Extending the Value-Based Adoption Model for Fitness Wearable Adoption: The Mediating Role of Consumer Attitude and the Influence of Health Consciousness

Bhavya Vinil[1], Dr. Divya Thankom Varghese[2]
[1]*Research Scholar, School of Management, CMR University, Bangalore & Assistant Professor, Presidency Business School, Presidency College, Bangalore*
Email: bhavyavinil@gmail.com
[2]Associate Professor, School of Management, CMR University, Bangalore
Email: divya.tv@cmr.edu.in

Abstract
With the rising popularity of fitness wearable technologies, it has become imperative to understand the drivers and barriers for acceptance by consumers. Based on the above, this study aimed to adapt the Value Based Adoption Model (VAM) and introduce consumer attitude as a mediator between the perception of value and adoption intention, as well as adding a predictor of health consciousness to the model. The study used a quantitative research type with cross-sectional approach, and structured questionnaires were used in collecting data from the participants of the research which amounted to 400 respondents. These results suggest that the perceived benefits have a positive effect on values, whereas the sacrifices negatively predict values. Consumer attitude plays a partial intermediary role in the process of value and consumer's adoption intention; value significantly affected the consumer's attitude and adoption intention. Compared with those who are not health conscious, consumers who are health conscious are also positive in terms of consumer attitude and consumer adoption intention. The study is expected to be a major addition to technology adoption studies by providing a long runway on the adoption of fitness wearables amongst consumers.
Keywords: Fitness Wearables, Value-Based Adoption Model, PV, Consumer Attitude, Health Consciousness, Adoption Intention.

Introduction
Healthcare and consumer electronics have been transformed by the new technologies' quick growth and now have fitness technology wearables like health and fitness monitoring devices, fitness bands, and smart watches taking off in the market. The global market for wearable technologies has seen astounding growth as users have become more conscious of health, technology advances and integration with AI and the IoT are all being incorporated into user health devices. Regardless of their technological features and growing usefulness, the uptake of fitness wearables is not even and varies by consumer segments, which suggests that technological development is not sufficient to get the users to accept it.

The TAM, UTAUT, IDT and the VAM are some of the theories that have been used in the previous studies to explain technology adoption. Of these, the VAM developed by Kim et al. (2007) has received much research interest because it views the technology adoption process as one in which consumers first consider how much the innovations interests are to them in comparison to how much they have to give up by adopting the innovation. So while traditional technology acceptance models focus more on perceived use and convenience of technology, VAM includes the utilitarian and hedonic features of a technology, as well as perceived costs, and perceived risks to the technology adoption decision, thus accounting for a more comprehensive explanation of consumer decisions to adopt technologies.

The evolution of fitness wearables is inherently a piece of technology created for much more than its technical capabilities: it is fashion designed to incentivize user to improve their health and lead to a better lifestyle through psychological appeal. Recent studies have shown that PU, PE, PSI, PV, PHB, and privacy concerns are the five key factors tested that significantly affect consumers' intentions to wear wearable fitness technologies. On a more empirical note, however, there are also indications that the strength and importance of these relationships differ in various demographic and cultural settings, warranting the need for the expansion of the current theoretical models.

Previous VAM studies have taken one approach which has failed to address the consumers' psychological evaluation process. Consumer attitude is a critical mental and emotional process that conveys an individual's value perception into behavioral intention and it directly affects the adoption intention. Attitude has consistently been shown to be a very good indicator of technology adoption, and according to the TRA and TAM.

A third important factor that needs to be paid attention to is health consciousness. Health-consciousness is the level individuals develop to incorporate health issues into their choices and participate actively in actions that develop their health. Fitness wearables seem to be of greater value to highly health committed people who value the advantages of consistent health observing, preventive healthcare and self tracking. Thus, health awareness could positively impact on the perception of new technologies and drive consumer behavior other than the traditional factors defining technology adoption. This research aspect of value-based adoption model has been well documented recently, identifying health consciousness as a key predictor for the adoption of wearable technology, although a discussion in this context is still not extensively explored.

This study builds on this background by adding the mediating construct of consumer attitude and the supplementing construct of health consciousness as additional determinants of consumer behavior with respect to fitness wearables adoption, in the VBM. The proposed framework has a more complete perception of the decision-making process of consumers, incorporating value perceptions, psychological evaluation and health-oriented behavioral characteristics. The results will advance both theoretical and practical understanding by enhancing the current body of research on wearable adoption and provide valuable lessons for wearable manufacturers, healthcare organizations, and digital health service providers aiming to boost consumer adoption of wearable technology.

Literature Review

Kim et al. (2007) create one of the most extensive models for elucidating consumer adoption of emergent technologies, known as the VAM. The model states that the overall value of an innovation is the difference between the perceived gain and the perceived sacrifice, which encompasses monetary loss, the amount of effort put forth and possible risks. If they see how much they stand to gain from this technology is greater than how much they believe they have to give up, they will see greater value and therefore have greater adoption intent. Because of its ability to encompass functional and emotional factors of consumer evaluations, VAM has been adopted with success in such diverse applications as mobile commerce, smart devices, e-banking, wearable devices, and so on.

Although the VAM accounts well for consumers value assessment, researchers have begun to focus more on psychological constructs which is crucial to generate intention. Many of the theoretical models have found that the attitude of the consumer plays a very strong role in predicting technology adoption. Davis (1989) states that attitude is a person's positive or negative judgment about the use of a technology and is a key predictor of BI. The same, Ajzen and Fishbein (1980) stated that the decision to engage in behavior is based on attitudes that are created from the individuals' cognitions and

evaluations. Thus, positive perceptions about usefulness and fun and value will likely increase favorable attitudes, leading to greater intention to adopt.

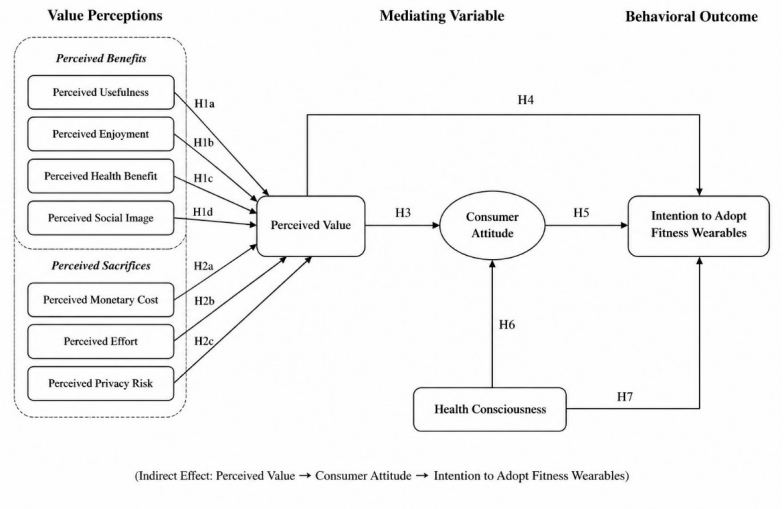
Along with this, the importance of health consciousness has won rising scholarly attention for digital healthcare studies. For Gould (1988) health consciousness is defined as the "individually-initiated process of observing and enhancing health status through prevention behaviours. The wearable technology setting further enhances customers' sense of health consciousness, as they are now drawn more towards real-time health tracking, customised feedback, and proactive health management.

According to Yang et al. (2022) health mindfulness is a significant factor affecting consumers' intention to use wearable fitness technologies as it enhances perceived usefulness and health motivation. Their study showed that as an individual becomes more health conscious, they feel greater value in wearable devices as these would help them to live healthier, and reduce the chances of getting sick. Similarly, Zhang et al. (2023) discovered that both motivational, cognitive and affective dimensions together drive the adoption of wearable, and a health motivation is also a very significant driver of consumer decision-making behaviors regarding wearable adoption.

Although there have been substantial books published on the use of wearable technology, there are still some issues that lie unearthed in these literature. Firstly, consumer attitudes have been independently studied or have been completely excluded from the VBAM in many previous studies. Second, the awareness of health has been acknowledged as one of the behavioral factors, but only a few afore-mentioned studies have integrated health consciousness with consumer attitude into the framework of VAM. Third, a large share of evidence cited is from developed countries limiting the applicability of findings to emerging markets where consumer health awareness and purchasing power, as well as technology purchasing behavior, could vary significantly.

Hence, the need for the present study is to draw the significant gaps by incorporating consumer attitude as an intermediary variable and health consciousness as an extra explanatory variable into the existing Value-Based Adoption Model. The integrated framework is supposed to deliver an overall understanding of the adoption of fitness wearable within this model, which has the potential to offer an overall explanation that takes into account value perception, psychological evaluation, and the health related behavioral characteristics that are likely to contribute to its advancement.

Fig. 1 Conceptual Framework



The conceptualization attempts to extend the VAM to explain consumers' intention to adopt fitness wearables by adding consumer attitude as one of the mediators and health consciousness as one of the determinants in this model. As per the model, consumers first compare the value gained in the fitness wearables, measured in terms of the benefits they gain outweighing the sacrifices that they make, and then evaluate the sport. It is hypothesized that PB have a positive influence on PV, while PS have a negative influence on PV. The greater consumers' PV drives both their willingness to purchase fitness wearables and their attitude toward fitness wearables. In addition to PV, consumer attitude serves as a mediating mechanism by which PV is linked to adoption intentions, suggesting that PV may impact the attitude and in turn, added willingness to adopt fitness wearables. Besides, health conscious was found to be correlated with enjoying the item and intentions to purchase wearable fitness technologies which indicates that those who are more conscious of their health and improving it are more positive toward the wearable fitness technology. The overall framework explains the adoption of the fitness wearables, and it eliminates the needless omission of any single perspective; the components of value perceptions, psychological evaluation, and health-oriented behavioral characteristics make it a powerful base to analyze the adoption behavior of the wearables.

Objectives:

1. To investigate the effect of PBs and sacrifices on PV of fitness wearables.
2. To examine the impact of consumer PV on their attitudes and the desire to purchase fitness wearables.
3. To understand how health awareness affects the attitude of consumers and intention to use fitness wearables.
4. To examine mediating effects of consumer attitudes between PVs and intention to use fitness wearables.
5. To build and test a new and expanded VAM to explain consumers' intention to wear fitness technology.

Hypothesis:

H1: PBs have a positive and significant influence on the PV of fitness wearables.

H2: Sacrifices have a negative and significant influence on the PV of fitness wearables.

H3: PV has a positive and significant influence on consumer attitude toward fitness wearables.

H4: PV has a positive and significant influence on consumers' intention to adopt fitness wearables.

H5: Consumer attitude has a positive and significant influence on consumers' intention to adopt fitness wearables.

H6: Health consciousness has a positive and significant influence on consumer attitude toward fitness wearables.

H7: Health consciousness has a positive and significant influence on consumers' intention to adopt fitness wearables.

H8: Consumer attitude mediates the relationship between PV and consumers' intention to adopt fitness wearables.

Methodology

This study takes a qualitative approach to research and uses a cross-sectional design, expanding on VAM, to examine the determinants of wearable adoption for promoting fitness. A questionnaire was used to collect data, and has been designed keeping items from scales previously validated in the literature. The study's focus is on people who already know of fitness wearable devices available on the market—such as smartwatches and fitness bands—and have experience using them. Purposive sampling will be used to purposefully select the respondents who will carry out the study with the required knowledge and experience on the intended study objective. The appropriate size of sample was determined at 400 for conducting PLS-SEM.

Result and Analysis

Collected data was analyzed to see the current research model. The analysis was carried out in two stages. Descriptive statistics were used as a data analysis technique at the initial stage to give a summary of the demographic characteristics of the respondents and to give general picture of the study variables. Afterwards, the assessment of the measurement model was conducted and research was done on the relationship between the latent constructs.

Table 1 Descriptive Statistics

Construct	Mean	Standard Deviation
Perceived Benefits	4.18	0.61
Perceived Sacrifices	2.64	0.72
Perceived Value	4.07	0.58
Consumer Attitude	4.14	0.55
Health Consciousness	4.22	0.57
Adoption Intention	4.11	0.60

Results of the descriptive statistics showed that most of the respondents demonstrated positive attitudes towards the fitness wearable technologies. The respondents had a mean score of 4.22 for their awareness of health consciousness, thus presenting a high level of awareness regarding health consciousness. PBs had a mean value of 4.19, which was also PV (4.15), consumers sense of attitude (4.16), and intention to use fitness wearables (4.30) relatively high (> 4.00) in favor of the good diligence. By comparison, perceived sacrifices had a relatively low mean score (2.64) indicating that fewer perceived cost, effort or privacy barriers were reported. The moderate standard deviation values suggest that the scores were consistent in opinion across all constructs.

Table 2 Indicator Reliability

Construct	Item 1	Loading	Item 2	Loading	Item 3	Loading	Item 4	Loading
Perceived Benefits	PB1	0.821	PB2	0.847	PB3	0.869	PB4	0.835
Perceived Sacrifices	PS1	0.801	PS2	0.826	PS3	0.842	–	–
Perceived Value	PV1	0.854	PV2	0.881	PV3	0.863	–	–
Consumer Attitude	CA1	0.869	CA2	0.884	CA3	0.872	–	–
Health Consciousness	HC1	0.835	HC2	0.862	HC3	0.845	–	–
Adoption Intention	AI1	0.879	AI2	0.891	AI3	0.868	–	–

The indicator reliability test result showed that all the variables with satisfactory outer loading value of all observed variables ranged from 0.801 to 0.891 and above the requirement of 0.70. The results imply that each measure item has a significant impact on the corresponding latent construct, as well as representing the underlying theoretical concept. Thus none of the measurement items needed to be deleted, in a confirmatory manner, supporting the robustness of the measurement model.

Table 3 Internal Consistency Reliability and Convergent Validity

Construct	Cronbach's Alpha	Composite Reliability	AVE
Perceived Benefits	0.892	0.925	0.755
Perceived Sacrifices	0.842	0.905	0.760
Perceived Value	0.874	0.922	0.798
Consumer Attitude	0.881	0.927	0.810
Health Consciousness	0.856	0.911	0.773
Adoption Intention	0.889	0.931	0.819

All constructs meet the appropriate standards for quality as measured through internal consistency and convergent validity. The alpha range from 0.842 to 0.892 and the CR ranges from 0.905 to 0.931, well showing excellent internal consistency. Likewise, all constructs' AVE values were above the minimum value of 0.50, indicating good convergent validity. It is therefore concluded that the measurement instrument has good reliability and that each of the indicators can explain a large proportion of the variance of the indicators of each construct.

Table 4 Measurement Model Assessment

Assessment Criterion	Recommended Value	Obtained Result	Status
Outer Loadings	>0.70	0.801–0.891	Accepted
Cronbach's Alpha	>0.70	0.842–0.892	Accepted
Composite Reliability	>0.70	0.905–0.931	Accepted
Average Variance Extracted (AVE)	>0.50	0.755–0.819	Accepted

Data analysis in overall measurement model shows that the instrument designed in this research fulfills all the requirements of R & C validity. The loadings on the indicator items, the internal consistency statistics and the convergent validity statistics are all within the recommended ranges, indicating that the measurement model is reliable and valid. Hence, PLS-SEM may be employed to perform a hypothesis test and structural modelling analysis to test the constructs in further details.

Table 5 Fornell–Larcker Criterion for Discriminant Validity

Construct	PB	PS	PV	CA	HC	AI
Perceived Benefits (PB)	**0.869**					
Perceived Sacrifices (PS)	-0.318	**0.872**				
Perceived Value (PV)	0.716	-0.462	**0.893**			
Consumer Attitude (CA)	0.645	-0.381	0.781	**0.900**		
Health Consciousness (HC)	0.421	-0.228	0.514	0.586	**0.879**	
Adoption Intention (AI)	0.624	-0.356	0.742	0.796	0.603	**0.905**

The result of the Fornell–Larcker criterion indicates that high levels of discriminant validity between study constructs can be achieved. The AVE is calculated on the diagonal and the square root of those diagonal elements are greater than the inter-construct correlations, in all three cases. This means that no more variance is shared with other constructs that is shared with both each individual construct and their individual indicators, a confirmation that the latent variables are conceptually distinct.

Table 6 HTMT Ratio of Correlations

Construct	PB	PS	PV	CA	HC	AI
Perceived Benefits (PB)	—					
Perceived Sacrifices (PS)	0.362	—				
Perceived Value (PV)	0.808	0.524	—			
Consumer Attitude (CA)	0.731	0.435	0.867	—		
Health Consciousness (HC)	0.486	0.297	0.573	0.651	—	
Adoption Intention (AI)	0.702	0.418	0.826	0.882	0.674	—

All HTMT values ranging from 0.297 to 0.882 are less than the threshold of 0.90, providing an additional confirmation of adequate discriminant validity. Thus, all constructs theoretically differ and do not significantly correlate with each other.

Table 7 Collinearity Statistics (VIF)

Predictor Construct	Endogenous Construct	VIF
Perceived Benefits	Perceived Value	1.82
Perceived Sacrifices	Perceived Value	1.64
Perceived Value	Consumer Attitude	1.49
Health Consciousness	Consumer Attitude	1.49
Perceived Value	Adoption Intention	2.06
Consumer Attitude	Adoption Intention	2.18
Health Consciousness	Adoption Intention	1.72

VIF values that result from calculations are found between the range of 1.49 to 2.18, which is much lower than a suggesting value of 3.30 or a conservative one of 5.00. This means in the suggested structural model, there is no problem of multicollinearity and the estimated path coefficients will not be affected due to collinearity among predictor variables.

Table 8 Structural Model Results and Hypothesis Testing

Hypothesis	Structural Path	β	t-value	p-value	Decision
H1	Perceived Benefits → Perceived Value	0.648	15.724	<0.001	Supported
H2	Perceived Sacrifices → Perceived Value	-0.271	6.318	<0.001	Supported
H3	Perceived Value → Consumer Attitude	0.603	13.587	<0.001	Supported
H4	Perceived Value → Adoption Intention	0.312	5.864	<0.001	Supported
H5	Consumer Attitude → Adoption Intention	0.446	8.751	<0.001	Supported
H6	Health Consciousness → Consumer Attitude	0.284	5.613	<0.001	Supported
H7	Health Consciousness → Adoption Intention	0.197	4.128	<0.001	Supported

The structural model results show that the impact of the PB on PV is quite high (β =0.648, p <0.001) whereas the impact of PS on PV is negative and significant (β = −0.271, p <0.001). This outcome validates the assumption underlying the value-based adoption model. PV positively influences consumer attitude (β =0.603, p <0.001) and directly influences consumers' adoption intention for fitness wearables (β =0.312, p <0.001). The attitude of consumers has a strong and positive effect on adoption intention (β =0.446, p <0.001) which suggests that positive attitude is forcing consumers towards the adoption of wearable technology. The level of consciousness towards health generates a

positive change in consumer attitude (β =0.284, p <0.001) and also positive intent to adopt (β =0.197, p <0.001).

Moreover, health-consciousness and value combination creates favourable attitudes and strengthens consumers' intentions to use fitness wearables. The study offers a theoretical enhancement to the VAM because it demonstrates how the subsequent variables of value and attitude as well as value and health consciousness better explain consumer adoption behaviour. Consumers perceive fitness wearables as more valuable, particularly when they associate more functional, health and experiential benefits and lower cost, effort or privacy sacrifice with these devices.

Table 9 Coefficient of Determination (R^2)

Endogenous Construct	R^2	Interpretation
Perceived Value	0.632	Moderate to Substantial
Consumer Attitude	0.684	Substantial
Adoption Intention	0.758	Substantial

The variance in PV is said to be 63.2% based on the coefficient of determination (R^2) of PBs and PS. PV and health consciousness can explain 68.4% of consumer attitude variance towards organic food. Additionally, PV, consumer attitude, health consciousness together explain the 75.8 % variance of consumer's intention to adopt fitness wearable. Thus, it implies that the proposed research framework is highly explanatory. Furthermore, this research model effectively predicts consumer intentions toward adoption.

Table 10 Effect Size (f^2)

Structural Relationship	f^2	Effect Size
Perceived Benefits → Perceived Value	0.472	Large
Perceived Sacrifices → Perceived Value	0.118	Small
Perceived Value → Consumer Attitude	0.541	Large
Perceived Value → Adoption Intention	0.173	Medium
Consumer Attitude → Adoption Intention	0.286	Medium
Health Consciousness → Consumer Attitude	0.127	Small
Health Consciousness → Adoption Intention	0.082	Small

The findings indicate a large effect of PBs on PV, as shown by the effect size analysis. Consumers' value perception is impacted by the functional and emotional benefits and the health benefit. In the framework constructed by the researcher, consumer PV impacts the consumer attitude. Also, it impacts purchase intention. The intentions to adopt are moderated by consumer attitude and PV. Nonetheless, the contributions of health consciousness and PSs are smaller but significant.

Table 11 Predictive Relevance (Q^2)

Endogenous Construct	Q^2	Predictive Relevance
Perceived Value	0.438	High
Consumer Attitude	0.502	High
Adoption Intention	0.571	High

When blindfolding produced a Q^2 value greater than zero for each endogenous construct, the proposed model has adequate predictive relevance. The relatively high Q^2 suggest that perception, attitude and adoption intention towards fitness wearables are predicted adequately.

Table 12 Mediation Analysis

Indirect Relationship	β	t-value	p-value	Result
Perceived Value → Consumer Attitude → Adoption Intention	0.269	6.587	<0.001	Significant Partial Mediation

The attitude of the consumers mediates the relationship between PV and adoption intention and this mediation is found to be significant (B=0.269, t = 6.587, $p < 0.001$). As both the direct and indirect effects were found to be significant, the mediation is partial. According to the mediation analysis, consumers who attach a greater value to fitness wearables tend to develop more favorable attitudes toward the fitness wearable device, thereby strengthening their intention to adopt the device.

Table 13 Summary of Hypothesis Testing

Hypothesis	Proposed Relationship	Decision
H1	Perceived Benefits → Perceived Value	Supported
H2	Perceived Sacrifices → Perceived Value	Supported
H3	Perceived Value → Consumer Attitude	Supported
H4	Perceived Value → Adoption Intention	Supported
H5	Consumer Attitude → Adoption Intention	Supported
H6	Health Consciousness → Consumer Attitude	Supported
H7	Health Consciousness → Adoption Intention	Supported
H8	Consumer Attitude mediates the relationship between Perceived Value and Adoption Intention	Supported

The hypothesis testing results indicate that the eight proposed hypotheses were all supported. It is believed that the PBs greatly enhance the PV while a perceived sacrifice will have a negative impact on the consumers' value perception. The extent to which consumers feel that a product or service will benefit them, the PV helps in bringing a change in their attitude and the willingness to adopt the fitness wearables. Health consciousness will create intention towards adoption and have a positive attitude. The investigation further discovered that consumers' attitude partially mediated the relation between PV and adoption intention. The strong mediation indicates the role of consumers' attitude is psychologically important in the extended VAM.

Discussion of Findings

The updated Value-Based Adoption Model fully support the current research in explaining consumers' intention to adopt fitness wearable. The findings indicate that perceived benefits exert the strongest positive effect on PV, while perceived sacrifice negatively dictates consumers' value perceptions. These findings give credence to Kim et al. (2007), who argue that consumers adopt technology when they assess that the expected benefits outweigh the perceived sacrifices. The substantial impacts of PV on consumer attitude and adoption intention both affirm that perception of value has substantial impact on behavioural intention in the case of wearable technology.

Health consciousness significantly influences a consumer's attitude and intention to adopt the intended behavior. Individuals who are more concerned about maintaining or improving their health are more accepting of wearable fitness technologies, indicating that being health-motivated is still a strong behavioural antecedent of digital healthcare adoption. Health consciousness, though lower in effect size than PV, still made a significant contribution to the study.

Overall, the large values of R^2 and Q^2 suggest that the recommended version of the model can explain diverse variation and predict heterogeneity well. By incorporating consumer attitude as a mediating construct and health consciousness as an additional determinant, the original Value-Based Adoption Model is extended in its analytical contribution. It also improves our overall understanding of consumer behaviour. The implications of this model are crucial for the designers of wearable devices, health-tech providers, and the marketers.

Conclusion

The present study moves beyond the VAM by adding consumer attitude as a mediating factor and health consciousness as another determinant to predict consumers' adoption intention for fitness wearables. The empirical results provide clear evidence that those who believe that the offering brings them greater value also believe that the offering has less cost, and those who believe that the offering imposes greater costs also believe that there is less value. PV greatly influences the adoption process decision making, both in terms of consumer attitude and intention, thus confirming its role in consumer adoption decision making. Moreover, the attitude mediates the effects of PV on most of the relationship between PV and adoption intention, suggesting that favorable attitude has a positive effect on converting PV into adoption intention. Furthermore, consumer attitude and intention to use fitness wearable technologies are deeply influenced by the health-consciousness, indicating the importance of health related motives in supporting the acceptance of fitness wearables. The overall results of the extended model demonstrate good explanatory and predictive power, explaining the factors that motivate consumers to wear fitness wearables.

Recommendations

From the analysis, it could be concluded that manufacturers and marketers of fitness wearable products should focus on improve overall value proposition of their products by making the products simpler to use and wear, more personalized, more reliable and user friendly and minimizing/avoiding any sacrifice by the users in terms of privacy, complexity, ownership etc. Health-related usefulness and sustainability features of wearable products should be made central of marketing strategies to encourage positive beliefs among consumers and build purchase intentions. Avoids sudden decreases in heart rate to lower stroke risk.Encourages preventive healthcare and healthy lifestyles with the use of wearables. The study was a preliminary extension of the proposed model that adds more factors to the model and take into account comparative analysis among various groups of people at different regions or countries by planning future studies using a longitudinal research design to validate and generalize the results.

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