Exploring the factors affecting behavioral intention to adopt wearable devices

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ABSTRACT

The study explores factors like healthcare, fashionability, ease of use, affecting adoption of wearable devices, with the intent to contribute to the current global health research.

Objective: The objective of this study is to identify the effect of different factors on behavioral intention to adopt wearable device. With regard to the intention to utilize smart wearables, we explicitly proposed a theoretical model based on the task-technology fit (TTF) model, the technology acceptance model (TAM), and external factors.

Methods: Primary data was collected from 139 respondents and structural equation modeling was performed for getting insights regarding intention to adopt wearable devices. SmartPLS software was used to analyse the data.

Results: The hypothesized model explains 76.9 % variance of BI. 73.5 % of PEOU and 79.3 % of PU. Task and technology characteristics explain 88.9% of TTF construct. Connectivity and health care have a significant impact on TTF. TTF model has effect on TAM model leading to Behavioral Intention to adopt smartwatch. In addition, fashionability had a significant effect on BI. However as per study results, perceived privacy did not impact BI.

Conclusions: In conclusion we document that our findings are in consistency with the original TAM and TTF model. Therefore, this provides an opportunity to extend previous findings of users’ adoption. From this study the reliability and validity of integrated models is also verified. Furthermore, the aspects of wearable devices such as fashionability, ease of use, connectivity and healthcare turned out to be significant in the intention to adopt wearable devices.

1. Introduction

Instruments or devices that may be used on the body and are fitted with sensors that can detect numerous physiological variables are known as wearable devices. Watches, bracelets, phones, glasses, hearing aids, belts, shoes, and patches are examples of items that can be worn on the limbs, torso, or head. Numerous physiological indicators, including heart rate, rhythm, blood pressure, oxygen level, skin temperature, steps taken on a daily basis, level of calorie expenditure, blood glucose levels, and UV radiation exposure can all be measured by these devices.1 (see Fig. 1)

It is possible to monitor users’ health parameters, such as elevated heart rate functions, blood pressure, bradycardia, etc. with the aid of data collected from different user segments across the nation. It is also possible to promptly provide feedback to users so they can take appropriate corrective action. Wearable technology has seen a surge in acceptance in recent years, even among socioeconomic groups with middle-to high-income levels. Wearable smartwatches could be viewed as a breakthrough in medical technology. It offers patient monitoring, diagnostic, and therapy help. It can keep a check on physical labor including location and daily step count.2

According to a recent systematic review and meta-analysis of numerous randomized controlled trials, consumer wearable activity trackers (CWAT) can increase physical labor in sedentary older adults who are overweight/obese or have chronic respiratory diseases and lower systolic blood pressure, waist circumference, and low-density cholesterol in people with type 2 diabetes mellitus and cardiovascular diseases.3 According to the data obtained from the Organization for

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Economic Cooperation and Development (OECD) it indicates that healthcare spending as a percentage of gross domestic product (GDP) is at an all-time high, due to both rising spending and a general slowdown in the economy. The purpose of wearable devices is to optimize performance and reduce the risk of illness, damage, and inconvenience by matching the living environment to the physical and cognitive talents and limitations of people with disabilities or diseases. People’s daily activities are becoming more and more intertwined with health motivation.Customers who live a “wellness-oriented” lifestyle are therefore more likely to engage in riskier health choices, such as regular exercise, a healthy diet, and the use of health technologies.

The main goal of this study is to provide predictions about a variety of wearable device user adoption trends. With regard to the intention to utilize smart wearables, we explicitly proposed a theoretical model based on the task-technology fit (TTF) model, the technology acceptance model (TAM), and external factors.

2. Literature review

2.1. TAM model

How users accept and embrace new technologies is described by the technology acceptance model (TAM). TAM was first put out by Davis in 1986 and has since been improved upon and expanded by several scholars. According to TAM, accepting smart wearables and use of technology are mostly influenced by two factors: perceived usefulness and perceived ease of use.

Perceived usefulness refers to how much consumers believe technology will enhance their performance and assist them in achieving their goals. The degree to which consumers perceive technology to be simple to learn and use is referred to as perceived ease of use. According to TAM, these two elements have a significant impact on users’ attitudes and intentions toward using a technology, which in turn determines whether it is adopted and used indefinitely.

According to TAM, technology acceptance is a three-stage process, whereby external factors (wearable device design features) trigger cognitive responses (perceived usefulness and perceived ease of use), which, in turn, form an affective response (behavioral intention), influencing use behaviour of the device.

2.2. TTF model

According to the Task Fit Framework (TTF) idea, task characteristics, and technological attributes work together to create task fit levels, which in turn predict an individual’s performance index and utilization. TTF could be a useful way to assess whether an information system satisfies its consumers’ needs. The Task-Technology Fit (TTF) theory provides a mechanism to gauge a system’s technology’s effectiveness by assessing how well it complements the tasks it is designed to help with. Although the theory is well known and has been used in many contexts, there has not been much done to summarize and synthesize its use in literature. The Task-Technology Fit (TTF) hypothesis, which has been dubbed “one of the most important developments in information system theory,” is one such widely acknowledged approach in information system (IS) research. TTF offers a way to gauge how effective a company’s use of technology is.

2.3. External factors

2.3.1. Perceived ease of use

The behavior of customers and their intention to adopt wireless technology is significantly influenced by both perceived usefulness and perceived simplicity of use. Perceived usefulness is significantly influenced by perceived simplicity of usage. Perceived ease of use is a result of three of the four adoption factor maps for smartwatches, demonstrating that smartwatches prioritize usability, possibly as a result of

![Fig. 1. Hypothesized model.](image-url)
2.3.2. TTF

The primary reason for using TTF theory is because it focuses on utilization as a dependent variable. TTF is used in some information systems studies to measure intentions to use instead of utilization. In order to examine individuals’ behavioral intention to adopt smartwatches for learning activities, TTF factors and the highest quality elements of smartwatches, namely availability and mobility, were used in recent researches. The Task Fit Framework (TTF) concept states that task features and technology characteristics combine to produce task fit constructs, which eventually forecast the performance and utilization of an individual. TTF could be a helpful method for determining whether an information system fulfills the needs of its users.

2.3.3. Communication

The ability to respond to text messages, take calls, use applications, and get notifications without ever touching or looking at ones smartphone has revolutionized the way we communicate. Wearables are facilitating a new kind of social interaction by allowing people to support one another via their smartwatches. Current smartwatches allow users to exchange activities or fitness goals.

2.3.4. Connectivity

Wearable products represent computing devices with advanced communications and electronics technologies that may be worn by people, allowing users to engage with smart platforms. Furthermore, wearable devices, particularly smart watches, are receiving considerable focus and large funding from major smartphone companies, demonstrating the new era of smartwatches.

2.3.5. Healthcare

Numerous health indicators, such as blood pressure, oxygen saturation, heartbeat, pulse, sleep schedule, and Basal Metabolic Rate, may be monitored by it. It can also be used as a reminder for daily activities such as exercising and taking medications. It can monitor physical activity, such as daily step counters and location. Smartwatches can identify early signs of illness by monitoring variations in blood pressure and temperature of the skin, both of which rise while the body’s immune system is fighting an infection. Some studies suggest that the technology may be able to detect alterations that are early warning symptoms of diseases like cancer.

Wearable technology has a lot of potential advantages for seniors, however, this group adopts these technologies at a relatively slow rate. Therefore, it is crucial to understand the factors that restrict seniors to use smart wearables. The degree of subjective well-being of seniors, however, this group adopts these technologies at a relatively slow rate. Therefore, it is crucial to understand the factors that restrict seniors to use smart wearables. The degree of subjective well-being of seniors determines how cognitive age affects their use intentions. Gender, smart device use, and the need for medical attention are individual characteristics that have an impact on psychological perception and user attitudes.

2.3.6. Fashionability

Among the different wearable form factors, smartwatches have emerged as a crucial entry point for the widespread use of wearable technology. Smartwatches are a brand-new IT product as well as fashion item. The current study investigates whether elements pertinent to the characteristics of fashion items affect consumers’ intentions to use smartwatch in light of the fact that the smartwatch represents the meeting point of IT innovation and fashion. The current study expanded the technology acceptance model (TAM), which it used as its foundation, by adding fashionability, which is influenced by a person’s vanity and demand for uniqueness.

2.3.7. Perceived usefulness

The decreased use of smartwatches is sometimes caused by technological problems, which is why they do not offer a “life-changing experience.” Smartwatches are also productive and educational. The lives of users need to be improved by the inspirational applications that developers make. Marketers should adapt their marketing methods to this positive news item as smartwatches make lifestyle modifications easier. The enormous benefits associated with the use of smartwatches are what appeal to potential customers to turn up into actual customers.

2.3.8. Perceived privacy

Wearable technology tracks and monitors physical activity and has many advantages, including raising self-awareness and encouraging healthy behaviors. Wearables, however, can present privacy hazards related to the self-disclosure of sensitive personal information. Self-tracking, or the process of self-quantifying one’s health and well-being via mobile applications and wearable technology, is increasingly helping people develop their sense of self and providing health and wellness services. Nevertheless, the ongoing collection of detailed health data poses fresh difficulties for informational privacy.

3. Research model and hypotheses

3.1. Research model

Figure illustrates the proposed research model in this study. As discussed, the model is constructed from a combination of the TAM and the TTF models. Moreover, we incorporate additional external factors to extend the original model. A total of 10 hypotheses are proposed based on the literature review.

3.2. Hypotheses

3.2.1. Relationship between communication and task-technology fitness, connectivity and task-technology fitness

The majority of the studies have concluded that task characteristics and technology characteristics have a positive relationship. Therefore, we hypothesize that individuals with a higher expectation level of task and technology characteristics are more likely to have more positive opinions of the TTF. Based on these perspectives, we formulated the following hypothesis.

H1. Communication task characteristics have a positive effect on TTF.
H2. Connectivity task characteristics have a positive effect on TTF.
H3. Healthcare task characteristics have a positive effect on TTF.
H4. Task-technology fit is used as the theoretical foundation for user evaluation of electronic health record systems. The task-technology fit instrument is validated by analysis of the results, which supports task-technology fit as a model for forecasting performance impact in a healthcare setting. Based on the observation, we formulated the following hypothesis.

H5. Task-technology fitness has a positive effect on PU.
H6. Task-technology fitness has a positive effect on PEOU.
H7. Relationship between perceived ease of use and behavioral intention

Numerous research studies have shown that PU and PEOU positively affect BI, even if the significance levels vary, as was previously mentioned. Therefore, we formulated the following hypotheses.
H6. Perceived ease of use has a positive effect on behavioral intention.

3.2.5. Relationship between perceived ease of use and perceived usefulness, perceived usefulness and behavioral intention

Based on the previous findings, perceived ease of use is related to usefulness and behavioral intention. Therefore, we formulated the following hypotheses.

H7. Perceived ease of use has a positive effect on perceived usefulness.

H8. Perceived usefulness has a positive effect on behavioral intention.

3.2.6. Relationship between perceived privacy and behavioral intention

Numerous studies have discovered that a user’s perception of the level of information protection affects their conduct in a positive way. Therefore, the following hypothesis is made:

H9. Perceived privacy has a positive effect on behavioral intention.

3.2.7. Relationship between fashionability and behavioral intention

It is generally known how emotions function in hedonic service contexts, but little is known about how they function in utilitarian service contexts. Limited literature is available on the effects of external characteristics of wearable devices on behavioral intention to adopt it, this study aims to close this knowledge gap. Recent research has displayed a correlation between the two. Based on these, we formulated the following hypothesis.

H10. Fashionability has a positive effect on behavioral intention.

4. Result

4.1. Measurement model

A measurement model must be assessed before a structural model is examined. A measurement model can be assessed based on internal consistency, convergent and discriminant validities. Cronbach’s alpha was used to verify the internal consistency; a value of 0.7 or higher is recommended. Furthermore, item loadings are recommended to exceed 0.6 and the composite reliability (CR) values are recommended to exceed 0.7. The average variance extracted (AVE) value for each latent variable should exceed 0.5. Table 1 displays all item loadings, Cronbach’s alpha, CR, and AVE Results. As indicated in Table 1 all the constructs meet the threshold value and hence, the measurement model is significant and the criteria for reliability and validity are met (see Table 2).

Path Analysis is performed to understand the effects of different constructs on behavior intention. Path analyses help in understanding which construct has a greater effect.

The hypothesized model explains 76.9 % variance of BI. 73.5 % of PEOU and 79.3 % of PU. Task and technology characteristics explain 88.9% of TTF construct. All hypotheses were verified except H1, H7, and H9. Connectivity and health care have a significant impact on TTF. TTF model has effect on TAM model leading to Behavioral Intention to adopt smartwatches. In addition, fashionability had a significant effect on BI. However as per study results, perceived privacy did not impact BI.

5. Discussion and conclusion

The premise of the study was to better understand the early phases of wearable device adoption. For the study, a comprehensive model of the TAM and TTF was adopted and extended by including other latent variables grouped into three categories viz., task and technological characteristics, perceived privacy, and fashionability. These variables were proposed in order to have a better knowledge of user behavior. A survey was performed to gather user feedback and the research model was statistically evaluated.

The data analysis yielded significant findings. First, in the TAM construct, PEOU had a stronger effect on BI than PU. Further, PU did not mediate the link between BI and PEOU. From the results it is significant that user expectations regarding variable devices depend on how easy a device is to use rather than the usefulness of that particular device. This might be because users are already using gadgets like mobiles and laptops and these devices are providing similar benefits in comparison to a smart watch. Hence, the BI to adopt a smartwatch comes more from its PEOU. Wearable device manufacturing companies may focus more on

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Path analysis</th>
<th>B value</th>
<th>Significance</th>
<th>Supported</th>
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<tbody>
<tr>
<td>H1 Communication &gt; TTF</td>
<td>0.073</td>
<td>0.205</td>
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<tr>
<td>H2 Connectivity &gt; TTF</td>
<td>0.522</td>
<td>*</td>
<td>Supported</td>
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<tr>
<td>H3 Healthcare &gt; TTF</td>
<td>0.400</td>
<td>*</td>
<td>Supported</td>
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<tr>
<td>H4 TTF &gt; PEOU</td>
<td>0.768</td>
<td>*</td>
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<td></td>
</tr>
<tr>
<td>H5 TTF &gt; PU</td>
<td>0.859</td>
<td>*</td>
<td>Supported</td>
<td></td>
</tr>
<tr>
<td>H6 PEOU &gt; BI</td>
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</tr>
<tr>
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<td>H9 Perceived Privacy &gt; BI</td>
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<td>0.811</td>
<td>Not supported (as p value is greater than 0.05)</td>
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</tr>
<tr>
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<td>0.200</td>
<td>0.020</td>
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</table>
ease of use, to gain a competitive advantage. Further, we also document that task technology fit is associated with PEOU and PU. These results are in corroboration with earlier literature.

If we look at R square results, the construct TTF model 89.2% of the variance is explained by connectivity, communication, and healthcare. And among these factors’ communication was not a significant predictor of TTF. This might be because mobile phones are popularly used for the purpose of communication. Bluetooth connectivity is essential for smartwatch functioning. Hence it is a significant factor. Also, Healthcare factors have a significant impact on BI, as per the results of this study. This was also brought out in recent research work in which the discussion was not only the utilitarian characteristics of wearable devices but also their health-protective dimensions, which have become crucial in times of life-threatening situations such as the COVID-19 pandemic. The findings indicate that there is a significant impact of both the protective and utilitarian dimensions on BI to use of such devices.

Furthermore, fashionability and perceived privacy have a 77.7% impact on BI. Fashionability, that is the look and appeal of the product plays a significant role in the adoption of the device. Recent research has also shown that visual appeal is an important factor while deciding to adopt wearable devices. Wearable devices are in the early stages of adoption, and aesthetic and visual appeal can be considered as an important basis for consumer decision-making. According to the research of Jeeyeon et al., wearable devices are a fashion product, their exquisite appearance, and their unique design structure increase users’ intentions to adopt.

Unexpectedly perceived privacy is not significant to BI. There can be two reasons for this kind of outcome. Either users believe that all companies are taking care of privacy issues, or they are not worried about sharing the kind of data that wearable devices have. There is a scope for further research to explore the perceived privacy factors related to wearable devices. This may open new dimensions about how privacy is perceived by the users. As the market of wearable devices is growing at a faster rate, there is a need to explore this dimension further.

In conclusion the proposed research model provides implications to the academic fraternity and industry. This study provides several implications to business practitioners like designers and marketers. Since, the market of wearable devices is still at a nascent stage, practitioners have relatively less knowledge about the factors that impact consumers’ attitude towards adopting smart wearable devices as compared to their reaction towards other mature information technologies. The proposed research framework and the findings along with linked generalisations offer firms an overview of what types of, how and under which conditions, different factors are important to wearable technology adoption.

From this study, the reliability and validity of integrated models is also verified. Further, the aspects of wearable devices such as fashionability and perceived privacy are explored. This is comprehensive research on the factors such as TTF, perceived privacy, and fashionability that promote understanding of the adoption of wearable devices. The study also found that healthcare management plays a significant role in the adoption and acceptance of wearable devices. We expect that this finding will provide significant information for researchers as well as manufacturers related to the subject of wearable devices.

6. Limitations of the study and scope of further research

The generalization of the research can be an issue as participants were not operating under control. The study has considered factors search as TTF and fashionability as an external factor. Future studies can consider other factors also, such as perceived privacy can be explored as a variable in TTF and TAM model.

Ethics approval

A verbal informed consent was obtained from the respondents of the questionnaire. Since the information provided by them was not sensitive in nature with respect to their personal or financial privacy, a written consent was not needed.

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Author contributions


Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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