FUSING TECHNOLOGY, STYLE, AND HEALTH: INVESTIGATING FACTORS DRIVING CONTINUED USE OF SMARTWATCHES

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ABSTRACT

Currently, smartwatch is one of the most popular wearable devices which combines technology with style and health. Recognizing the aforementioned statement and building upon technology adoption model and innovation diffusion theory, the study proposes a model of smartwatch adoption by identifying the relative importance of factors affecting the attitude towards using and purchasing it. Primary data for the study has been collected using an online questionnaire from 318 respondents pertaining to different dimensions identified from review of literature. Findings suggest that the independent variables have disparate influence on attitude and purchase intentions. For instance, the perceived enjoyment and perceived health benefits constructs impacts both attitude and purchase intentions, whereas aesthetic value and perceived ease of use only impact attitude whereas perceived usefulness only impacts purchase intentions. The model's fit indices suggest that the model fits the data well.

Keywords: Smartwatch; Perceived Enjoyment; Aesthetic Value; Perceived Ease of Use; Perceived Health Benefits; Perceived usefulness; Attitude; Purchase Intention.

INTRODUCTION

Wearable devices which in recent years have gained huge popularity especially among the youth, are electronic devices used by individuals in the form of accessories or clothing such as smart shoes, smart pants, smart bracelets, smartwatch, smart glasses etc. According to a report by Businesswire (2022), the global wearable market, which was estimated at US$62.11 billion in 2021, is anticipated to cross US$145.49 billion in year 2027.These devices are programmed to record and analyze various health and fitness parameters and provide real-time statistics pertaining to different activities undertaken. They can also be used as smart phone for dialing and picking calls, locating places using maps etc. Since the genesis of wearable devices in 1960's, a lot has changed in terms of their technology, features, usability, and acceptance. The first wearable device was a four-button computer that could fit into a shoe or could be worn on the wrist. In 1977 the first heart rate monitor was invented and used by sportspersons. In the early 2010s, smartwatches were introduced which resulted in a tangential change in the wearable technology marketplace. Many vendors, such as Apple, Samsung, Google, Garmin ventured into this segment and later these watches were tuned with mobile phones and therefore offered a multitude of features like message/ whatsapp alerts, GPS, and music.

Nowadays smartwatches have become really smart. this can be attributed to multiple continuous innovations and advancements in technology. Discovery and ground-breaking innovation in area of sensors and wireless technologies have enabled smartwatches to continuously measure various health-related parameters viz. heart rate, number of steps taken, calories burnt and send these parameters to attached mobile phones for user to monitor and save. Apart from this, most smartwatches enable the wearer to listen music online, receive/ send messages, fix and track their fitness goals, connect with like-minded people in addition to maintaining time and monitoring water intake. With numerous applications which promotes awareness and motivates the wearer to maintain a healthy lifestyle especially after Covid-19,

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the smartwatch is here to stay and have a growing userbase. Apart from promoting a healthy lifestyle, smartwatch has also become a fashion accessory as it comes in multiple designs and colors to attract people from all age groups. It is indeed a beautiful marriage of technology with style. Multiple companies have ventured into the wearables market, some prominent ones are Google, Apple Samsung, Xiaomi, Huawei, Garmin and Fitbit.

According to a report by Grand view research (2019), the compound annual growth rate (CAGR) of global smartwatch market is predicted to increase at a rate of 8.2 % during 2022 to 2030. The post-Covid era is witnessing a sudden surge in adoption of devices that monitor health and have fitness tracking features. Thus, manufacturers have introduced a multitude of cutting-edge features for monitoring health such as SpO2 sensors, stress level detection, electrocardiograms, calorie intake, water intake etc. in smartwatches. The report by Grand view research (2019) also suggests that the share of smartwatches in overall wearable device segment accounted for more than 49.45% of the total revenue. Amidst this continued surge in sale of smartwatches is it important to understand the key drivers in their mass adoption. While multiple studies have focussed on description, concepts, challenges, and advantages of smartwatches in areas of fitness and healthcare, very few empirical research have been undertaken that focus on key factors that have led to their adoption. Therefore, like any other consumable product, it is pivotal to study the perceptions of customers of smartwatches from both technological and humane aspects, especially when innovation in smartwatches is in its nascent stage.

The study makes significant contribution to existing body of literatures in many aspects. Firstly, by providing the key drivers that impact the user's attitude towards using and purchasing a smartwatch. Secondly, identifying the relative importance of these drivers would help understand which features to focus more on. Thirdly the findings of the study can be used by smartwatch manufacturers to better understand customers needs and expectations while designing subsequent versions of smartwatch devices to increase their acceptance, popularity, and sales.

Theories of Technology Adoption and Literature Review

The existing study is based on two well-researched frameworks on adoption of technology: Technology Acceptance Model (TAM) and Innovation Diffusion Theory (IDT).

Theoretical Background

TAM developed by Davis in 1989 remains as one of the most popular models of technology adoption till date that highlights users' decision-making process when considering adoption of a new technology (Davis, Bagozzi, & Warshaw, 1989). The model demonstrates the role of perceived usefulness and perceived ease of use in determining an individual's motive to engage with technology. Perceived usefulness indicates the extent of positive impact using a particular technology has on the way they do their job while, perceived ease of use shows the extent to which a user finds technology engaging, interesting and user-friendly (Davis, Bagozzi, & Warshaw, 1989). TAM has varied applications in numerous fields, including information systems, finance, human resources and marketing, to predict the acceptance and usage of technologies in the form or software, hardware, websites, mobile applications etc. (Almaiah et al., 2022; An et al., 2023; Hanum et al., 2023; Kim & Shin, 2015; Na et al., 2022; Sahi & Madan, 2015). Therefore, for the current study on acceptance of smartwatches, the latent variables of TAM, i.e., perceived ease of use and perceived usefulness, seem to be very pertinent and pivotal.

Innovation Diffusion Theory (IDT) of Individual Adoption is a social science theory that traces the spread of new ideas and proposes at five-stage process of technology acceptance

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entailing knowledge, persuasion, decision, implementation, and confirmation (Rogers & Cartano, 1962). IDT postulates that adoption decision pertaining to an innovation is affected by evaluation of multiple characteristics of the said innovation. IDT has been used in varied areas of research, including adoption of Artificial Intelligence in education, hospitality and tourism, finance, energy, digital farming technologies, healthcare among others (Almaiah et al., 2022; Cirus & Simonva, 2020; Huang et al., 2022; Shang et al., 2021; Yuen et al., 2021).

Research on Factors Influencing Smartwatch Adoption

While TAM and IDT have been applied in multiple areas pertaining to adoption of new technologies, research in wearable technology is limited. This section gives an overview of the research done in the area till date.

Kim and Shin (2015) applied TAM to illustrate continuance intentions among users of smartwatches and identified appeal and price of the watch as significant enablers of intention. While the research delves into providing insights about wearable technology, it has certain limitations. For instance, the study primarily focuses on current users thereby neglecting the adoption intention of potential users. Additionally, while the sample population in the study consists of a large number of working professionals, the authors fail to do justice to job-related measures (e.g., "smartwatch helps me in doing my job more effectively" or "smartwatch has significantly improved the quality of my work"). Wu et al. (2016) apply IDT, TAM and the unified theory of acceptance and use of technology (UTAUT) to study the customer intentions to use a smartwatch in Taiwan. They additionally focus on perceived enjoyment and posit that people in the age group of 35 to 55 show a great interest for enjoyment in their use of smartwatch. Further they point out that attitude positively influences the intention to use a smartwatch, while ease of use is not significant but considered as hygiene factor. Gender of the user was also found to be insignificant while determining attitude towards using a smartwatch.
Chuah et al. (2016) study adoption related to smart wearables with special reference to smart glasses from technological and fashion aspects. They coin a term "fashionology" thereby indicating an amalgam of technology and fashion. According to their findings a majority of their sample subjects perceive smart glasses as a fashionlogy product which satisfies their technological as well as fashion needs. While their study provides a unique perspective to overall adoption research, it has certain challenges. The study uses several single item measures raising the question of coverage of other constructs. Adapa et al. (2018) extend the research of Chuah et al. (2016) and study the adoption of google glasses and smartwatch and posit that while look and feel of the smart glasses was a significant predictor, accessibility of fitness apps and its waterproof feature were significant for the smartwatch.

Hsiao & Chen (2018) based their research on theory of reasoned action and study the value a smartwatch from software, hardware, and aesthetic design perspectives and explore the factors that influence people's decision to buy a smartwatch. Their model suggests that the attitude towards using smartwatches had most significant effect on purchase intention, further they suggest that as watch is a popular fashion accessory, and thus its user-friendly design is also an important determinant of its usage and purchase. Sabbir et al. (2020) study intention to use smartwatches among consumers in Bangladesh. Their study extends the TAM and incorporates additional constructs of aesthetic appeal, perceived enjoyment, fashion-related factors, and health related factors. Emulating the results of Hsiao & Chen (2018), their study also finds attitude as having a strong effect on intention to purchase smartwatches.

Siepmann & Kowalczuk (2021) apply self-determination theory which is a basic theory for motivation in human beings and add emotional and health related factors to understand continued usage of smartwatches. Their results prove the importance of self-quantification in explaining goal pursuit motivation which is a part of health and fitness factors. Their study

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underlines that intention to use a smartwatch is not only impacted by hedonic, but also by utilitarian aspects. Saygili & Yalçıntekin (2021) focus their study on two consequent factors namely "willingness to pay a price premium" (WTP) and repurchase intention (RI), customer satisfaction (CS) as a mediating factor and two antecedent factors namely hedonic value (HV), utilitarian value (UV) with respect to smartwatches. Their findings show strong that HV and UV significantly impact customer satisfaction which also positively influences WTP and RI.

Elnagar et al. (2022) studied the usage of smartwatches in the domain of medicine with an aim to improve the role of doctors and make health records of patients easily accessible to doctors. They reveal that a satisfied user is more likely to adopt a medical smartwatch. Further, their study suggests that innovativeness and richness of content increase perceived usefulness. Almarzouqi et al. (2022) also study factors that impact smartwatch usage in the medical area by using TAM and additionally use flow experience variable to measure the efficacy of the smartwatch. Their research demonstrates that satisfaction, PEU, PU and flow experience highly impact the usage intentions towards smartwatches.

Hypothesis Development

The framework includes five independent factors namely perceived ease of use and perceived usefulness that are rooted in the TAM framework, aesthetic value, perceived enjoyment and perceived health benefits and two dependent factors namely attitude towards using smartwatches and intention to purchase it. This section contains the hypothesis and relate these antecedent variables with the consequent variables.

As discussed above, the current model draws Perceived usefulness and Perceived ease of use from the TAM framework, which was effectively applied in the area of smartwatch adoption (Almarzouqi et al., 2022; Kim & Shin, 2015; Chuah et al., 2016; Sabbir et al., 2020; Wu et al., 2016). TAM defines PU in a job-related setting with precise expectations to be accomplished. In the present study, PU is studied in the context of smartwatches and indicates the how useful a particular technology is to a user and how positive an impact it has on the way they do their job. The other construct of TAM, ease of use shows the extent to which a user finds technology engaging, interesting and user-friendly (Davis, 1989). Especially in context of using new technology, perceived ease of use becomes the main factor influencing users' attitude towards that technology. Several earlier studies (e.g., Kim and Shin, 2015; Sabbir et al., 2020; Wu et al., 2016) also reported that perceived ease and perceived usefulness were found to positively impact the attitude. In line with previous TAM research, following hypothesis are proposed:

H1. Perceived usefulness is positively related to attitude towards using smartwatches.

H2. Perceived usefulness is positively related to purchase intention towards smartwatches.

H3. Perceived ease of use is positively related to attitude towards using smartwatches.

H4. Perceived ease of use is positively related to purchase intention towards smartwatches.

Aesthetic value refers to the value the product possesses to please and appeal to the eye of the user. Many studies (Cyr et al., 2006; Hsiao and Chen, 2018; Nanda et al., 2013; Sabbir et al., 2020) have suggested that aesthetic values of smartwatch positively influences the wearers' attitude toward using smartwatches. The current study defines aesthetic value as a way in which the design, color, and fit of the product create an overall attractive appeal in the mind of users as many people perceive a smartwatch as a symbol of style and fashion as well. Studies such as (Hsiao and Chen, 2018; Nanda et al., 2013; Sabbir et al., 2020) suggest that overall aesthetic appeal of a smartwatch positively impacts and enhances consumers' adoption intention.

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Therefore, the following hypothesis is proposed:

H5. Aesthetic value of a smartwatch is positively related to attitude towards using it.

H6. Aesthetic value of a smartwatch is positively related to purchase intention towards it.

Perceived enjoyment indicates how much a user enjoys using and engages with his/her smartwatch. For smartwatches, perceived enjoyment can be pivotal in ascertaining the attitude of the user. A smartwatch with which user experiences enjoyment is most definitely expected to be purchased and used regularly. This may also motivate the user to spread positive word-of-mouth and engage in repeat purchases. Prior research has also demonstrated that enjoyment with technology positively influences the attitude towards using it and purchase intention (Choi and Kim, 2016; Davis et al., 1992; Sabbir et al., 2020; Wu et al., 2016). Thus, it is hypothesized that:

H7. Perceived enjoyment from a smartwatch positively relates to attitude towards using it.

H8. Perceived enjoyment from a smartwatch positively relates to purchase intention towards it.

Perceived health benefits in the current study indicate the extent to which an individual thinks that using a smartwatch might impact their health positively. Dehghani et al. (2018) call this health motivation and while coining the term 'healthology' defined it as a component integrating health monitoring features in a technology thus enabling people to monitor their health more conveniently. Nwosu et al. (2018) and Canhoto and Arp (2017) suggest that management of health of human beings can be controlled by wearable devices. Post Covid-19, people have come to realize the importance of health and any wearable device that promotes a healthy lifestyle and helps them to monitor various health parameters such as SPO2 level, blood pressure, heart rate, sleep patterns are seen not as an expenditure but as an investment into one's health. In fact, smartwatch manufacturers are focusing on health while marketing their product. Therefore, following Dehghani et al. (2018) and Sabbir et al. (2020), following hypothesis are proposed:

H9. Perceived health benefit from smartwatch positively relates to attitude towards using it.

H10. Perceived health benefit from smartwatch positively relates to purchase intention towards it.

Purchase intention in the study refers to one's likelihood to purchase a smartwatch. According to multiple studies based on TAM, attitude, resulting in individual's positive or negative evaluation of a technology is an important determinant of intention (Davis et al., 1989; Park and Chen, 2007). In context of smartwatches, prior research has also illustrated that attitude positively relates to adoption intention (Choi and Kim, 2016; Hsiao and Chen, 2018; Wu et al., 2016). Therefore, the following is hypothesized:

H11. Attitude towards using a smartwatch positively affects the intention to purchase it.

The above hypotheses are graphically presented in Figure 1 that consists of five antecedent and two consequent variables. The relationship between these variables is studied in this section.

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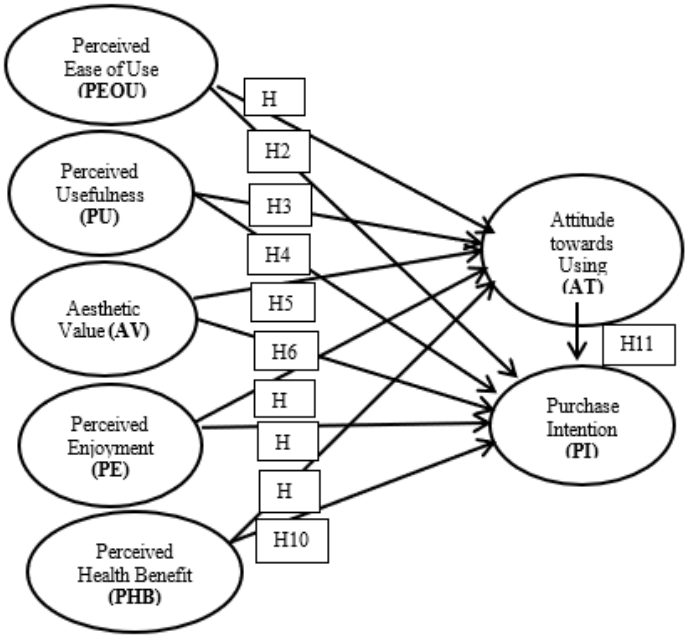

FIGURE 1
MODEL OF SMARTWATCH ADOPTION

Research Methods

Both primary and secondary data sources have been utilized for the present study. Primary data has been collected using a questionnaire having 21 items that were borrowed from past research and were altered to suit the study pertaining to attitude towards using and intention of purchasing smartwatches. To measure the items, a five-point Likert scale has been used that ranges from "strongly agree" (5) to "strongly disagree" (1). In totality 330 surveys were filled by the participants over a period of four weeks.

Out of these 12 invalid responses were removed and therefore 318 usable surveys provide data for analysis. In the sample, 168 respondents (52.7%) were males, and 150 respondents (47.3%) were females. Most of the respondents were aged 30 and younger (38.8%), followed by 30-40 (28.6%), 40 to 50 (21.6%), and (11%) in the age group of 50 and above. From the point of view of descriptive statistics, the mean value of all constructs was greater than 3.6 and standard deviation was less than 0.9 signifying high level of agreement between the variables.

Results

This section of the study has been broken down into three parts; the first part describes the reliability and validity statistics for each latent variable. In the second part, the hypotheses formulated above are tested and in the last part discusses the finding of complete structural equation model.

Reliability and Validity of Constructs

Cronbach's alpha statistic is used to measure the reliability and validity of each construct. A value of alpha greater than 0.7 indicates acceptable reliability level. Table 1 shows all the seven constructs along with their measured variables, their mean, and standard deviation. Researchers have advocated that to ascertain the validity and reliability of constructs, it is imperative to see that the composite reliability is more than 0.7 and average variance extracted

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of each construct is more than 0.5 (Fornell and Larcker, 1981; Hair et al., 2006) As depicted in Table 1, the values of Cronbach alpha, AVE and CR overtake their threshold limits.

Confirmatory factor analysis and correlation statistics

Once the construct reliability and validity has been established, it is paramount to understand the relationship between a construct and its items. To achieve this, the task confirmatory factor analysis (CFA) is performed. Figure 2 shows the results of CFA and table 1 highlights the correlation statistics of all seven constructs. Results illustrate the validity of all constructs and their related items. CFI and RMSEA statistics are 0.94 and 0.07 which are in line with acceptable standards (Hu and Bentler, 1999).

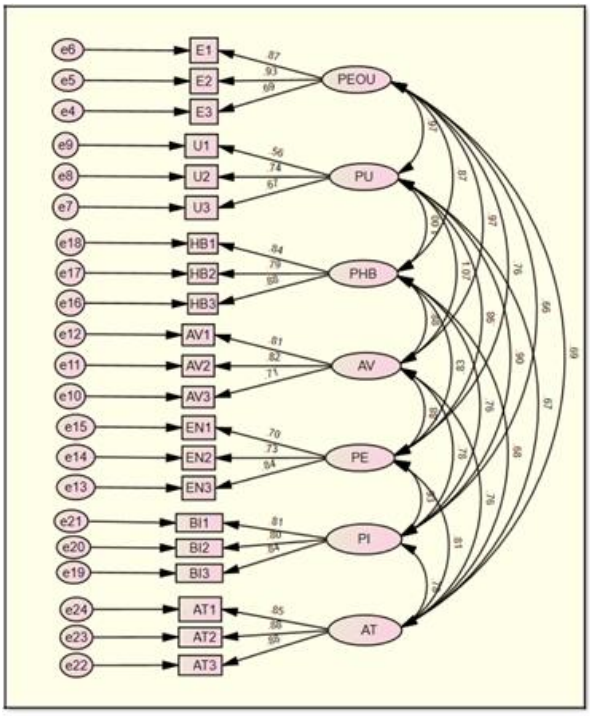

FIGURE 2
CONFIRMATORY FACTOR ANALYSIS

Table 1
PEARSON CORRELATION VALUES

Constructs	PEOU	PU	AV	PHB	PE	AT	PI
PEOU	1	0.97**	0.975**	0.872**	0.756**	0.688**	0.658**
PU		1	0.750**	0.67**	0.650**	0.67**	0.899**
AV			1	0.876**	0.883**	0.760**	0.782**
PHB				1	0.825**	0.678**	0.765**
PE					1	0.812**	0.934**
AT						1	0.778**
PI							1

Note: **Significant at p<0.01.

Hypothesis Testing

Results of hypothesis testing done using SEM are depicted in Table 2. The table also depicts other relevant data such as standardized and unstandardized regression coefficients (SRC and URC), critical ratio (CR) and squared multiple correlation (SMC). It can be observed

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that p values of all eleven hypotheses are accepted with substantial confidence.

Table 3
HYPOTHESIS TESTING RESULTS

Hypothesis	Dependent Construct	Independent Construct	URC	SRC	SMC (%)	CR	Hypothesis Supported?
H1	AT	PEOU	0.697	0.70	49%	10.908*	Yes
H2	PI	PEOU	0.995	0.64	41%	7.423*	Yes
H3	AT	PU	1.103	0.74	55%	6.462*	Yes
H4	PI	PU	1.217	0.96	92%	9.970*	Yes
H5	AT	AV	.961	0.81	66%	10.443*	Yes
H6	PI	AV	1.092	0.77	59%	8.44*	Yes
H7	AT	PE	1.082	0.76	59%	8.149*	Yes
H8	PI	PE	1.243	0.94	87%	10.912*	Yes
H9	AT	PHB	.606	0.68	46%	9.747*	Yes
H10	PI	PHB	.775	0.76	57%	10.500*	Yes
H11	PI	AT	.804	0.78	61%	8.060*	Yes

Note: *Significant at p<0.001.

It can be observed from table 3 that in determining attitude towards using a smartwatch while all the five constructs are important, perceived enjoyment is most important (SRC= 0.81). On the other hand, in determining purchasing intention, perceived usefulness (SRC= 0.96) followed by perceived enjoyment is most important (SRC= 0.94).

Model Testing using SEM

After individually testing each hypothesis, it is paramount that the model be tested as a whole. The overall structural equation model is shown in Figure 3. Table 4 highlights the standardized and un-standardized regression estimates, standard error and critical ratio of the entire model as opposed to table 3 which shows similar statistics albeit in the presence of one antecedent and one consequent variable. When tested as a whole, the impact of certain antecedent variables on consequent variables may decrease due to the presence of other independent variables. This may be caused due to the moderation effect of other independent variable(s). To aid proper understanding, the results have been divided into two sections based on the two dependent variables namely attitude towards using and purchase intention.

It is evident from table 3 that all independent variables have a strong positive effect on attitude towards using a smartwatch with aesthetic value being the highest (0.81, p<0.001) followed by perceived enjoyment (0.76, p<0.001). However, while testing the complete model it can be observed from figure 3 and table 4 that in presence of other strongly impacting variables, the impact of perceived health benefits has decreased significantly (from 0.68 to 0.193). Further, the impact of perceived usefulness on attitude has gone from positive to negative (0.74 to -0.45) indicating that in presence of other variables, PU negatively impacts attitude towards using a smartwatch. It can also be stated that the aesthetic value (0.52, p<0.001) and perceived enjoyment (0.46, p<0.001) still play a very important role in determining the attitude towards using a smartwatch.

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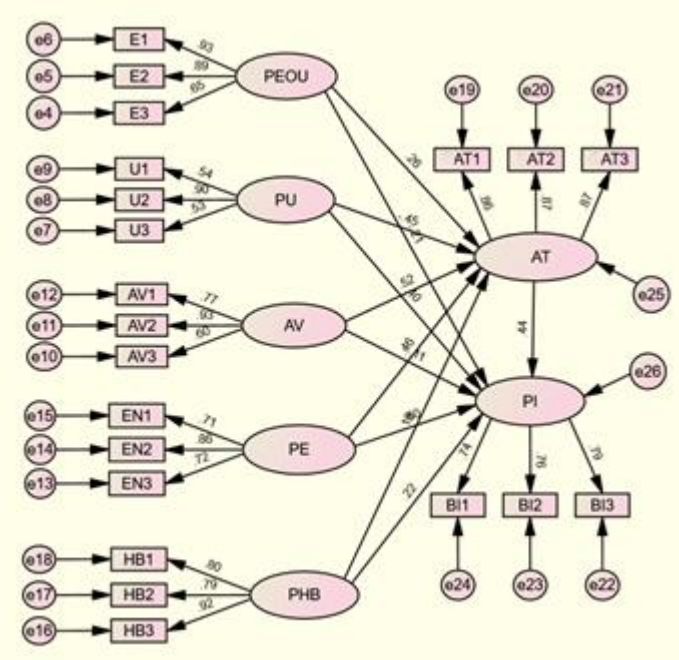

FIGURE 3
GRAPHICAL REPRESENTATION OF THE MODEL

Further, in determining purchase intention, from table 3 it can be inferred that all independent variables as well as attitude towards using the smartwatch contribute significantly. Amongst all variables perceived usefulness (0.96, p<0.001) and perceived enjoyment (0.94, p<0.001) contribute most substantially. Following the pattern of first dependent variable from figure 3 it can be inferred that in presence of other variables, perceived ease of use and aesthetic value no longer influence purchase intention in the present context. On the other hand, perceived enjoyment (0.597, p<0.001), attitude towards using (0.437, p<0.001) and perceived usefulness (0.404, p<0.001) positively influence an individual's intention to purchase a smartwatch. To determine the fitness of the structural model the normed chi-square statistic which is 2.94 in the present study should ideally be less than 5 as suggested by (Schumacker & Lomax, 2004). The Comparative Fit Index (CFI) is 0.908, and the Root Mean Square Error of Approximation (RMSEA) is 0.068 which are within acceptable levels of 0.90 and between permissible range of 0.05 and 0.08 (Hair et al. 1998) respectively, hence the model seems to be fit. The model fit statistics are shown below Table 4.

Table 4
MODEL FIT STATISTICS

Model	**Normed Chi Square**	**CFI**	**NFI**	**TLI**	**RMSEA**	**LO**	**HI 90**
Fit	**(CMIN/df)**					**90**	
Statistic	2.94	0.908	0.88	0.95	0.068	0.06	0.08

Limitations

The current study provides many meaningful insights researchers, smartwatch manufacturers and smartwatch designers and highlights important constructs that influence the attitude towards using and purchasing a smartwatch. However, this study is subject to certain limitations. The study focused solely on one product i.e., smartwatch, future studies can focus on other wearable devices as well and provide a comparative analysis according to each device. Another important extension could be to undertake a longitudinal study to understand how the importance of independent variables may impact the two consequent constructs i.e. attitude

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towards using and the intention to buy smartwatch over time. For instance, one of the aftermaths of covid has been an increased awareness towards health which was perhaps not as important before as it is presently. Furthermore, the inclusion of age, income, technological know-how, and technological exposure as moderating factors in the current model could add several new and interesting findings. The data for the current research originates from Indian audience only, therefore, represents the views and ideas of Indian audience. Replicating this study to a different audience might provide different results. Although the questionnaire which was used to collect the data was tested both for internal as well as external validity, the method as such might inherently bring in users' bias. Further, the questions in the questionnaire have room for improvement and can be made more contextual and relevant in future studies.

CONCLUSION

The study has added value to the area of adoption of smartwatches by studying both functional as well as hedonic aspects of a smartwatch. All seven constructs of the model were found to be reliable after checking for both internal consistency and convergent validity. The CFI, NFI and RMSEA values of the model were reported to be better than the acceptable values. Strong correlations were found between PEOU and PU and AV, PU and PI and AT, and PE and AT. Perceived Aesthetic Value and Perceived enjoyment from smartwatches were shown to have a strong positive effect on Attitude towards using and Purchase Intention respectively. Attitude towards using a smartwatch also strongly influences the purchase intentions. As a result it may be concluded that smartwatches must be designed to be visually and aesthetically appealing, useful, provide health monitoring features etc. Hence, in order to encourage adoption of smartwatches, it is imperative that it be easy to use, visually and aesthetically pleasing, cater to the health needs of the wearer and provide an overall delightful experience. This in turn might result in user's positive attitude and higher purchase intention. The framework suggested in the study is sound an robust and can certainly help practitioners and researchers in furthering their understanding of the factors impacting the continued usage of smartwatches.

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