The Role of Technology Readiness towards Technology Acceptance on Smartwatch Use

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Abstract

Wearable industry shipment and use prediction is increasing until 2026, especially smartwatches. In this pandemic phenomenon, smartwatches have become more critical because they can monitor fitness activities and rest in detail. In addition, the technology contained in the smartwatch must also be considered. The advanced technology available may make some users feel discomfort and insecure. This study is formed to consider the technology readiness index (TRI) such as optimism, innovativeness, insecurity, and discomfort in the technology acceptance model (TAM) towards user acceptance in using their smartwatch. 192 respondents filled out an online survey and then tested it using the PLS-SEM method. The result showed from 12 hypotheses that three hypotheses have no significant impact. Insecurity has no significant impact on perceived ease of use and usefulness, with the p-value 0,082 and 0,467. Optimism also has no significant impact on influencing perceived usefulness, with a p-value 0,220.

Keywords
Technology Acceptance Model, Technology Readiness Index, PLS-SEM, Wearable Industry and Smartwatch

1. Introduction
Wearable devices have become one of the most popular technologies like advanced information and communication technology (ICT). The global smart wearable industry has been growing for several quarters, but in Q4 2020, a significant shift in the smart band/smartwatch dynamic occurred. Even though the pandemic has sparked interest in health and fitness tracking, wrist-worn wearables such as watches and wristbands encountered hurdles during the quarter due to supply restrictions and shifting demand. But smartwatch selling succeeded as a critical growth engine (Chen and Low 2021).

Total shipments rose 5.6 percent year over year in Q2 2021. On the other hand, smart band sales fell 23.8 percent (Lim 2021). The growth of full-fledged smartwatches, which climbed by 37.9 percent year over year and now account for 62 percent of global sales, somewhat offset the decline of the smart band. In the Q3 of 2021, smartwatches' shipments keep rising at about 16 percent compared to the same quarter the previous year. According to a market research study, the global wearable technology market is predicted to rise at a compound annual growth rate of 22,5 percent between 2021 and 2026 (Mehra 2021).

Until the end of 2016, smartwatch adoption is still in the early adopter stage because people who purchase and own smartwatches are often those with a high enough income to justify the technology's cost, or those who are already conscious of the necessity of preserving health and comprehending technology. Another point to consider is that to reap the benefits, the users must engage in intensive or long-term use (Moore 2021).

On the other hand, the adoption of smartwatches is still being assessed. The technology acceptance model (TAM) is a fundamental theory that uses two ideas to explore end-user acceptance or adoption of technology: perceived usefulness and perceived ease of use. The technology readiness index (TRI) also undoubtedly plays a role as an external element in technology acceptance on smartwatch use. TRI component extends the TAM theory in the new technology acceptance.

The primary purpose of this study is to investigate consumers' acceptance of smartwatch use in Indonesia. This study uses the TAM theory, which is well-suited to the setting of smartwatches, to look at customers' intentions to utilize them. This study also examines the role of the TRI's variables in the acceptance of smartwatch use. The study's findings may then be used to reflect smartwatch brands' awareness of and development of technologies integrated with smartwatches in Indonesia.

2. Literature Review

2.1 Technology Readiness Index (TRI)

TRI was initially defined as a person's general beliefs in new technology. TRI is an individual's conviction in employing and using a system with new technologies to attain their objectives. There are four components of TRI that can affect user readiness in using and utilizing technology, namely Optimism, Innovativeness, Discomfort, and Insecurity.

Optimism refers to a favorable attitude toward technology and the assumption that it provides individuals with more control, flexibility, and efficiency in their daily lives. The ability to be a technological pioneer and a thinking leader is called innovativeness. The sense of being overwhelmed by technology and the idea of a lack of control over it is known as discomfort. Insecurity is a fear of technology that stems from doubts about its ability to perform well and concerns about its potential for harm (Parasuraman 2000).

Technology readiness is used in several works of literature to examine the role in the use of wearable devices (Kim and Chiu 2018, Raman and Aashish 2021). Technology readiness is also used in study by Lin and Hsieh (2005) to see the effect on satisfaction and behavioral intention toward self-service technology.

2.2 Technology Acceptance Model (TAM)

Various theoretical models have been offered to explain the adoption process since new technologies are continually being produced and marketed in today's digital environment. TAM is a paradigm for modeling user acceptance of an ICT created from the Theory of Reasoned Action (TRA). In particular, TAM is one of the most widely used theoretical frameworks for examining end-user adoption of ICT. Perceived ease of use (PEOU) and perceived usefulness (PU) are major psychological factors of user attitudes (ATT) and intention to use (INT), according to the original TAM (Davis, 1989) (Figure 1).

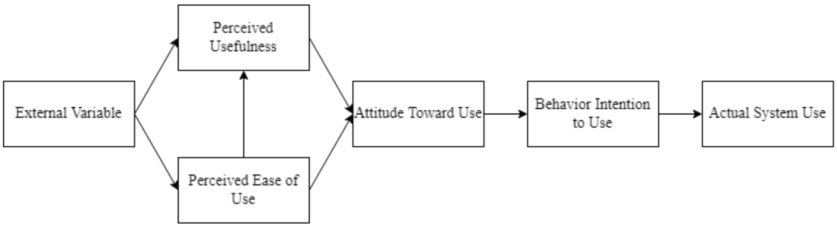

Figure 1. Original TAM in 1986

PU measured the degree to which an individual feels that adopting a given system will assist them in performing a specific activity. PEOU is an individual's conviction that utilizing a particular technique for a particular purpose would save the user's time and effort in a given activity must be greater than the effort required to learn how to use the technology in the first place. ATT stands for attitude toward use, and it interprets a user's good or bad feelings if they have to accomplish the tasks. A person's desire or intention to undertake a specific activity is referred to as INT. A person will engage in a behavior if he desires or intends to do so (Davis, 1989).

In the studies of Kim and Shin (2014), STĂNESCU and ROMAȘCANU (2021), Raman and Aashish (2021), Chang et al. (2016), and Felea et al. (2021), TAM is used to examine the acceptance of wearable technology. Of course, these various studies use different external variable to mix and match with TAM, which is tailored to the objectives of their respective study.

3. Methods

This study uses primary data through an online survey conducted by targeting smartwatch users. The questionnaire results will then be processed using SmartPLS 3.3.7 using the PLS-SEM method. In determining the variables used in this study, a literature review of TAM was first carried out, which was used to research the smartwatch use. The TAM uses PU, PEOU, ATT, INT, OPT, INN, INS, and DIS as external variables to determine the users' intention to use. OPT, INN, INS, and DIS in TRI are external variables in this study included in TAM and processed using the PLS-SEM approach. This approach contains TRI as an external variable to measure the specific component of the user's preparedness to adopt and utilize technology. The variables needed in this study were gathered by the literature review in Table 1 on the next page.

Table 1. Variable selection based on literature review

Variable	Reference
OPT	Kim and Chiu (2019), Aripradono (2021), Raman and Aashish (2021)
INN	Kim and Chiu (2019), Aripradono (2021), Raman and Aashish (2021)
INS	Kim and Chiu (2019), Aripradono (2021), Raman and Aashish (2021)
DIS	Kim and Chiu (2019), Aripradono (2021), Raman and Aashish (2021)
PEOU	Chang et al. (2016), Kim and Chiu (2019), Aripradono (2021), Raman and Aashish (2021), Holdack et al. (2021)
PU	Chang et al. (2016), Kim and Chiu (2019), Aripradono (2021), Raman and Aashish (2021), Felea et al. (2021), Holdack et al. (2021)
ATT	Holdack et al. (2021)
INT	Chang et al. (2016), Kim and Chiu (2019), Aripradono (2021), Raman and Aashish (2021), Felea et al. (2021), Holdack et al. (2021)

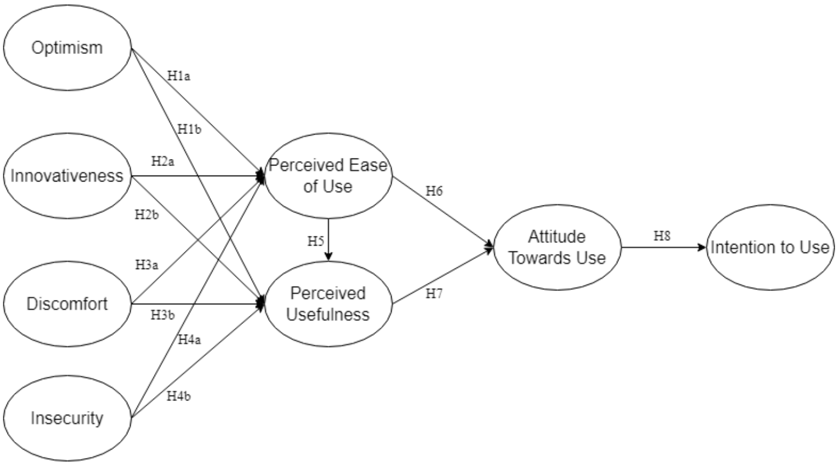

Figure 2. Research model

The model produced by the literature reviews after variable selection is shown in Figure 2. Each variable in the research model has a route to other variables. The following are some of the hypotheses that may be found in Figure 2's research model:

H1a : OPT positively influences PEOU for the smartwatch use,
H1b : OPT positively influences PU for the smartwatch use,
H2a : INN positively influences PEOU for the smartwatch use,
H2b : INN positively influences PU for the smartwatch use,
H3a : DIS positively influences PEOU for the smartwatch use,
H3b : DIS positively influences PU for the smartwatch use,
H4a : INS positively influences PEOU for the smartwatch use,
H4b : INS positively influences PU for the smartwatch use,
H5 : PEOU positively influences PU for the smartwatch use,
H6 : PEOU positively influences ATT for the smartwatch use,
H7 : PU positively influences ATT for the smartwatch use,
H8 : ATT positively influences INT for the smartwatch use.

4. Data Collection

The data needed for this study was gathered using an online survey questionnaire created with a Google Form that anybody with a link may fill out. The sampling technique used in this study is voluntary response sampling. Voluntary response sampling is a non-probability sampling technique in which the sample is an individual who voluntarily takes part in the study (Elder 2010). 243 respondents filled the questionnaire. However, only 192 respondents could be included in the study since they fit the smartwatch's use criteria. There are four criteria needed in this study such as a smartwatch with the ability to receive and read the contents of incoming notifications, control music and the camera while in use, track fitness and rest activities in detail, and have many types of connectivity such as Bluetooth, Wi-Fi, and Global Positioning Systems (GPS).

The survey was divided into seven sections. The respondent's profile, such as gender, age, and educational level, is included in the first section. The second section focuses on confirming smartwatch acceptance and selecting smartwatch features. Optimism and innovativeness statements are covered in the third section. Then, insecurity and discomfort statements are in the fourth section. The fifth section comprises ideas about perceived ease of use and perceived usefulness. The sixth section provides comments about attributes towards use and intention to use (Table 2).

Table 2. Questionnaire list adapted from literature review

Latent Variable	Measured Variable	Reference	Content
Optimism (OPT)	OPT1	Lin and Hsieh (2007), Kim and Chiu (2019)	You like the idea of using the new technology
	OPT2		Technology gives you more freedom of mobility
Innovativeness (INN)	INN1	Lin and Hsieh (2007), Kim and Chiu (2019)	You can usually figure out new high-tech products and services without help from others
	INN2		You keep up with the latest technological developments in your areas of interest
	INN3		You enjoy the challenge of figuring out high-tech products
Insecurity (INS)	INS1	Lin and Hsieh (2007), Kim and Chiu (2019)	If you provide information to your device or via the internet, you can be sure it really got to the right place
	INS2		You do not worry that the information you send over the internet will be seen by others
	INS3		You are not afraid to transact online in terms of buying or subscribing to a system offered by your device
Discomfort (DIS)	DIS1	Lin and Hsieh (2007), Jin (2013), Kim and Chiu (2019)	New technology makes it very difficult for an agency to spy on a person
	DIS2		You think that technology systems are also designed to be used by ordinary people
	DIS3		If you buy a technology product, you prefer to choose a model with many additional features than the basic model
	DIS4		You do not feel ashamed if you have a problem with your high-tech device when people see you operating it
Perceived Ease of Use (PEOU)	PEOU1	Davis (1989, 1993), Kim and Shin (2014)	Operating this smartwatch is easy for you
	PEOU2		You find this smart watch easy to use
	PEOU3		You do not require a lot of effort while using this smartwatch
Perceived Usefulness (PU)	PU1	Davis (1989, 1993), Kim and Shin (2014)	Using this smartwatch helps you productively complete your tasks
	PU2		Using this smartwatch improves your ability to complete your tasks
	PU3		This smartwatch is useful in doing your job
	PU4		Using the smartwatch helps you effectively do your job
Attitude Towards Use (ATT)	ATT1	Venkatesh et al. (2003), Kim and Shin (2014)	Using this smartwatch is a good idea
	ATT2		You have a generally favourable attitude toward using this smartwatch
	ATT3		You like the idea of using this smartwatch
	ATT4		Overall, using this smartwatch is beneficial
Intention to Use (INT)	INT1	Venkatesh et al. (2003), Kim and Shin (2014)	You predict that you will use this smartwatch in the future

	INT2		You plan to use this smartwatch in the future
	INT3		You expect your use of this smartwatch to continue in the future

5. Results and Discussion
5.1 Profile of Respondents
Table 3 below shows the profiles of respondents who have been successfully collected on the questionnaire for this study. As many as 92 are male respondents and 100 are female respondents. Respondents with an age range of 20 - 29 became the largest number with a percentage of 72,9%, 16,7% for the age range 20 or lower, 8,8% for the age range 30 - 39, and 1,6% for the age range 40 - 49. There are as many as 2,6% respondents with Junior High School education level or lower, 14,1% respondents with High School Education level, 25,5% respondents with Diploma education level, 47,4% respondents with Bachelor education level, 8,3% with Master education level, and 2,1% respondents with Doctoral education level.

Table 3. Sample demographics

Variable	Category	Frequency (Percentage)
Gender	Male	92 (47,9%)
	Female	100 (52,1%)
Age	20 or lower	32 (16,7%)
	20 - 29	140 (72,9%)
	30 - 39	17 (8,8%)
	40 - 49	3 (1,6%)
Education	Junior High School or lower	5 (2,6%)
	Senior High School	27 (14,1%)
	Diploma	49 (25,5%)
	Bachelor	91 (47,4%)
	Master	16 (8,3%)
	Doctoral	4 (2,1%)

5.2 Model and Structural Measurement
Table 4 shows the results of the model measurement. According to Ringle (2006), the loading value must meet the minimum criteria of 0.7. Hair et al. (2018) state that measured variables having a loading value of less than 0.7 are excluded. Cronbach's alpha and composite reliability have a threshold value of 0.7. The value of 0.7 is the same as that found by Henseler et al. (2012). The average commonality for each latent variable in the reflective model is shown by the Average Variance Extracted (AVE). The AVE value should be more than 0.5, according to Chin (1998) and Höck and Ringle (2006), which suggests that each latent variable must explain at least half of the variation. If the AVE is less than 0.50, the error variance is greater than the explained variance.

Table 4. Construct reliability and validity

Latent Variable	Measured Variable	Loading	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
OPT	OPT1	0,871	0,903	0,933	0,776
	OPT2	0,890			
INN	INN1	0,775	0,757	0,845	0,577
	INN2	0,817			
	INN3	0,894			
INS	INS1	0,834	0,773	0,869	0,689
	INS2	0,790			
	INS3	0,813			
DIS	DIS1	0,705	0,750	0,854	0,661
	DIS2	0,787			
	DIS3	0,714			
	DIS4	0,826			
PEOU	PEOU1	0,930	0,875	0,923	0,800
	PEOU2	0,938			

	PEOU3	0,832			
PU	PU1	0,911	0,711	0,874	0,776
	PU2	0,942			
	PU3	0,954			
	PU4	0,937			
ATT	ATT1	0,900	0,883	0,928	0,812
	ATT2	0,902			
	ATT3	0,900			
	ATT4	0,820			
INT	INT1	0,871	0,953	0,966	0,876
	INT2	0,939			
	INT3	0,872			

Discriminant validity was assessed using the heterotrait-monotrait ratio (HTMT) to determine the real correlation between two constructs assuming they were properly measured, as recommended by Hair et al (2018). Table 5 describes that no result exceeds the acceptable value (0.9), indicating that each variable was accurately assessed.

Table 5. Heterotrait-monotrait ratio (HTMT)

Variable	ATT	DIS	INN	INS	INT	OPT	PEOU	PU
ATT								
DIS	0,714							
INN	0,677	0,413						
INS	0,319	0,703	0,316					
INT	0,870	0,660	0,474	0,458				
OPT	0,807	0,434	0,796	0,225	0,680			
PEOU	0,784	0,572	0,732	0,228	0,620	0,774		
PU	0,780	0,663	0,608	0,373	0,522	0,593	0,685	

The inner model's findings are then examined using the Variance Inflation Factor (VIF) Value. According to Ringle et al. (2015), if the VIF value is less than 5, there is no multicollinearity problem. The VIF values in this study's data are all lower than 5 that indicates no multicollinearity problem that shows in Table 6.

Table 6. Inner variance inflation factor (VIF) value

Variable	ATT	DIS	INN	INS	INT	OPT	PEOU	PU
ATT					1,000			
DIS							1,565	1,757
INN							1,575	1,808
INS							1,397	1,413
INT								
OPT							1,573	1,814
PEOU	1,656							2,149
PU	1,656							

The absence of a high correlation between latent variables supports the idea that there is no multicollinearity problem when evaluated from the VIF value. Table 7 shows the investigation findings on the correlation of latent variables in the model. There is no concern of multicollinearity between latent variables in the findings of this study since correlation values > 0.9 or -0.9 suggest a high correlation in the inner model (Hair et al. 2018).

Table 7. Latent variable correlations

Variable	ATT	DIS	INN	INS	INT	OPT	PEOU	PU
ATT	1,000	0,609	0,566	0,268	0,778	0,648	0,705	0,724
DIS	0,609	1,000	0,343	0,527	0,540	0,340	0,481	0,574
INN	0,566	0,343	1,000	0,212	0,386	0,580	0,609	0,525
INS	0,268	0,527	0,212	1,000	0,391	0,137	0,189	0,324
INT	0,778	0,540	0,386	0,391	1,000	0,537	0,549	0,480
OPT	0,648	0,340	0,580	0,137	0,537	1,000	0,616	0,489
PEOU	0,705	0,481	0,609	0,189	0,549	0,616	1,000	0,629
PU	0,724	0,574	0,525	0,324	0,480	0,489	0,629	1,000

Furthermore, through Table 8, there are 12 hypotheses, of which 3 of the 12 hypotheses, namely H1b, H3a, and H3b, were rejected because the p-values were larger than the 5 percent confidence level, with p-values of 0.220, 0.082, and 0.467, respectively. Meanwhile, the alternate hypotheses, is stated to have a significant effect because its p-value is lower than the confidence level.

For the optimism variable, there are two hypotheses. H1a describes the path from optimism to perceived ease of use, then H1b describes the path from optimism to perceived usefulness. H1a supports the initial hypotheses, which positively affects perceptions of ease of use with a path coefficient of 0.335 that can be seen in Figure 3 and a p-value of 0.000. On the other hand, H1b, with a path coefficient of 0.086, optimism has no positive effect on perceived benefits with a path coefficient of 0.086 and a p-value of 0.220. It shows that if the user's positive assessment of the optimism of the technology in the smartwatch, the higher their assessment of the perceived ease of use and the perceived usefulness. However, statistically, the direction of the relationship from optimism to perceived usefulness has no effect. Significant results on the relationship between variables mean that these variables positively influence their daily lives. The conclusion from the hypotheses on optimism is that respondents in Indonesia have a positive assessment of optimism towards using their smartwatch. However, the benefits offered only affect or are consciously felt by perceived ease of use (H1a), while on perceived benefits (H1b), the benefits offered have no effect on respondents in Indonesia. This finding applies equally to all of this study's hypotheses, as shown in Figure 3.

According to Figure 3, there is only one hypothesis stated with a negative path coefficient, namely the H3a hypotheses, which suggests that each addition of 1 INS variable would influence the PEOU variable by -0.085 (Hair et al. 2018).

Table 8. Hypotheses test

Hypothesis	Path or Relation			Path Coefficient	t-value	p-value	Result
H1a	OPT	to	PEOU	0,335	4,305	0,000	Significant
H1b	OPT	to	PU	0,086	1,227	0,220	Not Significant
H2a	INN	to	PEOU	0,330	4,052	0,000	Significant
H2b	INN	to	PU	0,165	2,167	0,031	Significant
H3a	INS	to	PEOU	-0,085	1,745	0,082	Not Significant
H3b	INS	to	PU	0,055	0,728	0,467	Not Significant
H4a	DIS	to	PEOU	0,299	4,450	0,000	Significant
H4b	DIS	to	PU	0,306	4,554	0,000	Significant
H5	PEOU	to	PU	0,318	4,118	0,000	Significant
H6	PEOU	to	ATT	0,413	5,210	0,000	Significant
H7	PU	to	ATT	0,464	6,739	0,000	Significant
H8	ATT	to	INT	0,778	15,633	0,000	Significant

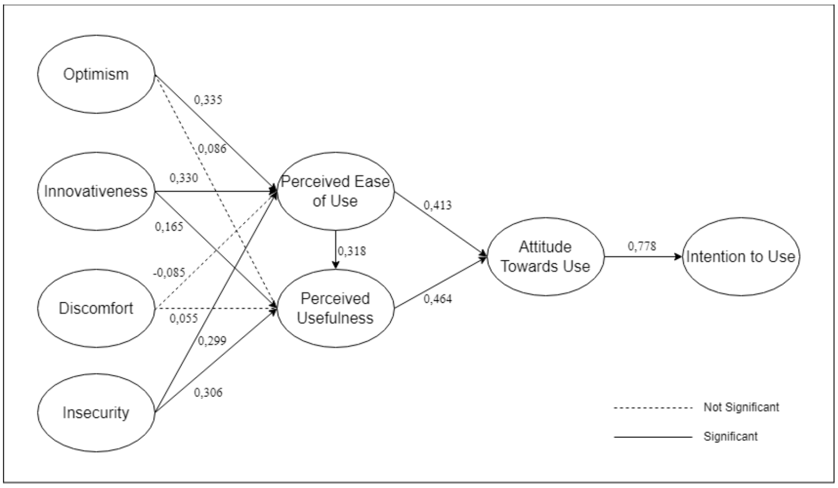

Figure 3. Path coefficient

5.3 Model Fit Measurement

In SmartPLS, there are two types of model fit measurement results: saturated model and estimated model. The saturated model evaluates the correlation between all variables in the model fit test, whereas the estimated model is based on the total or overall effect scheme. If the SRMR number, or Standardized Root Mean Square Residual, is less than 0.1, the model is deemed to fit the suggested model (Hair et al. 2018, Hu and Bentler 1998, Hooper et al. 2008). Because the SRMR value is less than 0.1, the model fit of the suggested model appears to be pretty excellent and acceptable. The fit model may also be examined using the Normed Fit Index (NFI) value in addition to the SRMR value. NFI values vary from 0 to 1, with 0 being the lowest and 1 being the highest. The SRMR and NFI values in the research model are listed in Table 9.

Table 9. Model fit

Model Fit	Saturated Model	Estimated Model
SRMR	0,084	0,097
NFI	0,677	0,661

6. Conclusion

The user intention in Indonesia to utilize the smartwatch was assessed using an extension of the technology acceptance model that included optimism, innovativeness, insecurity, and discomfort. The results showed if insecurity has no significant impact on perceived ease of use and usefulness. Some issues that became the statements of discomfort and insecurity are the big problem for using the smartwatch. Also, the optimism result showed that optimism has no significant impact on perceived usefulness. In addition, the technology readiness index entirely plays a role in smartwatch use in Indonesia.

Based on the Technology Acceptance Model (TAM) theory, if users feel it is easy to operate the technology, users will receive the benefits so that they decide to adopt the technology longer than when they used it when this research was implemented. With a very high path coefficient, users will continue to use their smartwatch in the future based on the existing attitude during use.

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