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From Wearable Data To Business Value: How Self-Tracking Engagement Drives Customer Retention In The Fitness Industry

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Abstract: *The rapid adoption of wearable fitness technologies has transformed how individuals monitor, interpret, and manage their health-related behaviors. Despite their widespread use, limited research has examined how self-tracking engagement translates into perceived value and customer retention intention, particularly through psychological mechanisms. Drawing on the Technology Acceptance Model (TAM) and Social Cognitive Theory (SCT), this study develops and tests a conceptual framework that links self-tracking engagement, perceived value of fitness services, exercise self-efficacy, and customer retention intention. Data analysis with 315 respondents through SmartPLS 3 reveals that self-tracking engagement positively influences perceived value, which in turn enhances customer retention intention. In addition, self-tracking engagement also has a direct effect on retention intention. Importantly, exercise self-efficacy is found to moderate the relationship between self-tracking engagement and perceived value, such that the effect is stronger for individuals with higher levels of self-efficacy. These findings highlight the critical role of psychological factors in shaping how users derive value from wearable technologies. The study contributes to the literature on digital health and technology adoption by extending TAM to post-adoption behavior and integrating SCT to explain individual differences in value perception. Practical implications are provided for designers and managers of wearable fitness services to enhance user engagement, perceived value, and long-term customer retention.*

Keywords: Customer retention intention; exercise self-efficacy; perceived value; self-tracking engagement; wearable fitness technology.

1. INTRODUCTION

In recent years, the rapid emergence of fitness technologies, particularly mobile applications and wearable devices such as smartwatches, has fundamentally transformed how individuals engage with their health and wellness routines (Ferreira et al., 2021). These technologies have extended beyond simple activity tracking to encompass comprehensive health monitoring, including heart rate, sleep patterns, and stress levels, thereby providing users with continuous and personalized insights into their physical and mental well-being. Such capabilities not only support preventive healthcare through early detection of potential health issues but also promote a proactive approach to health management, shifting the focus from treatment to prevention. As a result, wearable technologies have become integral tools in fostering sustained user engagement in health-related behaviors.

Beyond their functional benefits, wearable devices and tracking applications have increasingly become embedded within broader socio-cultural and economic contexts. Tracking technologies, such as Fitbit and application-based services like Map My Run, now occupy a central role in shaping the notion of the healthy and responsible citizen, aligning with the growing emphasis on individual responsibility in healthcare and the promotion of healthy lifestyles (Anderson & McCormack, 2018). Through continuous data collection and feedback, these devices facilitate new forms of self-care practices and self-knowledge, enabling users to monitor, interpret, and regulate their own bodies. Drawing on the concept of digital biopedagogy, wearable technologies can be understood as pedagogical tools that train individuals to adopt specific health behaviors through everyday micro-practices of self-tracking, data interpretation, and social sharing. In this sense, these technologies function not only as health tools but also as communicative and normative devices that shape user identities, behaviors, and perceptions of health. Importantly, the rise of self-tracking technologies has significant implications not only for individual well-being but also for business value creation within the fitness industry. As users increasingly engage with wearable devices, their continuous interaction with self-generated health data fosters deeper levels of engagement, which may translate into long-term usage, subscription renewal, and brand loyalty. This shift highlights the growing importance of self-tracking engagement as a key driver of customer retention.

Despite the increasing adoption of wearable technologies and their potential to enhance health management and user engagement, existing research remains limited in explaining how self-tracking engagement translates into perceived value and long-term behavioral intentions in fitness service contexts. Most prior studies have primarily focused on technology adoption or initial usage intention, while relatively fewer have

examined post-adoption behaviors such as sustained engagement and customer retention (Davis, 1989; Venkatesh et al., 2003). Moreover, although self-tracking features are widely recognized as a key value proposition of wearable devices, there is still insufficient understanding of the psychological and behavioral mechanisms through which users derive value from continuous interaction with these technologies. In particular, the role of perceived value as a mediating mechanism between self-tracking engagement and customer retention intention has not been sufficiently explored in prior research. While perceived value has been identified as a critical predictor of continued usage in service and technology contexts, less attention has been paid to how such value is formed through ongoing engagement with self-generated data. Furthermore, individual differences in psychological resources, such as exercise self-efficacy, may play a crucial role in shaping how users interpret and respond to self-tracking information. However, empirical evidence integrating these cognitive and behavioral dimensions within a unified framework remains scarce.

To address these gaps, this study develops and empirically tests a conceptual model that integrates the Technology Acceptance Model (TAM) and Social Cognitive Theory (SCT) to examine the relationships among self-tracking engagement, perceived value of fitness services, exercise self-efficacy, and customer retention intention. Specifically, this research investigates how self-tracking engagement influences perceived value and retention intention, and how exercise self-efficacy moderates the relationship between engagement and perceived value. The contributions of this study are threefold. First, it extends the literature on wearable technologies by shifting the focus from adoption to post-adoption behaviors, particularly sustained engagement and retention. Second, it enriches the understanding of value formation in digital fitness services by identifying self-tracking engagement as a key antecedent of perceived value. Third, it incorporates exercise self-efficacy as a boundary condition, thereby highlighting the role of individual psychological differences in shaping user responses to technology-mediated feedback. The study is divide into 5 parts inluding (1) Introduction; (2) Conceptual framework and hypothesis development; (3) Methodology; (4) Results and discussion; and (5) Implications and conclusion.

2. CONCEPTUAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

2.1 Theoretical foundations

This study draws on two key theoretical frameworks, namely the Technology Acceptance Model (TAM) and Social Cognitive Theory (SCT), to explain the relationships among self-tracking engagement, perceived value of fitness services, customer retention intention, and the moderating role of exercise self-efficacy.

The Technology Acceptance Model (TAM) provides a foundational framework for understanding how users evaluate and adopt technology. While health information technology (IT) research has traditionally focused on system design and implementation (Anderson, 1997) increasing attention has been directed toward how end users respond to implemented technologies in real-world contexts. Evidence suggests that the success of IT systems depends not only on their technical functionality but also on how well they fit users' work systems and how they are actually used in practice. Numerous cases of underuse, resistance, and even abandonment demonstrate that user acceptance and engagement are critical determinants of technology success (Holden et al., 2009). In this regard, TAM has been widely applied to explain and predict user acceptance and usage behaviors, and is often considered a gold standard in information systems research. Empirical studies show that TAM can explain a substantial proportion of variance in technology acceptance, typically around 30–40% , (King et al., 2006). At its core, TAM posits that perceived usefulness and perceived ease of use influence users' attitudes and behavioral intentions toward technology use. In the context of wearable fitness technologies, self-tracking engagement can be viewed as a behavioral manifestation of technology use, while perceived value of fitness services reflects users' evaluation of the benefits derived from such technologies. Customer retention intention, in turn, represents the outcome of sustained positive evaluations and continued usage behavior. Accordingly, TAM provides the theoretical basis for explaining the direct and indirect relationships among the key constructs in this study. Specifically, self-tracking engagement enhances users' perceptions of usefulness and benefits, thereby increasing perceived value, which subsequently influences customer retention intention. This framework helps explain how interaction with wearable data is transformed into business value through sustained customer relationships.

Besides, this study draws on Social Cognitive Theory (SCT) to explain the moderating role of exercise self-efficacy. SCT emphasizes the dynamic interaction between personal factors, behavior, and environmental influences, with self-efficacy identified as a central cognitive mechanism shaping individuals' actions and responses (Bandura, 1986). Self-efficacy refers to individuals' beliefs in their capability to perform specific tasks and achieve desired outcomes (Bandura, 1997). In the context of fitness services, self-tracking engagement provides continuous feedback on users' performance and progress, which serves as an important source of information for evaluating service value. However, the way individuals interpret and respond to such feedback depends on their level of exercise self-efficacy. Individuals with higher self-efficacy are more likely to interpret feedback positively, feel in control of their behavior, and effectively utilize information to improve their performance. In contrast, individuals with lower self-efficacy may experience uncertainty, reduced motivation, and disengagement when faced with the same information.

Therefore, exercise self-efficacy is expected to moderate the relationship between self-tracking engagement and perceived value, such that the positive effect of engagement on perceived value is stronger for individuals with high self-

efficacy and weaker for those with low self-efficacy. By incorporating SCT, this study extends TAM by accounting for individual differences in cognitive processing and behavioral responses, providing a more comprehensive explanation of how wearable data translates into customer value and retention in the fitness industry.

2.2 Self-tracking engagement in wearable technology

Self-tracking is not a new phenomenon, as early forms of wearable technologies for personal monitoring date back to the 1970s (Krijnen et al., 2013). Over time, this practice has evolved alongside digital innovations, leading to the emergence of related concepts such as lifelogging, personal informatics, and the quantified self. According to Johns (2021), self-tracking involves practices in which individuals knowingly and purposively collect, review, and apply personal data to better understand and manage their lives. The concept of the quantified self, defined as self-knowledge through numbers, further emphasizes the role of quantitative data in shaping individuals' behaviors and self-awareness. These developments highlight how digital technologies have transformed self-monitoring into an integral aspect of everyday life.

In recent years, wearable technologies have significantly advanced the practice of self-tracking. Several technology companies, including Fitbit, Apple, Samsung, and Garmin, have entered the growing market of population health through the introduction of fitness trackers. These devices are equipped with sensors and companion mobile applications that collect and display activity-related metrics such as step count, sleep patterns, and calorie consumption (Kim & Shin 2015). By enabling individuals to monitor their physical activity and health status continuously, fitness trackers support personal health information management in a convenient and accessible manner, thereby encouraging users to make more informed health decisions. A key component influencing user interaction with wearable technologies is the user interface (UI), which presents raw sensor data in a meaningful and user-friendly format (Galitz 2007). Through visual representations such as graphs, progress indicators, and summaries, the UI allows users to track their physical activity over time and better understand their performance. For example, the interface of devices such as the Apple Watch enables users to map their activity progress, thereby enhancing awareness and motivation. In addition, advanced features such as gamification elements including daily challenges and leaderboards further increase user engagement by introducing competition and social interaction.

Building on these technological features, self-tracking engagement can be conceptualized as the extent to which users actively interact with, interpret, and utilize self-generated data through wearable devices and their associated applications. This includes behaviors such as frequently checking activity metrics, monitoring progress, setting goals, and adjusting behaviors based on feedback. Importantly, engagement is not solely driven by technological capabilities but is also influenced by how data is presented and experienced through the UI, which shapes users' perceptions and interactions with the system (Patel et al., 2015). From a theoretical perspective, self-tracking engagement can be explained through frameworks which emphasize the role of technology affordances in fulfilling users' psychological needs. Features such as real-time feedback, progress tracking, and goal achievement can enhance users' sense of competence and autonomy, thereby motivating continued engagement. As users interact more frequently with their data, they are more likely to develop healthy habits and sustain physical activity over time, leading to long-term health benefits such as weight management and reduced risk of cardiovascular diseases (Song et al., 2021).

However, despite these potential benefits, prior research highlights a significant challenge in maintaining user engagement. The dropout rate of fitness tracker usage remains high, with more than half of users discontinuing use and a substantial proportion abandoning the device within the first six months (Radhakrishnan et al., 2020). This indicates that initial adoption does not necessarily translate into sustained engagement, underscoring the importance of understanding the factors that drive continuous interaction with self-tracking technologies. In terms of measurement, previous studies have operationalized self-tracking engagement through various indicators, including frequency of device usage, intensity of interaction with tracked data, and behavioral responses such as goal setting and adherence to fitness routines. These measures reflect both behavioral and cognitive dimensions of engagement, capturing how users not only use the technology but also derive meaning and motivation from their interactions. Overall, self-tracking engagement represents a critical link between wearable technology and user behavior. By facilitating continuous interaction with personal health data, wearable devices can transform passive monitoring into active engagement, which is essential for sustaining long-term usage. From a business perspective, this sustained engagement plays a crucial role in enhancing customer retention and generating long-term value in the fitness industry.

2.3 Self-tracking engagement, perceived value and customer retention intention

From a theoretical perspective, the value derived from fitness services can be conceptualized as perceived value, which refers to users' overall evaluation of the utility of a service based on the trade-off between perceived benefits and costs. In the context of fitness services, perceived value of fitness services encompasses multiple dimensions, including functional value (e.g., effectiveness in improving health), hedonic value (e.g., enjoyment), social value (e.g., social recognition), and symbolic value (e.g., identity expression) (Chuah et al., 2019). This multidimensional perspective highlights that users do not only assess fitness technologies based on their utilitarian outcomes but also on experiential and psychological benefits.

The relationship between self-tracking engagement and perceived value can be explained through several theoretical mechanisms. First, based on the TAM, perceived usefulness plays a key role in shaping users' evaluations of technology (Kim, 2014). Greater engagement with self-tracking features helps users recognize practical benefits such as health monitoring and personalization, thereby enhancing perceived value. Additionally, from a motivation perspective, continuous interaction with self-tracking data strengthens users' sense of control and progress, which further increases satisfaction and value perception. Moreover, self-tracking provides immediate and cumulative numerical feedback, which serves as a proxy for users' progress toward their health goals (Jin et al., 2021). Such feedback can generate a sense of competence and accomplishment, especially in effortful activities that require significant physical or cognitive investment . As users observe improvements in their tracked metrics (e.g., increased running distance or improved sleep quality), they are more likely to perceive that the fitness service effectively supports their goals, thereby increasing its perceived value. Empirical evidence also supports the positive relationship between self-tracking engagement and perceived benefits. Prior studies have shown that perceived benefits, including utilitarian, hedonic, social, and symbolic values, are key determinants of users' evaluations of fitness technologies. Additionally, research has demonstrated that perceived usefulness and perceived ease of use significantly influence users' attitudes and behavioral outcomes in health technology contexts (Feng et al., 2021). Furthermore, mediating mechanisms such as inspiration, well-being, and empowerment have been found to enhance users' perceptions of value when interacting with self-tracking technologies. Based on the above arguments, the following hypothesis is proposed:

H1: Self-tracking engagement has a positive effect on the perceived value of fitness services.

Customer retention intention refers to a customer's willingness and commitment to continue using a service or maintaining a relationship with a service provider over time. In service-based industries, retention intention is a critical determinant of long-term business performance, as retaining existing customers is often more cost-effective than acquiring new ones. The importance of retention is particularly evident in competitive markets, where increased choices have empowered customers and intensified the need for firms to sustain long-term relationships. In the fitness industry, this challenge is even more pronounced due to high dropout rates, making customer retention a key strategic objective (Ghadiri et al., 2021). Notably, even a small increase in customer retention can generate substantial financial returns, with a 5% increase leading to up to 95% additional value for organizations.

Perceived value plays a fundamental role in shaping customer retention intention. From a theoretical perspective, perceived value reflects the trade-off between benefits and sacrifices, including both monetary and non-monetary costs (Martín et al., 2008; Voss et al., 1998). Customers do not always seek the lowest price but rather value for the effort, time, and resources invested (Berry et al., 2002). In service contexts, non-monetary sacrifices such as time, accessibility, and psychological effort, are particularly important in influencing value perceptions (Zeithaml & Bitner, 2000). The concept of service convenience further explains how reducing effort and time enhances perceived value and, consequently, customer retention (Berry et al., 2002). Seiders et al. (2007) identified multiple dimensions of service convenience, including decision, access, transaction, and post-service convenience, all of which contribute to a more favorable service evaluation. In the fitness context, factors such as accessibility of facilities, travel time, and ease of use significantly affect users' perceived value and their willingness to continue using the service. Empirical evidence also shows that lack of time is a major reason for discontinuing fitness activities (Zeithaml, 1988), highlighting the importance of perceived value in sustaining engagement. Based on the above arguments, the following hypothesis is proposed:

H2: The perceived value of fitness services has a positive effect on customer retention intention.

Besides, self-tracking engagement can also directly influence customer retention intention by enhancing users' interaction with fitness technologies. Self-tracking provides immediate and cumulative numerical feedback on behavioral outputs, such as steps or calories burned (Jin et al., 2021). This feedback acts as a proxy for progress toward health goals, allowing users to visualize their achievements over time. From the theoretical perspective, such feedback mechanisms can enhance users' sense of competence and accomplishment, particularly in effortful activities that require sustained effort and attention (Bandura, 1982). As individuals observe increasing performance metrics, they are more likely to perceive that their behaviors are effective in achieving desired outcomes, which reinforces motivation and continued usage. Furthermore, prior research suggests that individuals respond positively to increasing values linked to their behaviors, as these signals provide immediate and rewarding feedback .

This effect is particularly strong in effortful activities, where achieving higher performance requires greater investment of effort and thus generates stronger feelings of accomplishment. As a result, continuous engagement with self-tracking technologies can foster habit formation and increase users' intention to continue using fitness services. Based on the above arguments, the following hypothesis is proposed:

H3: Self-tracking engagement has a positive effect on customer retention intention.

While self-tracking engagement can directly influence retention, its effect is also likely to operate through perceived value. According to García-Fernández et al. (2018), value perceptions are situational and depend on the context in which evaluation occurs. This suggests that users derive value from

different stages of service interaction, including usage and consumption. Self-tracking engagement enhances users' interaction with fitness services by providing meaningful feedback, increasing perceived competence, and reinforcing goal achievement. These experiences contribute to higher perceived value by improving both functional benefits (e.g., effectiveness of workouts) and psychological benefits (e.g., satisfaction and accomplishment). As perceived value increases, users are more likely to develop positive evaluations of the service, which in turn strengthens their intention to continue using it. Empirical and theoretical evidence thus suggests that perceived value serves as a key mechanism linking engagement with retention outcomes. In other words, self-tracking engagement increases perceived value, which subsequently drives customer retention intention. Based on the above arguments, the following hypothesis is proposed:

H4: The perceived value of fitness services mediates the relationship between self-tracking engagement and customer retention intention.

2.4 The moderating role of exercise self-efficacy

Exercise self-efficacy, rooted in Social Cognitive Theory, refers to an individual's belief in their capability to successfully perform and sustain exercise-related behaviors (Bandura, 1997). In the fitness context, it reflects not only confidence in executing physical activities but also persistence, resilience, and the ability to overcome barriers during exercise routines (McAuley & Blissmer, 2000). Prior research has consistently demonstrated that self-efficacy is a key determinant of motivation, effort, and behavioral persistence across various domains, including health and physical activity (Bandura, 1997).

From a theoretical perspective, self-efficacy plays a critical role in shaping how individuals process information and respond to feedback. Individuals with higher self-efficacy are more likely to interpret performance-related information positively, exert greater effort, and persist in the face of difficulties, whereas those with lower self-efficacy tend to doubt their capabilities and disengage more easily (Bandura, 1997). In technology-related contexts, self-efficacy has also been shown to influence how users interact with and utilize systems. For instance, computer self-efficacy enhances users' ability to effectively use technological features and derive benefits from system usage (Compeau & Higgins, 1995; Staples et al., 1999).

Applying these insights to wearable fitness technologies, self-tracking engagement provides users with continuous feedback on their behaviors and performance, such as activity levels, calories burned, and progress toward fitness goals. However, the extent to which such engagement translates into perceived value depends on users' exercise self-efficacy. Individuals with high exercise self-efficacy are more capable of interpreting self-tracking data, integrating feedback into their routines, and using this information to improve performance. As a result, they are more likely to perceive greater functional and psychological benefits from their interactions with fitness technologies. In contrast, individuals with low exercise self-efficacy may find it difficult to interpret or act upon self-tracking information, leading to weaker value perceptions despite similar levels of engagement. Therefore, exercise self-efficacy is expected to condition the effectiveness of self-tracking engagement in generating perceived value. Specifically, the positive relationship between self-tracking engagement and perceived value of fitness services is likely to be stronger for individuals with higher levels of exercise self-efficacy and weaker for those with lower levels. Based on the above arguments, the following hypothesis is proposed:

H5: Exercise self-efficacy moderates the relationship between self-tracking engagement and the perceived value of fitness services.

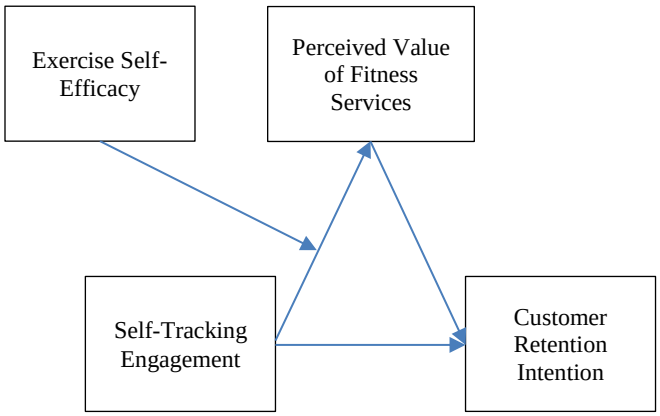

Figure 1: Research model

3. METHODOLOGY

3.1 Measures and questionnaire development

The measurement instrument for this study was developed based on previously validated scales from prior research on self-tracking behavior, consumer value, and fitness-related engagement.

The questionnaire included four key constructs: Self-Tracking Engagement (STE), Perceived Value of Fitness Service (PVF), Exercise Self-Efficacy (ESE), and Customer Retention Intention (CRI). All measurement items were adapted and refined to ensure their suitability for the context of wearable technology in the fitness industry, while preserving their original theoretical meanings. Specifically, STE was measured using four items adapted from Feng et al. (2021) and Jin et al. (2021). PVF was measured using four items based on Jin et al. (2021), Zeithaml (1988), and García-Fernández et al. (2018). ESE was measured using four items adapted from Satjawathee et al. (2022), while CRI was measured using five items based on Ghadiri et al. (2021).

All items were measured using a five-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"), which is widely used in consumer behavior and technology adoption research. Prior to the main data collection, a pilot test was conducted with a small group of respondents to ensure the clarity, readability, and reliability of the measurement items. Based on the feedback received, minor adjustments were made to improve the wording and contextual relevance of the questionnaire.

3.2 Sample, data collection and analysis

The 315 valid data for this study were collected through a structured questionnaire administered to individuals using wearable technologies in the fitness context in Vietnam, with the aim of examining how self-tracking engagement influences customer retention intention. The questionnaire was primarily distributed through online channels, including social media platforms, fitness-related communities, and university networks where users of wearable fitness devices are highly active. This approach enabled the study to reach a diverse group of respondents who regularly engage in fitness activities and interact with wearable technologies.

The sampling strategy targeted individuals who actively use wearable devices such as smartwatches, fitness trackers, and other health-monitoring technologies. To ensure the relevance of the sample, a screening question was included to confirm that respondents had prior experience using wearable devices. In addition, the questionnaire incorporated several demographic and behavioral measures, including gender (male, female), age (<18, 18–25, 25–35, >35), frequency of exercise (<1 time, 1–3 times, 3–5 times, >5 times per week), types of wearable technologies used (e.g., smartwatch, fitness tracker, heart rate monitor, smart clothing, and other devices), experience with wearable devices (rarely, sometimes, often, always), and monthly income (<500 USD, 500–1000 USD, 1000–2000 USD, >2000 USD). These variables were included as they may influence individuals' engagement with wearable technologies and their intention to continue using fitness services.

For data analysis, this study employed Partial Least Squares Structural Equation Modeling (PLS-SEM) using SmartPLS 3 to assess the reliability and validity of the measurement model and to test the proposed hypotheses. This approach is appropriate for exploratory research and complex models involving multiple constructs and relationships.

4. RESULTS AND DISCUSSION

4.1 Demographics of respondents

The demographic profile of the 315 respondents provides important insights into the characteristics of the sample. In terms of gender, the sample is relatively balanced, with females accounting for 54.9% and males representing 45.1% of the total respondents. Regarding age distribution, the majority of respondents fall within the 18–25 age group (51.4%), followed by those aged 25–35 (30.5%). A smaller proportion of participants are above 35 years old (12.4%), while only 5.7% are under 18. This indicates that the sample is predominantly composed of young adults, who are more likely to adopt wearable fitness technologies.

Table 1: Demographics of respondents

Demographics		Frequency	Percent (%)
Gender	Male	142	45.1
	Female	173	54.9
Age	< 18	18	5.7
	18 - 25	162	51.4
	25 - 35	96	30.5
	> 35	39	12.4
Frequency of Exercise	< 1 time	28	8.9
	1 - 3 times	121	38.4
	3 - 5 times	113	35.9
	> 5 times	53	16.8
Wearable Technologies	Smartwatch	138	43.8
	Fitness tracker	74	23.5
	Heart rate monitors	32	10.2
	Smart clothing	15	4.8
	Smart glasses and head mounted devices	11	3.5
	Others	45	14.3
Experience with Wearable Devices	Rarely	36	11.4
	Sometimes	98	31.1
	Often	112	35.6
	Always	69	21.9
Monthly income	< 500 USD	84	26.7
	500 - 1000 USD	109	34.6
	1000 - 2000 USD	83	26.3
	> 2000 USD	39	12.4
Total		**315**	**100**

In terms of exercise frequency, most respondents reported engaging in physical activity on a regular basis. Specifically, 38.4% exercise 1–3 times per week, while 35.9% exercise 3–5 times per week. A smaller group (16.8%) reported exercising more than five times per week, whereas only 8.9% exercise

less than once per week. This suggests that the majority of respondents maintain an active lifestyle. With respect to wearable technologies, smartwatches are the most widely used devices (43.8%), followed by fitness trackers (23.5%). Other devices such as heart rate monitors (10.2%), smart clothing (4.8%), and smart glasses or head-mounted devices (3.5%) are less commonly used. Additionally, 14.3% of respondents reported using other types of wearable technologies. These findings indicate that smartwatches dominate the wearable fitness market among the sample. Regarding experience with wearable devices, a large proportion of respondents reported frequent usage. Specifically, 35.6% indicated that they often use wearable devices, and 21.9% reported always using them. Meanwhile, 31.1% use them sometimes, and only 11.4% rarely use such technologies. This reflects a relatively high level of engagement with wearable devices among the respondents.

Finally, in terms of monthly income, the largest proportion of respondents falls within the 500–1000 USD range (34.6%), followed by those earning below 500 USD (26.7%) and those earning between 1000–2000 USD (26.3%). A smaller proportion (12.4%) reported income above 2000 USD. This distribution suggests that most respondents belong to the middle-income group, which aligns with the affordability and accessibility of wearable fitness technologies. Overall, the sample is characterized by young, active individuals with moderate to high engagement in wearable technology usage, making it appropriate for examining self-tracking engagement and customer retention intention in the fitness industry.

4.2 Scale reliability and validity assessment

The reliability and convergent validity of the measurement model were assessed using Cronbach's alpha, rho_A, composite reliability (CR), and average variance extracted (AVE). The results indicate that all constructs achieve excellent levels of internal consistency. Specifically, Cronbach's alpha values range from 0.907 to 0.951, while composite reliability values range from 0.935 to 0.965, both exceeding the recommended threshold of 0.7. The rho_A values are also consistently high, further confirming the robustness of the measurement model.

Table 2: Construct Reliability and Validity

	Cronbach's Alpha	**rho_A**	**Composite Reliability**	**Average Variance Extracted (AVE)**
STE	0.907	0.911	0.935	0.783
ESE	0.935	0.941	0.953	0.836
PVF	0.951	0.953	0.965	0.873
CRI	0.941	0.942	0.955	0.809

Source: Data analysis by SmartPLS3

In terms of convergent validity, all AVE values are well above the recommended threshold of 0.5, ranging from 0.783 to 0.873. This indicates that each construct explains a substantial proportion of the variance in its indicators. Notably, Perceived Value of Fitness Service (PVF) and Exercise Self-Efficacy (ESE) exhibit particularly high levels of reliability and convergent validity, followed closely by Customer Retention Intention (CRI) and Self-Tracking Engagement (STE). The moderating effect construct reports values of 1.000 across all indices, which is expected as it represents an interaction term in the PLS-SEM model rather than a reflective construct. Overall, these results confirm that the measurement model demonstrates strong reliability and convergent validity, providing a solid foundation for subsequent structural model analysis.

The discriminant validity of the measurement model was assessed using the Fornell–Larcker criterion and the Heterotrait–Monotrait ratio (HTMT). The results confirm that discriminant validity is well established. According to the Fornell–Larcker criterion, the square root of the AVE for each construct is greater than its correlations with other constructs. Specifically, CRI (0.899), ESE (0.914), PVF (0.934), and STE (0.885) all exceed their corresponding inter-construct correlations, indicating that each construct is empirically distinct. Furthermore, all HTMT values are below the recommended threshold of 0.85 (or 0.90), ranging from 0.084 to 0.678. This further supports the discriminant validity of the constructs, suggesting that there is no issue of multicollinearity or construct overlap. The moderating effect construct also demonstrates acceptable values, as expected for an interaction term in PLS-SEM. Overall, these findings confirm that the constructs in the model are sufficiently distinct from one another, supporting the adequacy of the measurement model for subsequent structural analysis

Table 3: Fornell-Larcker Criterion and Heterotrait-Monotrait Ratio (HTMT)

		CRI	ESE	Moderating Effect 1	PVF	STE
Fornell-Larcker Criterion	CRI	0.899				
	ESE	0.064	0.914			
	Moderating Effect 1	0.388	0.085	1.000		
	PVF	0.509	0.244	0.471	0.934	
	STE	0.543	0.004	0.442	0.630	0.885

Heterotrait-Monotrait Ratio	CRI					
	ESE	0.084				
	Moderating Effect 1	0.399	0.089			
	PVF	0.537	0.258	0.483		
	STE	0.585	0.118	0.464	0.678	

Source: Data analysis by SmartPLS3

4.3 Research model assessment and discussions

In terms of explanatory power, the model explains 48.7% of the variance in perceived value, with an Adjusted R^2 of 0.487, indicating a strong level of predictive capability. This suggests that the independent variables included in the model, particularly self-tracking engagement and exercise self-efficacy, effectively explain users' perceived value of fitness services. Furthermore, the model explains 33.7% of the variance in customer retention intention, with an Adjusted R^2 of 0.337, which can be considered a moderate level of explanatory power in behavioral research. This indicates that while the model captures key determinants of retention intention, there are still other relevant factors such as service quality, motivation, or habit that could be explored in future studies.

Table 4: Structural Equation Modelling Results Estimates

Paths	Original Sample	Sample Mean	S.D	T Statistics	P Values
STE → PVF	0.533	0.535	0.053	10.046	0.000
PVF → CRI	0.277	0.279	0.058	4.758	0.000
STE → CRI	0.369	0.365	0.062	5.997	0.000
STE → PVF → CRI	0.147	0.150	0.038	3.886	0.000
Moderating Effect 1 → PVF	0.239	0.240	0.053	4.499	0.000
ESE → PVF	0.224	0.225	0.051	4.387	0.000
ESE → PVF → CRI	0.062	0.063	0.019	3.318	0.001
Moderating Effect 1 → PVF → CRI	0.066	0.067	0.020	3.315	0.001
Adjusted R^2: PVF = 0.487; CRI = 0.337					

Source: Data analysis by SmartPLS3

The results indicate that self-tracking engagement (STE) has a strong positive and statistically significant effect on the perceived value of fitness services (PVF), with a coefficient of 0.533 and a p-value below 0.001, thereby supporting H1. This finding suggests that individuals who actively engage in tracking their health and fitness data are more likely to perceive greater benefits from fitness services. Continuous monitoring of performance, progress, and health indicators enables users to better understand their outcomes, which enhances their overall evaluation of service value. This result is consistent with the study of Feng et al. (2021), which highlights that self-tracking behaviors improve users' awareness of their well-being and health outcomes. Similarly, Jin et al. (2021) argue that self-tracking engagement plays a crucial role in shaping users' task experience and perceived benefits in effortful activities such as fitness. Therefore, the current findings reinforce the argument that self-tracking engagement is a key antecedent of perceived value in the context of wearable fitness technologies.

The results show that perceived value of fitness services (PVF) has a positive and significant effect on customer retention intention (CRI), with a coefficient of 0.277 and a p-value below 0.001, supporting H2. This finding indicates that when customers perceive that the benefits of fitness services outweigh the associated costs, they are more likely to continue using those services. The result is consistent with the foundational work of Zeithaml (1988), who conceptualizes perceived value as a trade off between perceived benefits and sacrifices and emphasizes its central role in influencing consumer behavior. In addition, García-Fernández et al. (2018) demonstrate that perceived value significantly affects satisfaction and loyalty in fitness service settings. Therefore, the current study confirms that perceived value remains a critical determinant of customer retention intention in the fitness industry.

The results reveal that self-tracking engagement (STE) has a positive and significant effect on customer retention intention (CRI), with a coefficient of 0.369 and a p-value below 0.001, thereby supporting H3. This finding suggests that users who are more actively engaged in tracking their fitness activities are more likely to maintain long term relationships with fitness services. One possible explanation is that self-tracking enhances users' commitment to their personal fitness goals, which in turn strengthens their intention to continue

using related services. This result is in line with the findings of Jin et al. (2021), who indicate that engagement in self-tracking activities can enhance motivation and persistence in effortful tasks. Moreover, Feng et al. (2021) emphasize that self-tracking contributes to sustained behavioral change by reinforcing users' awareness and accountability. Therefore, the present findings confirm the important role of self-tracking engagement in driving customer retention intention.

The mediation analysis indicates that perceived value of fitness services (PVF) significantly mediates the relationship between self-tracking engagement (STE) and customer retention intention (CRI), with a coefficient of 0.147 and a p-value below 0.001, supporting H4. This finding suggests that self-tracking engagement influences retention intention not only directly but also indirectly through enhancing perceived value. In other words, users who engage more deeply with wearable technologies tend to perceive greater value in fitness services, which subsequently increases their likelihood of continued usage. This result is consistent with prior research in consumer behavior, as Zeithaml (1988) highlights that perceived value acts as a key mechanism through which consumer experiences are translated into behavioral intentions. Therefore, the current findings reinforce the importance of perceived value as a central explanatory mechanism in the model.

The results provide strong support for H5, as the moderating effect of exercise self-efficacy (ESE) on the relationship between self-tracking engagement and perceived value of fitness services is statistically significant, with a coefficient of 0.239 and a p-value below 0.001. This finding indicates that exercise self-efficacy significantly conditions how users translate their engagement with self-tracking technologies into perceived value. Specifically, the positive effect of self-tracking engagement on perceived value becomes stronger among individuals with higher levels of exercise self-efficacy. Users who are more confident in their ability to perform and sustain exercise are better able to interpret self-tracking feedback, make sense of performance data, and convert this information into meaningful evaluations of fitness services. In contrast, individuals with lower exercise self-efficacy are less able to effectively process and utilize self-tracking information, which weakens the extent to which engagement contributes to perceived value. Overall, these findings highlight that the value derived from self-tracking engagement is not uniform across users but depends significantly on their psychological capability, particularly their level of exercise self-efficacy.

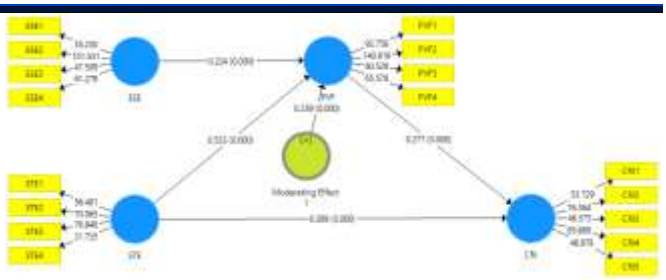

Figure 2: PLS bootstrapping model

Source: Data analysis by SmartPLS3

5. IMPLICATIONS AND CONCLUSION

This study provides a comprehensive examination of how self-tracking engagement in wearable fitness technologies translates into perceived value and customer retention intention, while also accounting for the moderating role of exercise self-efficacy. By integrating the Technology Acceptance Model (TAM) and Social Cognitive Theory (SCT), the findings offer a more nuanced understanding of the psychological and behavioral mechanisms underlying continued use of fitness technologies. The results highlight that value creation in digital fitness services is not solely determined by system usage, but is also shaped by users' cognitive evaluation processes and individual psychological resources.

From a theoretical perspective, this study contributes to the literature on technology-mediated health behavior in several important ways. First, it extends TAM beyond its traditional focus on adoption by emphasizing post-adoption behaviors, particularly sustained engagement and retention intention. Rather than treating usage as an outcome, this study conceptualizes self-tracking engagement as an active and continuous process through which users interact with personal health data and derive meaning from it. This shift provides a more dynamic understanding of technology usage in the context of wearable devices. Second, the study advances the concept of perceived value by demonstrating its role as a central mechanism linking user engagement to retention outcomes. In doing so, it highlights that value formation in fitness services is not static but emerges through ongoing interaction with self-generated data and feedback systems. Third, by incorporating exercise self-efficacy as a moderating factor, this research enriches SCT-based explanations of user behavior in digital environments. The findings suggest that psychological capabilities significantly shape how individuals interpret and benefit from self-tracking technologies, thereby introducing an important boundary condition into the engagement–value relationship.

From a practical standpoint, the findings offer meaningful implications for designers, developers, and managers of wearable fitness technologies as well as digital health service providers. The results suggest that enhancing user engagement with self-tracking features alone is not sufficient to ensure sustained customer retention if users are unable to effectively

interpret, internalize, and act upon the information generated by these systems. In this regard, the design of wearable technologies should move beyond simply increasing data availability toward improving the interpretability and usability of health information. Interface design and feedback mechanisms should therefore prioritize clarity, simplicity, and cognitive accessibility, enabling users to easily understand their progress, identify behavioral patterns, and recognize meaningful achievements over time.

In addition, the findings highlight the importance of designing feedback systems that support sense-making processes rather than merely presenting raw data. Visual analytics, progress tracking dashboards, and contextualized feedback may play a critical role in helping users translate numerical outputs into meaningful health insights. When users can clearly connect their behaviors to observable outcomes, their perception of value is likely to increase, which in turn strengthens their intention to continue using the service. This suggests that the effectiveness of wearable technologies depends not only on the accuracy of data collection but also on how effectively such data is communicated and framed for end users.

Besides, it also bring the need for personalization in wearable fitness services. The results indicate that exercise self-efficacy significantly influences how users convert engagement into perceived value, suggesting that users differ in their ability to interpret and respond to self-tracking information. Accordingly, fitness technology providers should consider adaptive system designs that account for individual differences in confidence, experience, and behavioral capability. Personalized features such as adaptive goal-setting, customized feedback frequency, and tailored difficulty levels can help ensure that both novice and experienced users derive meaningful value from their interactions with the system. Such adaptive mechanisms may be particularly beneficial for individuals with lower exercise self-efficacy, who may otherwise struggle to interpret performance data or maintain motivation over time.

Furthermore, the integration of motivational and behavioral support mechanisms within wearable ecosystems can significantly enhance perceived value and long-term engagement. Features such as guided goal-setting, real-time encouragement, behavioral reminders, and adaptive coaching interventions may help users maintain consistency in their exercise routines. Gamification elements, including achievement badges, progress milestones, and social comparison features, can further reinforce engagement by fostering a sense of accomplishment and social motivation. However, these features should be carefully designed to avoid cognitive overload or excessive competition, particularly for users who may have lower confidence in their exercise capabilities.

For service providers and fitness platform managers, these findings also underscore the importance of viewing wearable technologies not merely as tracking tools but as comprehensive behavior change systems. Long-term customer retention is more likely to be achieved when users perceive sustained value from their interactions with the system, which requires continuous alignment between technological features, user capabilities, and motivational needs. Therefore, strategic emphasis should be placed on designing holistic user experiences that integrate data tracking, behavioral feedback, and psychological support within a unified digital ecosystem.

This study still remains several limitations that open avenues for future research. The proposed model primarily focuses on self-tracking engagement and psychological factors within a fitness service context, and therefore may not fully capture other relevant influences such as social interaction, gamification features, or technological characteristics like device accuracy. Future research could extend this framework by incorporating these additional contextual and system-related variables to provide a more comprehensive understanding of value creation in wearable ecosystems. In addition, the cross-sectional nature of the study limits the ability to capture changes in engagement and perceived value over time, suggesting that longitudinal designs would be useful for examining dynamic retention behaviors. Finally, testing the model across different cultural and demographic settings would enhance the generalizability and robustness of the findings.

6. ACKNOWLEDGMENT

None

7. REFERENCES

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