13] mentioned perceived ease of use as a technicality factor that potentially influences the perceived value of M-Internet users. According to Venkatesh et al. [11], effort expectancy seems to be the most powerful predictor of behavioral intention to accept new technology in contrast with perceived ease of use. So, we consider effort expectancy as an important factor of perceived value and behavioral intention to use wellness wearables. Thus, the following hypothesis is proposed:

H5a. Effort Expectancy is estimated to have a positive impact on perceived value of wellness wearables.

H5b. Effort expectancy is estimated to have a positive impact on intention to use wellness wearables.

4.6 Social Influence (SI)

SI has defined as a degree to which a person perceives that family and friends believe he should use wellness wearables [12]. The relation of social influence and behavioral acceptance of new technology has been determined in prior studies [11], [12]. Researchers have confirmed that the opinion of important people in individuals' life (such as friends and family) positively affects their technology acceptance in sensitive context such as mobile health services [25] and healthcare wearables [4]. Users of wearable devices prefer to accept such devices according to others' opinion because these technologies are totally new for them [4]. So, this study hypothesizes:

H6. Social influence is estimated to have a positive relationship with intention to use smart wellness wearables.

4.7 Facilitating Conditions (FC)

FC has defined as a degree to which an individual perceives that the resources and support are available to use the wellness wearables [12]. Venkatesh and his colleagues [12] indicate that facilitating conditions are the result of internal and external conditions. Internal conditions are the users' opinion about the evaluation of their personal capabilities for doing a particular activity, while external conditions are the users' opinion about the availability of the essential resources for doing a specify activity [25]. Moreover, Venkatesh et al. [12] developed a new relationship between facilitating conditions and behavioral intention to use new technology. Also, many prior studies have determined the significance of facilitating conditions for predicting the behavioral intention of users to accept and use new technology such as Telemedicine [22]. On the other hand, most wearables consumers are using different devices that may affect differently on their intention to use wellness wearables [12]. Thus, the below hypothesis is established:

H7. Facilitating conditions positively affects intention towards using smart wellness wearables.

4.8 Perceived Trust (PT)

PT has defined as a degree to which a person perceives that wellness wearables are secure and trustworthy [26]. The effect of trust-related constructs on behavioral intention were determined as a potential relationship in different context such as mobile banking acceptance [16]. Lunney et al. [27] recommended the investigation of the influence of perceived trust on wearable technology adoption, since they discover a negative correlation between perceived usefulness and unreliable data generated by the wearable devices. Based on the above discussions, this study postulates the following hypothesis:

H8. Perceived trust has a positive influence on the intention of consumers for using wellness wearables.

4.9 Perceived Value (PV)

PV refers to the users' overall evaluation of wellness wearables according to their perception of what is received (Profit) and what is given (Loss) [15]. Previous researches have confirmed that perceived value has a significant effect on intention to use new technologies [13], [14], [20]. Hsu et al. [14] clarified that the IoT users' perceived value has potential effect on behavioral intention to use IoT in the future. So, the following hypothesis is proposed:

H9. The perceived value has a positive correlation with behavioral intention to use wellness wearables.

4.10 Perceived Health Increase (PHI)

Ernst and his teammates [28] defined perceived health increase as a degree to which users believe that using wellness wearables has positive consequences on their health. They identified that perceived health increase has a positive effect on behavioral intention to use fitness trackers. Based on a study carried out by Lamb et al. [29], physical activities could have positive impact on the health of people and self-rating of their health [28]. Fishbein and Ajzen [30], confirmed that individuals' willingness to engage in a particular behavior is based on the outcomes that they assume will be achieved [28], [30]. Individuals may be willing to use wellness wearables if they assume that wearables will improve their current health status [28]. Based on the aforementioned discussion, this study hypothesizes that:

H10. Perceived health increase positively affects the behavioral intention to use wellness wearables.

5. Scale Development

To examine the proposed research model, a quantitative survey was developed including the indicators of constructs engaged in the conceptual model. Almost all indicators were extracted from previous researches which are widely validated in the context of IoT and wireless technologies studies. Just two items, an item of perceived trust and an item of intention to use construct, were created by the authors (see Table 1). Moreover, the authors improved items with minimum correction to fit them in the smart wellness wearables domain. The items of the questionnaire were designed according to the five-point Likert-type scale ranging from 'Strongly Disagree' to 'Strongly Agree'. To be sure that all responses are selected carefully, the below attention-check item was inserted in the middle of the questionnaire: "You should answer strongly disagree to this statement to make sure you read all questions carefully". It is worth mentioning that this study is a small part of a PhD research and the main target population of the research will be Malaysian people. Therefore, a Malay version of the questionnaire was also developed, with the assistance of two senior PhD students from Malaysia. Then, to ensure that the Malay version of the questionnaire accurately reflects the English version, both versions were carefully perused by two senior lecturers at the Faculty of Computing, Universiti Teknologi Malaysia (UTM). Based on their feedbacks, some of the items were amended for clarity

and understandability. In addition, any differences between the two versions were minimized using the back-translation process [31]. To accomplish this, the Malay version of the questionnaire was translated back into English and then compared with the original English version, whereby no considerable discrepancy was found. The English version of the measurement items is presented in Table 1. The Malay version is attainable upon request from the first author.

Table 1. Measurement Items

Constructs	Measurement Items
EE1	Learning how to use wellness wearables is easy for me [12].
EE2	Using wellness wearables does not require a lot of mental and physical efforts [12].
EE3	My interaction with wellness wearables is clear and understandable [12].
EE4	Wellness wearables will be easy to use [12].
EE5	It is easy for me to become skillful at using wellness wearables [12].
PE1	I find wellness wearables useful in my daily life [12].
PE2	Using wellness wearables daily will increase my chances to improve my performance [10].
PE3	Using wellness wearables daily enables me to accomplish tasks more quickly [12].
PE4	Using wellness wearables will increase my productivity in doing daily activities [12].
PE5	Using wellness wearables will increase my chances of achieving things that are important to me [12].
FC1	I have the necessary resources (i.e., smartphone, Internet) to use wellness wearables [12].
FC2	I have the necessary knowledge to use wellness wearables [12].
FC3	If I have difficulty using wellness wearables, there will be some skilled friends to help me [12].
FC4	Wellness wearables are compatible with other tools and technologies that I use [12].
PEJ1	While using wellness wearables, I experience pleasure [14], [32].
PEJ2	I enjoy using wellness wearables [14].
PEJ3	Using wellness wearables is truly fun.
PEJ4	Using wellness wearables would be interesting [33].
PEJ5	Generally, using wellness wearables makes me feel good [32].
PF1	The fee that I have to pay for using wellness wearables is too high [14].
PF2	The fee that I have to pay for using wellness wearables is unreasonable [14].
PF3	Using wellness wearables would be a financial risk for me because of the possibility of higher maintenance and repair costs [32].
PF4	I am not pleased with the fee that I have to pay for using wellness wearables [14].
PP1	I am concerned that wellness wearables collect too much personal information from me [34].
PP2	I am concerned the wellness wearable providers might use my personal information [34].
PP3	I am concerned that wellness wearable providers might share my personal information [34].
PP4	I am concerned that hackers could access my personal information when I use wellness wearables [34].
PP5	Overall, I am concerned about the privacy of my personal information while using wellness wearables [34].
PT1	I believe that wellness wearables are trustworthy [23].
PT2	I believe that wellness wearables provide reliable information [23].
PT3	I can count on wellness wearables to protect my privacy [35].
PT4	Based on my experience, wellness wearables can be counted on as honest devices [36].
PT5	Overall, a wellness wearable can be considered as a safe device. (Self-developed)
PV1	Compared to the efforts I need to put in, using wellness wearables is beneficial to me [13].
PV2	Compared to the time I need to spend, using wellness wearables is worthwhile to me [13].

Constructs	Measurement Items
PV3	A wellness wearable represents good use of my time and money [37].
PV4	The overall value of my experience using wellness wearables is outstanding [37].
PV5	Taking all the pros and cons into consideration, using wellness wearables is beneficial to me [14].
SI1	People who influence my behavior (i.e., family) think that I should use wellness wearables [12].
SI2	People who are important to me (i.e., family, friends) think that I should use wellness wearables [12].
SI3	People, whose opinions I value (i.e., manager, teacher), prefer that I use wellness wearables [12].
SI4	I will use wellness wearables if my friends use them [38].
SI5	I will discuss my feeling when using wellness wearables with family and friends [38].
PHI1	In the near future, I expect to have better health if I use wellness wearables [28].
PHI2	By using wellness wearables, I expect my life to be healthier [28].
PHI3	If I continue to use wellness wearables, I think my health will be better in the future compared to now [28].
IU1	I intend to continue using wellness wearables in the future [12].
IU2	I plan to buy wellness wearables in the future if new versions are released (Self-developed).
IU3	I will always try to use wellness wearables in my daily life [12].
IU4	I am willing to recommend wellness wearables to others [32].

6. Conclusion and Future Work

Recently, wearable technology has started to gain the mass public awareness, but the actual acceptance of the technology is not as high as expected. Moreover, the intention of consumers to continuous use of such devices are decreases day-by-day. So, it is critical for business managers as well as developers to discover the enablers and obstacles of using wellness wearables from the consumers' standpoint. To do this, the present study proposed a unified framework based on the most significant factors that have been highlighted in prior studies. Moreover, this study developed the hypotheses as well as the measurement instrument. As the next step of this study, the reliability and validity of the developed instrument will be examined. Then, the authors will carry out a large-scale survey among wellness wearables' consumers in Malaysia to examine the proposed conceptual model.

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