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Evaluation Review on Wearable Technology Adoption for Sport Science

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Abstract

Optimal monitoring of athletes is conducted by up-to-date information at the individual and sports organization. Technology to accommodate these data can be varied. One of the trends in the millennial generation is to use wearable technology, such as smartwatches. Deployment of wearable in sport organization setting for the monitoring of athlete performance. A recent innovation in wearable technology can support sports organizations to collect athlete data that come from kinetic and kinematic activity. Besides, the utilization of wearable technology can protect the athlete from several potential injuries. However, this adoption needs behavior analysis from the user who uses this device. Therefore, this research focus to identify the variable that has a significant impact on the athlete to decide to wear this application. To analysis the data, this study uses some technical statistical. The result shows that the decision to buy or to use the wearable technology is not decided by the hedonic factor, but the awareness of the person to monitor their health performance. It will be an opportunity for sports organizations to explore more this wearable technology in the future.

Keywords—wearable technology, athletes, smartwatch, sports organization, adoption

1 Introduction

The most emerging technology allows technological devices to be connected easily through the internet (Anggraini et al., 2019). Along with developments in mobile technology, more and more technologies are being created to help human activities, such as wearable smartwatch technology. Terms of smart wearable technologies of wearable technology are defined to figure out seamlessly embedded portable computers and advanced technology that can be used on the part of the body and can interact between users and the smart environment anywhere and anytime they need. The successful wearable technology allows the embedded this device into a new generation of products.

This phenomenon changes the pattern of humans using watches in general. By using a smartwatch humans can communicate, interact with other people, and get various information. A smartwatch is a device that can be connected to a smartphone and can receive various information, such as time, text messages, schedules, and GPS data. Smartwatch technology is the latest development in wearable type technology. Smartphones and smartwatches have become a daily need for many people. Many people use this technology to accommodate the monitoring of health, especially as sports tools.

Smartwatch technologies innovate with many wireless sensors that can support people who intense to take exercises, such as athletes. With this smartwatch, the sensor can record sports activity, oxygen, heart rate, sleep quality. Moreover, it can synchronize the data from various platforms, thus leads to a database and network (Ha et al., 2017). Data from smartwatches can be support for sport science analysis because the human activity can become a part of an intelligent system (Ardiyanto et al., 2020) to recognize every pattern in daily sports activity, so the sports organization can monitor the athlete's performance periodically. Before sports organization adopts this technology, we need to do the evaluation review to check the behavior of people to use a smartwatch, what factors that influence people to decide to wear the smartwatch.

In this study, the factor he anthology, hedonic, habit, expectation confirmation models are explored to determine their influence on the smartwatch adoption. The result shows heathology and habit factors also have a significant effect on continuance intention variables. This proves that most smartwatch users feel that wearable technology can motivate them to exercise to maintain healthy health. Users also feel that using a smartwatch can help with certain tasks such as maintaining sleep patterns so that this can increase the user's continued intention to use the smartwatch. Therefore, overall in this study, it is evident that including `healthology and habit variables into the Expectation Confirmation (ECM) model framework will add predictive power in the user's continuing intention.

2 Literature Review

This session describes the theories from relevant previous research related to wearable technology and variable of research, as a background of this research:

2.1. Information Systems. The role of information systems in modern times can be found in everyday life. The application of information systems covers many fields such as education, banking, business, and health. Information systems in the health sector aim to make it easier to find patient data, drugs, and doctor's schedules. This is done to improve services at the hospital. Information systems serve as tools for gathering information and can monitor in an emergency (Holla & Moricova, 2019) and information systems are an important form of knowledge representation (Liu et al., 2020).

2.2. Internet of Things (IoT). Discussing the Internet of Things (IoT) is very broad because the Internet of Things (IoT) does not have a fixed definition. When discussing the Internet of Things (IoT), there is usually a new discussion, starting from everyday life to objects that are used as a device

to help with daily activities, such as using a smartwatch that can record user activity to find out the distance the user has traveled and then smartwatch data. connected to a smartphone to be used as a reference for users in carrying out activities. The Internet of Things (IoT) reshapes the world into smart cities, smart networks, smart agriculture, smart transportation, smart health care systems, and smart homes (Kamran et al., 2020) Internet of Things (IoT) applications can enable device-to-device and human-device interactions strongly and reliably (Nord et al., 2019).

2.3. Smartwatch. Wearable technological developments and advancements that are increasingly widespread today are supported by a variety of technological sophistication to give rise to the latest discoveries. One of them is the invention of wearable devices, which are objects in the form of accessories that have technology such as the small computer. Wearable devices can take the form of bracelets, clothes, glasses, and watches. In general, wearable device users are fans of the latest technological developments, sports players, and elderly people who are advised by medical personnel to maintain their activities and health. Wearable smartwatch technology is a modification of an ordinary watch into a communication tool. Today, most smartwatches have a variety of useful functions that turn them into mini-computers that can be used to run applications, answer calls, read messages, and receive notifications without having to look at the phone. Some smartwatches have complete fitness tracker functionality by monitoring important metrics such as running speed, several steps, and heart rate (Casselman et al., 2017) With the various features in the smartwatch, of course, it will be very useful for both individuals and health institutions. More and more testimonies prove that smartwatches can save people's lives in cases of medical emergencies. The use of smartwatches in health institutions, for example, monitors patients who have been in intensive care but have been allowed to return home. This helps medical personnel monitor the health of their patients so that medical personnel becomes more responsive, and for patients using smartwatches, they are more concerned about health. The use of smartwatches can improve the quality of health services by using data accuracy and easy monitoring and can encourage lifestyle changes to be healthy. According to (Ogbanufe & Gerhart, 2018) said that a smartwatch equipped with a pedometer function can be used to monitor health conditions such as heart rate and blood pressure. The more benefits that users get from the smartwatch, the result is that user satisfaction is met and allows users to continue using it (Nascimento et al., 2018).

2.4. Health and Healthology Variables. The application of the Internet of Things (IoT) in health products can change the focus of the health care industry into a preventive program, this allows a person to be active and take responsibility for their health. Therefore, the emergence of smart devices that can be used creates a new dimension to measure health and technology is considered appropriate, the term healthology is defined as the interaction of health, informatics, and technology problems (Dehghani et al., 2018).

2.5. Hedonism and Hedonic Variables. The life of hedonism in modern times is increasingly widespread starting from clothing styles, modern entertainment, modern technology, and consumptive lifestyles. Hedonism will continue to develop as long as humans are still alive and technology creators continue to develop their innovations. The development of technological innovations, for example in the use of watches, which currently have various functions. Given that smartwatches are multipurpose and convergent devices that are expected to meet the utilitarian and hedonic needs of users (Kim, 2016).

2.6. Habits and Habits Variables. Each individual certainly has the behavior to get pleasure or the goals to be achieved. The behavior that a person does repeatedly creates a habit of his actions. Habits are human actions that are repeated in the same way. The habit of using watches has changed, due to the creation of smartwatch technology or what is known as a smartwatch. The use of a smartwatch creates a new habit of using a watch. A smartwatch is not only useful as a smartphone companion, but has many functions such as adjusting sleep patterns, getting notifications, becoming a fitness tracker, and others. (Nascimento et al., 2018) observed that the effect of habit moderation in the relationship

between satisfaction and the continuing intention was statistically significant in the context of wearable technology.

2.7. Expectation Confirmation Model (ECM). The Expectation Confirmation Model (ECM) introduced by (Bhattacherjee & Barfar, 2011) is a well-known research model for explaining the sustainability of information systems. In the Expectation Confirmation Model (ECM) an individual's decision to continue using the information system depends on three variables, namely, confirmation, satisfaction, and perceived usefulness. (Bhattacherjee & Barfar, 2011) show that user continuity intention is determined by satisfaction in the use of information systems and perceived usefulness of the continuous use of information systems, then user satisfaction is influenced by the confirmation that users expect in using the information system, then perceived usefulness after acceptance in using the system. the information is affected by the user's confirmation level. Previous research using the Expectation Confirmation Model (ECM) such as mobile application journals written by (Hsu & Lin, 2015). e-learning system journals are written by (Daɬhan & Akkoyunlu, 2016), social commerce journals written by (Hew et al., 2016), a digital textbook journal is written by (Joo et al., 2017), continuation intention journal to use smartwatch (Hong et al., 2017), and journal of advanced features of smartwatch use (Ogbanufe & Gerhart, 2018).

3 Method

In this study, data collection uses primary data derived from questionnaires. The author creates a questionnaire in a digital form known as Google Form. This research was conducted starting in March 2020 and finished in June 2020. The objects used in this study were smartwatch users in the cities of Jakarta, Bogor, Depok, Tangerang, and Bekasi an age range of 12-65 years, male or female. The author distributes the questionnaire link to people who are around the author and have the desired respondent criteria. The criteria for the respondent are someone who has used a smartwatch with an age range of 12-65 years and then asks the person to invite a relative who has the same criteria in filling out the questionnaire. Also, the author uses personal social media to distribute the questionnaire link. In this study, there are two types of data sources used, including:

1. Primary data is a data source that is obtained directly through a questionnaire that has been filled in by respondents according to the desired criteria. In general, the questionnaire filled out by respondents is the opinion of individual subjects on an event, activity, or object.
2. 2. Secondary data is data that comes from several kinds of literature such as books, journals, publications, and other sources of information that have relevant value to this research.

To describe the correlation between variables that are involved in this research, it shows in Fig 1 that consists of seven variables, which are hedonic, confirmation, healthology, habit, perceived usefulness, satisfaction, and continuance intention.

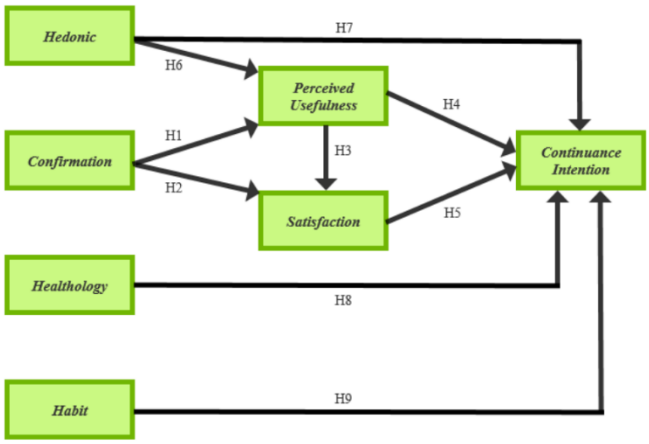

FIGURE 1. Research Model

4 Result & Discussion

4.1 Descriptive Analysis

In this study, the authors researched the Jabodetabek area (Jakarta, Bogor, Depok, Tangerang, and Bekasi). The population in this study were smartwatch users in the cities of Jakarta, Bogor, Depok, Tangerang, and Bekasi, with an age range of 12-65 years, male or female. Accessed from www.statista.com in the article Wearables in Indonesia. (Online) according to a survey conducted by Statista on the use of wearable smartwatch technology, stating that the number of wearable smartwatch users in Indonesia is only 2.2% of the total population in Indonesia. Therefore, the authors determine the population in the Jabodetabek area, because this area is one of the metropolitan cities in Indonesia and has quite a lot of wearable device users such as smartwatches. The data collected until the data collection period were 233 respondents, consisting of 170 or 73% of respondents who had used a smartwatch and 63 or 27% of respondents had never used a smartwatch. It can be seen in Fig 2.

Figure 2. Demographics of Smartwatch Users in The Jabodetabek

This study uses a technique that is classified as non-probability sampling because it is not known the exact number of residents in Jabodetabek (Jakarta, Bogor, Depok, Tangerang, and Bekasi) who use smartwatches. The author uses non-probability sampling because the costs incurred are cheaper and faster. The type of non-probability sampling used by the author is included in the type of convenience sampling. The reason the authors use this type of convenience sampling is because of the unknown population of smartwatch users. Therefore, the authors select a sample of people or units whose data are the easiest to find or access. According to (Etikan, 2016) said that when the subject was selected because of its proximity to a researcher, which is more accessible to the researcher, the researcher made a non-probability sampling which is a convenience sampling type.
The most distribution age of respondents involved in this research is 26-45 years old. The productive age to use smartwatches in their daily activity (Fig. 3) and there is no difference proportion gender, which is 50% for male and 50% for female as depicting in Fig. 4.

Figure 3. Age of Smartwatch Users Respondents in The Jabodetabek

Figure 4. Gender of Smartwatch Users Respondents in The Jabodetabek

Hair et all in their book says that to get better research results requires a total number of respondents of 100-200 people and if the population is not known with certainty, then the minimum sample size that must be met depends on the number of indicators used multiplied by 5 times (Hair et al., 2018). In this study, there are 30 indicators used, so that the minimum sample size required is 150 samples. Respondent measurement scale using a 6-point Likert scale. According to (Willits et al., 2016) the use of a Likert scale of 1 to 5 has a midpoint or neutral point and often causes bias.

In this study, data collection uses primary data derived from questionnaires. The outer model sees the relationship between variables and their indicators. Tests performed on the outer model analysis are convergent validity, composite reliability (CR), Average Variance Extracted (AVE), and Cronbach's alpha (CA).

4.2 Valid and Reliability. Based on Table 1 using the Rule of Thumb from (Ghozali, 2005) it can be seen that all indicator items have a loading factor value above 0.7 so that all question items used in this study are valid.

Based on the results of calculations carried out by the PLS Algorithm for the indicators in the valid table, it can be seen that the AVE value for all variables meets the requirement value, which is above 0.5. The lowest AVE value is in the Perceived Usefulness variable with a value of 0.609. By paying attention to the loading factor value and the AVE value in Table 1, the data from this study can be declared to have met the requirements of the convergent validity test.

After testing the construct validity, the next test is the construct reliability test using Composite Reliability (CR). The construct is declared reliable if the Composite Reliability (CR) value is 0.7. After testing using Composite Reliability (CR), the next test is the construct reliability test using Cronbach's Alpha (CA). The construct is declared reliable if the Cronbach's alpha (CA) value is 0.7.

Table 1. Validity and Reliability

Variable	Indicator	Cross Loading	AVE	CR	CA	Valid Yes / No
Confirmation	C10	0.871	0.716	0.910	0.867	Yes
	C11	0.863				
	C12	0.835				
	C13	0.814				
Perceived Usefulness	PU1	0.828	0.609	0.916	0.893	Yes
	PU2	0.811				
	PU3	0.792				
	PU4	0.781				
	PU5	0.771				
	PU6	0.711				
	PU7	0.762				
Satisfaction	S8	0.902	0.794	0.885	0.741	Yes
	S9	0.880				
Hedonic	HD17	0.811	0.680	0.895	0.843	Yes
	HD18	0.807				
	HD19	0.861				
	HD20	0.819				
Healthology	HL14	0.866	0.806	0.926	0.879	Yes
	HL15	0.911				
	HL16	0.915				
Habit	HB21	0.806	0.784	0.915	0.860	Yes
	HB22	0.922				
	HB23	0.923				
Continuance Intention	CI24	0.846	0.753	0.955	0.945	Yes
	CI25	0.773				
	CI26	0.875				
	CI27	0.906				
	CI28	0.875				
	CI29	0.896				
	CI30	0.897				

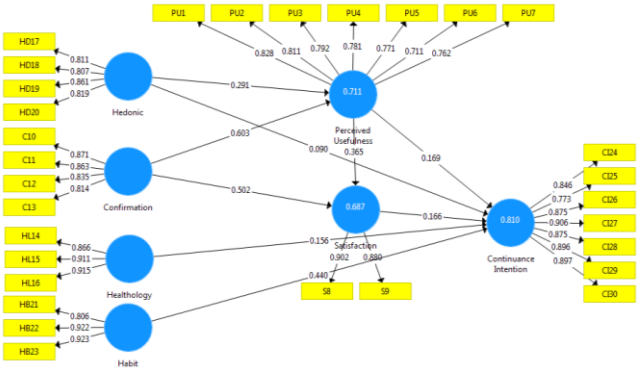

Figure 5. Model Path Coefficient Output

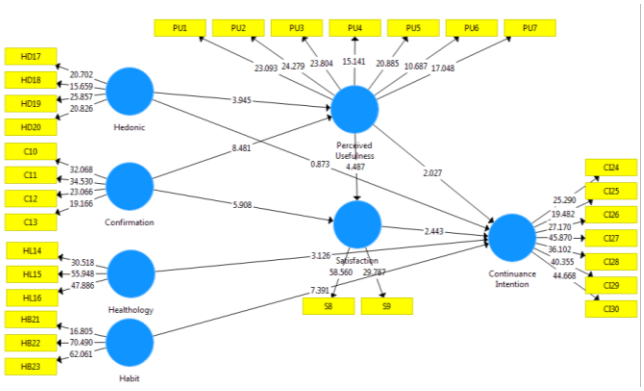

Figure 6. Path Coefficient and t-test value of Model

Based on Table 2, shows the PLS calculation results which state the direct effect between variables. It is said that there is a direct effect if the T Statistics value is 1.96 and it is said that there is no effect if the T Statistics 1.96. Based on Table 2, it can be stated as follows:

1. H1 is accepted: The Confirmation (C) variable has a significant effect on the Perceived Usefulness (PU) variable?
2. H2 is accepted: The Confirmation (C) variable has a significant effect on the Satisfaction (S) variable?
3. H3 is accepted: The Perceived Usefulness (PU) variable has a significant effect on the Satisfaction (S) variable?
4. H4 is accepted: The Perceived Usefulness (PU) variable has a significant effect on the Continuance Intention (CI) variable?
5. H5 is accepted: The Satisfaction (S) variable has a significant effect on the Continuance Intention (CI) variable?
6. H6 is accepted: The Hedonic (HD) variable has a significant effect on the Perceived Usefulness (PU) variable?
7. H7 is rejected: The Hedonic (HD) variable has a significant effect on the Continuance Intention (CI) variable?
8. H8 is accepted: The Healthology (HL) variable has a significant effect on the Continuance Intention (CI) variable?
9. H9 is accepted: The Habit (HB) variable has a significant effect on the Continuance Intention (CI) variable?

From nine variables only one variable was rejected (hedonic). According to the result, a sports organization has a big opportunity to adopt the smartwatch to support sports science. Nevertheless, the innovation of smartwatch technology for sport science will become numerous in the future.

5 Conclusion

Many companies have released smartwatch technology with futuristic expectations. Through this evaluation review, this study investigates the factors of smartwatch adoption in terms of people's needs. The findings of this study can conclude that people who use smartwatch is not influenced by hedonic factors, but by habit, ECM, and healthology. Thus, the smartwatch adoption will be different depending on the various wearable devices that can enable the user to wear a smartwatch.

Moreover, this result has some limitations, which are lack of respondent and the sampling method still use convenience sampling, that hard to be accepted as scientific research, so for future research we recommend enlarge the number of the respondent to more representative of the population.

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