# Modelling Malaysia Residents' Behavioural Intention to Use Smartwatch: The role of Health Technology and Device Benefits.

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## DECLARATIONS

This work has not previously been accepted in substance for any degree and not concurrently submitted in candidature for any degree award from other universities.

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# ACKNOWLEDGMENT

Working on a DBA thesis is a thorny journey, but the outcome is fruitful. The process teaches an appreciation of personal limitation, pushing the envelope of personal endurance and persistency required to cross the finishing line. With the conclusion of this thesis, another phase of the life journey is on the horizon. This thesis would not have completed without the support, understanding, and assistance of many individuals along the voyage.

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# ABSTRACT

Consumer smartwatches have been accessible for the worldwide consumer market since 2012 when Sony Corporation first offered them to the market. According to numerous smartwatch technology adoption journals, consumer smartwatch functionalities such as health technology, infotainment and communications, supported living and safety, and lifestyle and fashion are beneficial for social well-being. Researchers hypothesised that these practical applications which automatically manage individual personal information, simplify infotainment and communications, support safety and complement individual social lifestyles can improve individual social well-being and professional productivity. However, despite numerous benefits of consumer smartwatch technology, Malaysia population with good ICT and digital technology literacy have been slow to embrace smartwatches in comparison to other regional and global countries. Furthermore, smartwatch adoption research in Malaysia is still in its early stages, with only a few published studies accessible. These practical issues are the motivation for this study to examine Malaysia residents' behavioural intention to use a consumer smartwatch.

This study tested the factors that influence Malaysia residents' behavioural intention to use a consumer smartwatch by adapting and extending the UTAUT2 theory with health technology and design benefit in a single study. The conceptual model consists of seven determinants with seven hypotheses representing technical, social, economic, health technology, and design benefit. The research process emphasised theory to practice inquiry technique, ethical practises, attaining reliability and validity, and bias minimization targeting a confidence level of 95% with an error margin of ±5%. The study empirically tested 366 valid responses from Malaysia residents collected using an online cross-sectional self-administered survey questionnaire.

Structural equation modelling was used to analyse the suggested conceptual model. Effort expectancy and price value were found to not influence Malaysia residents' behavioural intention to use a consumer smartwatch. Performance expectancy, social influence, health technology, and design benefits all have significant effects and positive influences on Malaysian residents' behavioural intention to use a smartwatch, while hedonic motivation has a significant effect and negative influence. These constructs were found to explain 65% of the proposed model behavioural intention.

In conclusion, this study empirical findings based on extending the UTAUT2 theory generate awareness of the importance of performance expectancy, social influence, and hedonic motivation, health technology and design benefits in influencing Malaysians' behavioural intention to use a consumer smartwatch. The insights generated by this study based on the UTAUT2 theory provide new empirical information on the influence of health technology and design benefit which did previously not exist in any of the existing Malaysia smartwatch adoption research. The findings provide new reference dimensions for consumer smartwatch manufacturers seeking to improve their understanding of the Malaysia consumer smartwatch market.

# ACRONYMS

AMOS - Analysis of Moment Structures

AVE - Average Variance Extracted

CFA - Confirmatory Factor Analysis

CFI - Comparative Fit Index

CMB - Common Method Bias

C-TAM-TPB - Combined Technology Acceptance Model and Theory of Planned Behaviour

$D^2$ – Mahalanobis Distance

DB – Design Benefit

DBA - Doctor of Business Administration

*df* - Degrees of Freedom

DoSM – Department of Statistic Malaysia

DTPB - Decomposed Theory of Planned Behavior

EE – Effort Expectancy

EY - Ernst and Young

GoF - Goodness-of-Fit (index)

GPS – Global Positioning System

GSMA - Global System for Mobile communications Association

HM – Hedonic Motivations

HT – Health Technology

HTMT - Heterotrait-Monotrait Ratio

IBM – International Business Machine

IDT - Innovation Diffusion Theory

IEEE - Institute of Electrical and Electronics Engineers

IoT - Internet of Things

IPSOS - Institut de Publique Sondage d'Opinion Secteur.

IT - Information Technology

IS – Information Systems

KMO - Kaiser-Meyer-Olkin

MCMC - Malaysian Communications and Multimedia Commission

ML - Maximum Likelihood

MLE - Maximum-Likelihood-Estimation

MM - Motivational Model

MPCU - Model of Personal Computer Utilization

PC - Personal Computer

PCA - Principal Component Analysis

PE – Performance Expectancy

PV – Price Value

$R^2$ – Coefficient Determinants

RMSEA - Root Mean Square Error of Approximation

RQ – Research Question

RO – Research Objective

SCT - Social Cognitive Theory

SEM - Structural Equation Modeling

SI – Social Influence

SPSS - Statistical Package for Social Science

SRMR - Standardised Root Mean Square Residual

TAM - Technology Acceptance Model

TPB - Theory of Planned Behaviour

TRA - Theory of Reasoned Action

UTAUT - Unified Theory of Acceptance and Use of Technology

UTAUT 2 - Unified Theory of Acceptance and Use of Technology 2

VIF - Variance Inflation Factor

WHO – World Health Organisation

$\chi 2$ - Chi-square Goodness of Fit (Non-parametric test)

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# CHAPTER 1: INTRODUCTION

## 1.0 Chapter Overview

This chapter summarises the essential highlights of this thesis and introduces the research study. This chapter consists of ten sections, and the chapter's presentation flow begins with an introduction to the chapter, the background of this study, problem statement, research gap and feasibility, research question, research objectives, the study scope, the significance of the study, the thesis chapters, chapter summary and keyword for the study.

## 1.1 Background of the Study

The previous section introduces a brief outline of this chapter. This section introduces and provides a simplified perspective of the study's background to help the thesis's audience generate a quick overview of this study's background before progressing into the details. From a historical standpoint, the spread of new technologies altered many elements of human life, and the benefits and drawbacks resulting from technology acceptance and use at the societal and national levels have been extensively recorded in many research publications (Atkinson and Mckay, 2007). The adoption and usage of smartwatch technology, a new emerging technology believed to offer numerous beneficial applications which bring convenience and advancement to human life. Health and fitness technologies, infotainment and communications, assisted living and safety, and lifestyle and fashion are broad application categories classified by various researchers (Cheng and Mitomo, 2017; Choi and Kim, 2016; Chuah, Rauschnabel, Krey, Nguyen, Ramayah and Lade, 2016; Dehghani, 2018; Peake, Kerr and Sullivan, 2018; Tehrani and Andrew, 2014).

Despite an understanding of the various anticipated consumer smartwatch benefits, this study discovered that the current rate of smartwatch technology diffusion among populations in many countries is still low. In contrast, the consumer smartwatch diffusion rate in Malaysia is even lower, despite a government-led economy that prioritises emerging technology and its population's decent level of technology literacy, implying that Malaysia is facing smartwatch technology adoption challenges. This section's brief overview will be elaborated into more informative detail as the discussion in this chapter progresses.

### 1.1.1 Consumer Smartwatch Technology

The portable clock has its history tracing as far back as the fifteenth century. Its evolution into a mechanical portable watch, mechanical wristwatch and digital electronic wristwatch introduced to humankind with great success (Stephen and Dennis, 2000). Therefore, the basic concept of a multi-functional digital watch is not new to consumers.

Smartwatch was introduced by Sony Corporation in 2012 as a companion watch to complement its flagship Sony Ericsson Xperia smartphone. Smartwatch shares a similar design, look and feel and form factor with a digital wristwatch and traditional mechanical wristwatch. It is perceived as a "smart" version of rudimentary digital wristwatch technology widely popular during the 1970s to 2000s. It is tagged as "smart" because it is a miniature wireless digital computer equipped with environment sensors and ubiquitous communications that satisfy human sensing and communications needs at an affordable price (Cheng and Mitomo, 2017).

Academically, numerous researchers' perspective of smartwatch compiled from between the year 2014 until the year 2019 (refer to Chapter 2, section 2.2.2, Table 2-1 for elaborated details) suggested that the smartwatch as a mini wrist-worn multi-functional smart computing IoT device facilitates time-keeping, real-time smart sensing and communications between individuals and the digital world. It provides individuals with utilitarian and hedonic benefits, such as notifications, messages, health and fitness applications, installing and executing third-party applications, global positioning access for location tracking and navigation, short-range wireless or Bluetooth tethering to a smartphone, cellular connectivity and direct phone calls. Besides, a smartwatch also perceived by individuals as smart health technology and smart fashion technology.

The smartwatch worn persistently on a human body enabled continuous human biological and environment sensing needs, ubiquitous communications and intelligent computing that satisfied various human daily needs and expectations (Milosevic and Farella, 2017; Tehrani and Andrew, 2014). Smartwatch technology expected to significantly impact consumers' daily lives and gain acceptance into society's mainstream going forward (Cecchinato, Cox and Bird, 2015). Park, Kim and Kwon (2016) suggested that smartwatch could become the next-generation ubiquitous technologies after smartphones. Price Waterhouse Cooper (PWC) (2016) shares a similar optimism that smartwatch would become the next consumer electronic device of mass adoption after smartphones. Numerous researchers and practitioners perceive smartwatch technology as a practical, multi-functional innovative technology in everyday human living where insights from various smartwatch literature suggested four broad categories of applications that attracted consumers to use smartwatches. The four broad application categories are **health and fitness technology**, **infotainment and communications, assisted living and safety** and **lifestyle and fashion** (Cheng and Mitomo, 2017; Choi and Kim, 2016; Chuah, Rauschnabel, Krey, Nguyen, Ramayah and Lade, 2016; Dehghani, 2018; Peake, Kerr and Sullivan, 2018; Tehrani and Andrew, 2014).

This section briefly introduced the consumer smartwatch technology; more elaborated details presented in Chapter 2. The next section discusses numerous researchers' belief that adopting a smartwatch could promote individual change behaviour to adopt a more active lifestyle.

### 1.1.2 Consumer Smartwatch Technology and Society Well-Being

The usage of smart digital technology is a practical way to interrupt undesirable habits or train toward a target behaviour (Hermsen, Frost, Jan Renes and Kerkhof, 2016). The evidence from smartwatch patents analysis suggested that a smartwatch is well-position for both consumer and health care industry applications (Dehghani, Kim and Dangelico, 2018), and the smartwatch usage as a quantified self-tracking tool had attracted many practitioners and academic researchers' attention (Aliverti, 2017). Numerous research literature has mentioned that a smartwatch is a quantified self-tracking device that can collect, track, monitor and deliver personal physical activity and health information (Hänsel, Wilde, Haddadi and Alomainy, 2015; Jung, Kim and Choi, 2016; Lentferink, Oldenhuis, de Groot, Polstra, Velthuijsen and van Gemert-Pijnen, 2017).

Besides, the societal mindset has been gradually shifting away from the old believes in delegating personal health to physician toward a new paradigm where individuals take active control of personal health using consumer smartwatch by adopting quantified self-tracking of personal health and fitness. The availability of affordable consumer smartwatch products with access to mobile internet empowers consumers and facilitates quantified self-tracking behaviour (Swan, 2012). Numerous practitioner surveys report also indicated that the top two interests for adopting a smartwatch are personal communications and personal health and fitness (Richter, 2017; PWC, 2015; PWC, 2016).

The quantified self-tracking paradigm entailed personal quantification of personal biological and environmental data to benchmark against pre-set goals or pattern for intervention. At a personal level, quantified self-tracking behaviour consists of self-knowledge and self-optimisation behaviour using smart wearables technology (example, smartwatch or smart bracelet) to track and monitor personal biological, physical, behavioural, or environmental information (Swan, 2013). Irrespective of the purpose, any competence children, teenagers, and adults of any ages can pick up the quantified self-tracking skills, with individual adopting quantified self-tracking movement because of the personal desire to maintain a healthy lifestyle (Hänsel et al., 2015; Lentferink et al., 2017).

This study reviewed smartwatches available on e-commerce websites such as Alibaba.com and Amazon.com indicated that most consumer smartwatches have a sedentary reminder function to detect and remind a passive user. The sedentary reminder serves as a handy feature to remind or trigger a passive user to become more active because it is not practical to assume that all smartwatch users would adopt quantified self-tracking. Hence, the sedentary reminder feature is vital to remind and encourage smartwatch users not into quantified self-tracking movement to stay active.

This study believes that smartwatch technology through quantified self-tracking and sedentary reminder function empowers individual to change behaviour and enables intervention toward a more active and healthier lifestyle. This study made a logical assumption that every sane individual aspires to stay fit and healthy, and besides, as argued by Swan (2012), societal mindset is gradually changing toward adopting active management of personal health and fitness. Hence, this study inferred that high diffusion of smartwatch technology into a population is desirable and essential for personal health and well-being. The take away from the discussion in this section is that a high diffusion of consumer smartwatch technology promotes social wellbeing. The section discussion concludes at this point, and the subsequent discussion deals with the discussion related to smartwatches adoption challenges.

### 1.1.3 Consumer Smartwatch Adoption Challenges

As previously stated, the consumer smartwatch appearance, feel, and form factor is not new to humanity as an emerging technology gadget and physically remain consistent when compared to classic watch and electronic watch. With many researchers and practitioners remaining bullish about consumer smartwatch growth potential based on its application benefits for human society, this study naturally anticipated that consumer smartwatch adoption will be natural and easy for humans because of historical affiliation and familiarity.

However, in reality, consumers acceptance and adoption of smartwatches faces many challenges (Alrige and Chatterjee, 2015), and smartwatch diffusion remains passive and short of expected projections (Sultan, 2015). According to Institut de Publique Sondage d'Opinion Secteur (IPSOS) (2018), the United States of America leads developed economies with a smartwatch diffusion rate estimated at 51%, followed by Spain estimated at 19.5% while China at 28.1% and Russia at 23.8% are the leaders among developing countries. According to Ernst and Young, the Malaysia smartwatch penetration rate is estimated at 7% (2016 cited in Krey, Chuah, Ramayah and Rauschnabel, 2019; Chuah, 2019). The most recent data from IPSOS (2018) estimated that Malaysia's combined smart wearables diffusion rate is less than 13%. Although there is an improvement since 2016, the Malaysia smartwatch diffusion lagged in contrast to its immediate neighbouring countries and other global countries. For example, the Thailand smartwatch and fitness tracker diffusion rate was estimated at between 13% to 21% and the Singapore smartwatch and fitness tracker diffusion rate was estimated at between 21% to 29%. The growth data from IPSOS (2018) suggested that smartwatches' global diffusion rate is pale compared to smartphones.

The smartwatch adoption problems signal a research imbalance where smartwatch academic research focuses more on examining the technical aspects rather than technology adoption aspects suggesting that smartwatch technology adoption is under research (Choi and Kim, 2016; Dehghani, 2018). The research imbalance could stem from the need to prioritise smartwatch technical design and product development research before the product became mature for commercial launch; therefore, the consumer smartwatch adoption research is a lower priority in comparison. Since technology acceptance and use of technology research are relatively mature research areas from a historical perspective, the essence is to increase consumer smartwatch adoption study to supply insights that could advance consumers' smartwatch technology diffusion.

#### 1.1.4 Brief Overview of Malaysia Technology Transformation

Malaysia gained political independence from the United Kingdom in 1957, inheriting a robust education policy, democratic parliamentary administration, and economic infrastructures that serve as a stable foundation for the country's future economic growth. Before the 1970s, Malaysia's economy was based on mining and agriculture export. In the 1970s and 1980s, the country's economy began to diversify, with the emergence of export-oriented labour-intensive manufacturing. The Malaysian government has been working on Vision 2020 since 1991, intending to make Malaysia a fully developed country by 2020. In keeping with the vision, the Malaysian government set out to implement a series of long-term economic and transformation growth roadmaps that potentially generate good economic growth until the year 2020 (ITU, 2002).

The 6th Malaysia plan (1990-1995) and the 7th Malaysia plan (1996-2000) are two fundamental plans aimed at transforming Malaysia into an Information Communications Technology (ICT) and knowledge-driven economy. During both Malaysia plans, a national ICT Council, the Multimedia Super Corridor (MSC) economic hub through partnerships with foreign expertise, and the Malaysia Communications and Multimedia Commission (MCMC) worked together to accelerate the adoption of ICT in Malaysian industries, nurture and develop local ICT talent and spread ICT usage into Malaysian society. During the same period, Malaysian education was overhauled at all levels to embrace ICT education to accelerate ICT literacy to match future demand for ICT skilled human talents. The education transformation includes reskilling the existing Malaysian labour workforce to match the emerging demand for ICT skilled human talents (ITU, 2002).

The 8th Malaysia plan (2001-2005), 9th Malaysia plan (2006-2010), and 10th Malaysia plan (2011-2015) build on the foundations of earlier Malaysia plans, focusing on the creation of a borderless electronic business platform leveraging the economic benefits of high-speed Internet connectivity. During these periods, fixed narrowband internet access was phased out and replaced by fixed broadband ICT infrastructures. Subsequently, wireless broadband infrastructures were introduced to enable personal and professional mobility through the use of smart devices such as smartphones, smart tablets, and portable computers. The foundation works and achievement during the 8th, the 9th and 10th government-driven initiatives accelerated adoption of electronic commerce platforms leveraging high-speed Internet technology by businesses with the population using smart devices to access various services. Smart devices also become popular productivity tools for professional and personal use. These developments are necessary for Malaysia to remain competitive and continue to attract interest from foreign direct investment. (MCMC, 2018; MCMC, 2019; MCMC, 2020; MIMOS, 2015).

The impact of the Covid19 pandemic, in the final year of the 11th Malaysia plan (2016 to 2020), Malaysia's total economic growth dropped to -3.4% in 2020. During the first Malaysia movement control order (MCO 1.0) in early 2020, physical consumer spending fell to -33%, online consumer spending fell to -22%, and total consumer spending fell to -33%. However, as the Malaysian government, consumer businesses, and the general public gain more experience and adjust to the Covid19 pandemic, the second Covid19 Malaysia movement control order (MCO 2.0) issued in early 2021 saw a lower impact on physical consumer spending, with a -12% drop, while digital economic activities such as online consumer spending grew by 3% and online banking transactions increased by 10%, mitigating the physical spending shrinkage. The effect on total consumer spending for MCO 2.0 is at -4%, which is less severe compared with MCO 1.0 (BNM, 2021). The foresight, strategies and policies implemented in previous Malaysia transformation plans, over the last 30 years, had changed and shaped Malaysia ICT adoption and digital capabilities and capacities, thus allowing both its society and businesses to rapidly accelerate and embrace ICT and digital technology to mitigate the economic and social disruption of Covid19 pandemic.

## 1.2 Research Problem Statement

As presented in the background of this study, consumer smartwatches are available for the global consumer market since 2012 when it was first introduced to the consumer market by Sony corporation. Various researchers were bullish on the potential of consumer smartwatches health technology usage for social well-being as well as other consumer smartwatch usage benefits such as infotainment and communications, assisted living and safety, and lifestyle and fashion. If adopted, researchers hypothesised that these practical applications could potentially optimize human daily social and professional life through the automatic tracking and collection of individual personal information, simplification of communications resources and complimenting individual lifestyles and fashion.

The Malaysian Communications and Multimedia Commission (MCMC) has been conducting user surveys among Malaysians every two years since 2012, with the primary goal of tracking and understanding the changing patterns in Malaysian ICT adoption and usage behaviour. According to the content of the MCMC survey reports from 2012 to 2020, Malaysia's ICT usage behaviour trend has evolved over the last ten years toward mobility and seamless connectivity via smart devices. Smartphone usage among polled participants had steadily grown from 74.3% in 2014 to 98.7% in 2020. Mobile computing devices (laptops, notebooks, and netbooks) usage drop from 51.4% in 2014 to 37.9% in 2020, while desktop personal computer usage fell from 35.3% in 2014 to 16.2% in 2020, and smart tablets also fell from 25.5% in 2014 to 6.4% in 2020. The changing data trend suggests a strong preference for using a smartphone as a multi-purpose mobility device (MCMC, 2020).

The IPSOS (2018) smartwatch adoption data presented in section 1.1.3 indicated that Malaysia smartwatch diffusion is lagging when compared to regional and global countries. Locally, the usage of consumer smartwatches among polled participants from the 2014 and 2016 MCMC survey is zero, suggesting a low awareness of smartwatches among Malaysia population. The 2018 MCMC survey report indicated that there were

2.4% consumer smartwatch users among polled participants. However, the year 2020 MCMC survey report indicated that consumer smartwatch users among polled participants had declined to 0.6% (MCMC, 2020). In conclusion, despite good ICT literacy among Malaysia population and various applications benefits offered by consumer smartwatches, the data from both IPSOS (2018) and MCMC user survey reports suggest that Malaysia is experiencing consumer smartwatch adoption challenges.

A Google Scholar search with the keyword "Malaysia consumer smartwatch smart wearable technology acceptance adoption" and the search results cross-reference with Krey et al. (2019) and Niknejad, Ismail, Mardani, Liao, and Ghani (2020) smartwatch and smart bracelet compilation revealed that there were six pieces of Malaysia consumer smartwatch adoption literature available to date (refer to Chapter 2, section 2.6.3, Table 2-2). The first piece of literature was published in 2016, and five subsequent pieces of literature were published in 2019, indicating that Malaysia consumer smartwatch adoption research is still in an early stage. A research gap analysis on the six pieces of the literature revealed that none empirically test consumer smartwatch behavioural intention using the UTAUT2 theory extended with health technology and design benefits in a single study. In summary, the Malaysia smartwatch adoption rate problems observed in the previous paragraph and the research gap identified in this paragraph provides the justification and motivation for this study.

## 1.3 Research Questions

The previous section highlighted the research problem of this study. This section outlines the study research questions. The research questions section sets the boundary and direction and provides a guiding reference to guide this research process. This study's research questions were cross-referenced with existing Malaysia smartwatch adoption literature to cross-verify that other Malaysia smartwatch adoption studies have not previously addressed it. The research questions are:

I. **Research Question 1 (RQ1) –** What is the significance of Performance Expectancy on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context?

II. **Research Question 2 (RQ2) –** What is the significance of Effort Expectancy on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context?

III. **Research Question 3 (RQ3) –** What is the significance of Social Influence on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context?

IV. **Research Question 4 (RQ4) –** What is the significance of Hedonic Motivation on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context?

V. **Research Question 5 (RQ5) –** What is the significance of Price Value on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context?

VI. **Research Question 6 (RQ6) –** What is the significance of Health Technology on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context?

VII. **Research Question 7 (RQ7) –** What is the significance of Design Benefit on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context?

VIII. **Research Question 8 (RQ8) –** What is the total variance explained by the conceptual smartwatch adoption model observed at Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context?

## 1.4 Research Objectives

The previous section highlighted the research questions and their role in providing boundary, direction and guiding the study research process to test factors that influence Malaysia residents' behavioural intention to use a smartwatch in a consumer context. This section set and communicate the study research objectives. Consistent with the previous section's that consists of eight research question, this section also contains eight research objectives. The eight research objective of this study are:

I. **Research Objective 1 (RO1) –** To examine the Performance Expectancy's influence on Malaysia residents' Behavioural Intention to use a smartwatch and test the significance of Performance Expectancy on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context.

II. **Research Objective 2 (RO2) –** To examine the Effort Expectancy's influence on Malaysia residents' Behavioural Intention to use a smartwatch and test the significance of Effort Expectancy on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context.

III. **Research Objective 3 (RO3) –** To examine the Social Influence's effect on Malaysia residents' Behavioural Intention to use a smartwatch and test the significance of Social Influence on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context.

IV. **Research Objective 4 (RO4) –** To examine the Hedonic Motivation's influence on Malaysia residents' Behavioural Intention to use a smartwatch and test the significance of Hedonic Motivation on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context.

V. **Research Objective 5 (RO5) –** To examine the Price Value's influence on Malaysia residents' Behavioural Intention to use a smartwatch and test the significance of Price Value on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context.

VI. **Research Objective 6 (RO6) –** To examine the Health Technology's influence on Malaysia residents' Behavioural Intention to use a smartwatch and test the significance of Health Technology on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context.

VII. **Research Objective 7 (RO7) –** To examine the Design Benefit's influence on Malaysia residents' Behavioural Intention to use a smartwatch and test the significance of Design Benefit on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context.

VIII. **Research Objective 8 (RO8) –** To identify the conceptual smartwatch adoption model and report the total variance explained by the conceptual smartwatch adoption model for Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context.

The next section deals with communicating the research scope of this study which, together with the research questions, research objectives provide the basis to guide the research process toward achieving its intended mission.

## 1.5 Research Scope

The previous section communicates the research objectives of this study which is consistent with the research questions. This section set and communicate the study research scope. A coherent research scope set the study's boundary to guide the research process and enable efficient management of time, budget and resources necessary to complete the research mission.

The information technology application of interest is consumer smartwatch technology. The theoretical model of interest is the UTAUT2 theoretical model and other factors that essential to smartwatch adoption. The general study scope excludes testing of the UTAUT2 use of technology behaviour, its determinants, and the effect of moderating variables such as age, gender, and experience. Hence, the general study scope focuses on applying and adapting the UTAUT2 theory extended with Health Technology construct and Design Benefit construct to test Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context.

The research study is an applied social science study that focuses on achieving external validity. This study approach problem solving by applying and adapting the UTAUT2 theory from the information technology research domain as the base theory to quantitative inquiry and deductive reasoning to address the research questions. The research study relies on data from both secondary and primary data sources to address research questions. This study emphasises ethics compliances, reliability, validity, minimising bias and adheres to the quantitative inquiry practice throughout the research study's journey. The approach to problem-solving in this thesis is theory to practice; the UTAUT2 theory adopted and adapted as a base theory and deduction theory applies to develop a conceptual smartwatch model and hypotheses to test Malaysia residents' behavioural intention to use a smartwatch in a consumer context.

The target population is Malaysia resident, preferably age 15 and above, and the unit of analysis is an individual residing in Malaysia who has experience using either a smartwatch, a smart band or a smartphone with health applications. Malaysia resident distributed across broad geographical location; hence this study employed an online cross-sectional self-administered questionnaire survey over the internet channel for primary data collection. The data collection sampling method based on non-probabilistic convenience and snowball sampling. The study aims to achieve a confidence level of 95% with an error margin of ±5%. The study target sample size based on structural equation modelling is a minimum of 200 valid samples; however, this study aims to attain larger valid samples to gain unbiased research findings.

The study data analysis employed three software tools. The Microsoft Office software to manage the preparation of this thesis and its associated content. The IBM SPSS version 23 software to analyse and present the study data screening, descriptive and inferential statistical findings. The IBM SPSS AMOS version 24 software and three AMOS plugins, “Model Fit Measures”, “Master Validity Tool” and “Multigroup Analysis” by Gaskin and Lim (2016) for AMOS version 24 to analyse and present confirmatory factor analysis and structural equation modelling findings. This study’s data analysis strategy measures the empirical data compliances to multivariate regression assumptions, common method bias, reliability, validity, the goodness of fit between research measurement instrument and measurement model before testing the hypotheses using structural equation modelling path analysis.

## 1.6 Significance of the Study

Venkatesh et al. (2012) have encouraged applying the UTAUT2 theory in different countries and applications context to understand the performance of the UTAUT2 theory since its inception in 2012. The smartwatch is a new product that is still evolving; the research study on a smartwatch adoption in Malaysia recently started in 2016 and still in its infancy stage. The study’s outcome can address the research gap identified in Malaysia consumer smartwatch adoption literature, contribute new insights to Malaysia smartwatch adoption body of knowledge and reference for both academic researchers and practitioners seeking to understand factors that plausibly influence Malaysia residents’ intention to use a smartwatch in a consumer context or interested in advancing Malaysia consumer smartwatch adoption.

Looking into the lens of academic perspective; to the best knowledge of this study, no Malaysia consumer smartwatch adoption literature found available testing the UTAUT2 theory extended with health technology construct and design benefit construct based on the Malaysia smartwatch adoption literature gathered and referred by this study. Therefore, identified that as a Malaysia smartwatch adoption research gap and outcomes of this study potentially contribute new insights to the Malaysia smartwatch adoption literature. The study contributes explicitly to the existing Malaysia consumer smartwatch adoption literature by testing a conceptual smartwatch adoption model that consists of five UTAUT2 constructs (Performance Expectancy, Effort Expectancy, Social Influence, Hedonic Motivation and Price Value) model extended with two smartwatch specific constructs (Health Technology and Design Benefit) toward Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context.

From the managerial perspective, since Malaysia smartwatch diffusion is low, the study smartwatch adoption outcome and recommendations enable Malaysia smartwatch producers to understand essential factors that influence Malaysia resident when considering using a smartwatch. The implication of better understanding Malaysia consumer smartwatch adoption variables enables smartwatch producers to optimise resources by charting better product management strategies that potentially satisfy consumers expectations.

## 1.7 Chapters of the Thesis

This thesis consists of five main chapters. **Chapter 1 Introduction** provides the background of this study, research gap, problem statement, research feasibility, research question, research objectives, the study scope, the significance of the study, and thesis outline and chapters. **Chapter 2 Literature Review** introduces historical perspectives, smartwatch technology development, its relation to societal wellbeing, adoption challenges, and linked the smartwatch adoption problem to this study's identified smartwatch adoption research gap; the application and extension of the UTAUT2 theory to investigate Malaysia residents' behavioural intention to use a smartwatch in a consumer context. Subsequently, the discussion continues into the reviews of research and practitioner literature to justify and confirm the UTAUT2 theoretical model as the base for research problem-solving. The research problem-solving continue with the development of a proposed conceptual smartwatch adoption model. The proposed conceptual smartwatch adoption model and derivation of hypotheses justify based on insights from various smartwatch adoption research and practitioner literature.

**Chapter 3 Research Methodology** outline the research methodology framework, philosophy, paradigm, approach, design, research instrument development process, data collection strategy and method, data analysis and interpretation strategy and method, research validation plan and ethical considerations. **Chapter 4 Data Analysis and Findings** consist of three sections. The first section deals with preliminary analysis and present data screening and verification against multivariate regression analysis assumptions, descriptive analysis of questionnaire responses, demographic inferential analysis and checking for influence of common method bias. The second section analyses and presents confirmatory factor analysis comprising composite reliability, convergent validity, discriminant validity, and verification of the goodness of fit between empirical data and measurement model. The third and final section involved testing hypotheses based on covariance-based structural equation modelling. The outcome of hypotheses testing together with $R^2$ and adjusted $R^2$ total variance explained extracted from the structural equation model addresses this study's RQ1 to RQ8. **Chapter 5 Discussion and Conclusion,** is the final chapter of this thesis that presents the discussion of findings, academic and managerial implications, study limitation and recommendations.

## 1.8 Chapter Summary

The chapter content introduces this study's background, problem statement, research gap and feasibility, research question, research objectives, the study scope and the study significance, and thesis outline and chapters. The study's background starts with the narrative by introducing the consumer smartwatch technology, its application and benefits for society well-being. Despite the advantages of consumer smartwatch technology, the diffusion among nations globally is still low, indicating smartwatches diffusion problems. Malaysia, on the other hand, had lower smartwatch diffusion among its population in comparison, and its smartwatch adoption research only recently began in 2016, with six pieces of literature indicating that it is in an early stage.

Based on the Malaysia smartwatch adoption literature compiled by this study, the Malaysia consumer smartwatch adoption is under research. The research gap identified was applying UTAUT2 theory extended with health technology construct and design benefit construct. Hence, this study focuses on applying and adapting the UTAUT2 theory extended with health technology construct and design benefit construct to test Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context. The research scope, together with the eight research questions and eight research objectives, collectively set the boundary to guide the study research process to complete this study's mission.

# CHAPTER 2: LITERATURE REVIEW

## 2.0 Chapter Overview

The preceding chapter introduces an overview of this study. This chapter, guided by the research objectives and questions, reviewed related literature to identify research academic gaps, issues, patterns and assembled other researchers' assumptions, opinions, and findings from various relevant research studies to support this study's mission. Three broad sections introduce the smartwatch technology, social phenomenon, academic gaps their association that represent the basis and frame of reference for embarking on this research project.

The first broad section consists of four related sections that start from section 2.1 until section 2.7. Section 2.1 deal with an overview of smartwatch history, followed by section 2.2, which explained the difference between a smartwatch versus a smart bracelet before moving into defining a smartwatch from an academic perspective and explained the smartwatch product characteristics and the potential of a smartwatch as the next generation smart ubiquitous communications device. Section 2.3 deal with providing insight into how consumers use a smartwatch, and section 2.4 explained smartwatch technology could potentially alleviate excessive sedentary behaviour, which is a pressing global societal challenge with grave consequences. Section 2.5 discuss the smartwatch adoption challenges, and section 2.6 introduce the rationale for studying smartwatch adoption in Malaysia and the rationale for choosing the UTAUT2 theory as the base theory for this study. Finally, section 2.7 explained the research approach and the scope of this study.

Subsequently, this chapter proceeds into the second broad section: theoretical background by reviewing the UTAUT2 theory and its underpinnings theory to review, contrast and justify the UTAUT2 theory. The second broad section consists of five sections which focus on theoretical scope and background start from section 2.8 until section 2.12, where the introduction and linking of related technology acceptance theories and model built progressively based on discussion centred around the following topics: an overview of theoretical background and scope, the eight underpinnings theories and models, the UTAUT theory, the UTAUT2 theory and finally, a balance reviews and contrast the empirical performance of the UTAUT2 theory against its underpinnings theory.

The third broad section focuses on three sections from section 2.13 until section 2.15 deal with conceptual smartwatch adoption model development to facilitate this study research investigation and hypotheses testing. The conceptual smartwatch adoption model and hypotheses served as the frame of reference and input for Chapter 3. Finally, this chapter concluded with section 2.16, which summarises the salient points of this chapter.

## 2.1 Smartwatch – A Historical Perspective

### 2.1.1 The Mechanical Analogue Watch Evolution

Although the inventor of the first mechanical portable clock that operated on an analogue mechanical system not documented, the history of portable clock goes as far back as the 1450s (Stephen and Dennis, 2000). Over the next few hundred years between the 1600s and 1900s, the portable watch design continues to evolve toward miniaturisation. At the end of the nineteenth century, a portable clock's size and weight have become adequately compact and light; the design known as a pocket watch. Men would carry a pocket watch secured via a short chain to their waistcoat pocket, and women wore pocket watches designed to be worn on a neck chain or attached to leather straps worn around the wrists. Pocket watches also become a popular human accessory for sports activities such as archery and cycling (Stephen and Dennis, 2000). A pocket watch design in the shape of a wristwatch design introduced after the mid-nineteenth century, and from the twentieth-century onward, the wristwatch design becomes a norm and continues until the present time (refer to Figure 2-1).

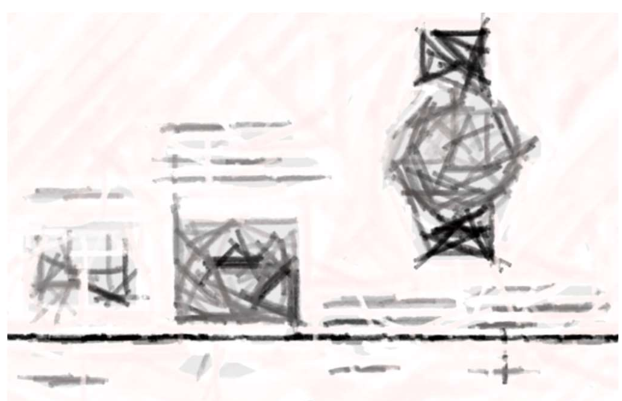


Figure 2-1 The Transformation of Mechanical Analogue Watch

Source: Adapted from the Internet image (Evolution of Watch by ArtfulHattress on DeviantArt)

The emergence of the electronic watch in the 1970s discussed in the next section did not stop or hamper the development of mechanical analogue watch as both mechanical and electronic watches continue to have their base of followers in the watch consumer market.

### 2.1.2 The Electronic Watch Development

One of the weaknesses of a mechanical watch is that the time-keeping becomes inaccurate throughout usage and requires recalibration. During the 1960s, groups of engineers located in Japan, Switzerland and the United States of America works simultaneously and independently to improve the wristwatch time-keeping accuracy. The integration of quartz and electronic technology created a new time-keeping standard that several times more accurate than a well-maintained mechanical watch. Consequently, the electronic watch's invention provides consumers access to electronic watch that can tell time up to split-second accuracy.

The first quartz electronic watch, Seiko Astron SQ, went on commercial sale in Tokyo on 25th December 1969, jump-start the consumer electronic era (refer to Figure 2-2). Although the physical appearance still resembles a mechanical watch, the watch's time engine is powered by quartz and electronic (Stephen and Dennis, 2000).

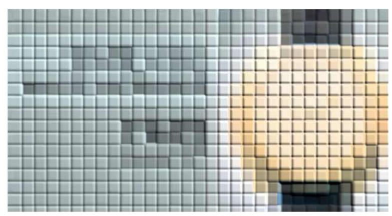


Figure 2-2 World First Quartz Electronic Watch - Seiko Astron SQ
Source: Adapted from the Internet – Seiko Watch Corporation.

Subsequently, in 1972, the first solid-state electronic watch with light-emitting diode (LED) display known as Pulsar commercially released for the consumer market by an American company – the Hamilton Watch Company (refer to Figure 2-3) (Stephen and Dennis, 2000).

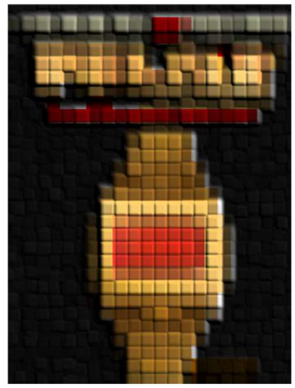


Figure 2-3 Pulsar - World First Solid-state LED Electronic Watch
Source: Adapted from the internet – www.oldpulsars.com

Hamilton released an electronic calculator watch in 1975 (refer to Figure 2-4). The event signals the electronic watch transition from being just an accurate time-telling device toward single functional computing. The technological evolution toward electronic watch that supports computing functionality arguably linked to another research development track known as wearables computers.

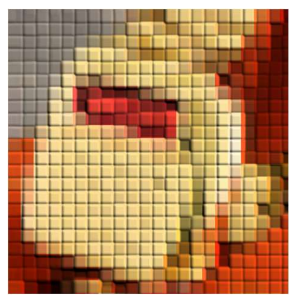


Figure 2-4 Pulsar - World First Solid-state LED Calculator Watch
Source: Adapted from the internet – www.oldpulsars.com

### 2.1.3 The Transition from Electronic Watch to Computer Watch

The electronic watch research begins with the concept of making a watch an accurate time-keeping device. However, the concept has grown from being a pure time-keeping device into a single function wearable computing device with the pulsar electronic calculator watch's commercial release in 1975 (refer to Figure 2-4). In the next two decades (during the 1980s and the 1990s), aided by the advancement in liquid crystal display (LCD), plastic technology and digital computing technology, various corporations embark on multi-functional electronic watch development and experiment with consumers acceptance of various types of multi-functional computing electronic watches. Those multi-functional innovations include calculator, calendar, business scheduler, radio, games, tv and data connectivity to a personal computer (refer to Figure 2-5). Therefore, the electronic watch's evolution path toward multi-functional computing converges in the same direction as the wearable computing domain's objective.

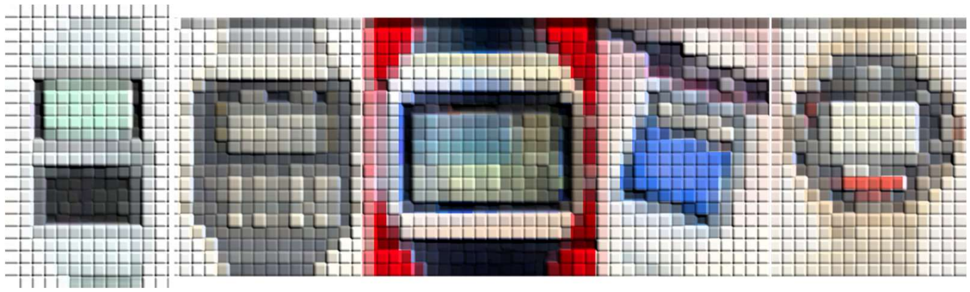


Figure 2-5 Example of Calculator, Games, TV, and Datalink Electronic Watch
Source: Assembled from the Internet image – Casio, Seiko and Timex Watch

Consumer electronic watches adoption continue to grow driven by technological innovation such as accurate time-keeping, innovative display that simplified human-computer interface, rich useful functionalities, cheap manufacturing facilities in various Asian locations, electronic watches' price kept low and affordable (Stephen and Dennis, 2000). These factors are the first source of preliminary baseline reference for this study when examining smartwatch adoption later.

#### 2.1.4 The Transition into Smartwatch

Wearable computer research is not new. The research and development of wearable computers started around the early 1960s (which is about the same timeline as electronic watch development described in the previous section) when Edward Thorp and Claude Shannon of the Massachusetts Institute of Technology created a wearable computer that can secretly assist human in predicting the probability of winning at gambling table games in casinos at Las Vegas (Thorp, 1998). In the past decades, wearable computer research has been investigated from different context and perspectives by academia and industry without an official charter.

In 1997 with the launch of the first Institute of Electrical and Electronics Engineers (IEEE) international symposium on modern wearables computers co-host by Carnegie Melon University, Georgia Institute of Technology and Massachusetts Institute of Technology in Cambridge, Massachusetts; the modern wearables computer research enter a new phase and officially become a recognised research domain within the research communities (Cook and Song, 2009); the research into smart wearables computers development has just kicked off. Innovative wearables development is transdisciplinary and necessitates the convergence of various technologies and synergy between many different research and development domains, such as material engineering, computer science, electronic engineering, human-computer interfaces, mobility, connectivity and sensing technologies.

Rhodes (1997) socialised the concept of modern wearables computer that exhibit five distinct characteristics: (1) portable during utilisation, (2) hands-free or near hand-free mode during operation, (3) availability of sensory capabilities, for example, location tracking, movement tracking, and cameras, (4) proactive user alerts or notifications when necessary and (5) continuously active and always accessible by the user. Since Rhodes (1997) definitions, the concept of modern wearables computer further refined; for example, the need for realisation of a self-powered wearable computer system that independent and operationally functional (Barfield and Baird, 1998), portable computer system that addresses both wearability and ubiquitous computing (Rhodes, Minar and Weaver 1999) and wearable computer that can ubiquitously operate in distributed computing environments (Bauer, Brugge, Klinker, MacWilliams, Reicher, Sandor and Wagner, 2002). Interestingly, Steve Mann of the Massachusetts Institute of Technology suggested that smart technology provides a sense of “personal empowerment” and context awareness for the user via synergistic cooperation between individual and smart technology (Mann, 1998).

Over the decades, wearable computer research has advanced the innovation of miniature wearable mobile computing devices for the human body. From a productisation perspective, the family of smart wearables computer consists of many different types and forms that can attach to or fit with a specific area of the human body (refer to Figure 2-6).

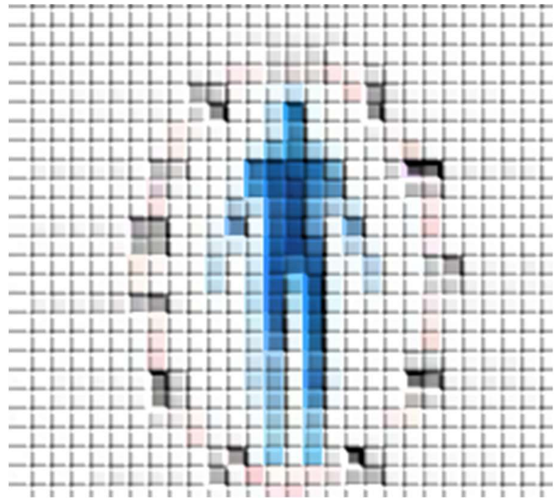


Figure 2-6 The Human Smart Wearables

Source: Adapted from Greengard (2019)

## 2.2 What is a Smartwatch

### 2.2.1 Smartwatch Versus Smart Bracelet

As illustrated in Figure 2-6, the two types of smart wearables computer worn on a human wrist are smartwatch or smart bracelet (also known as smart fitness band). The smart bracelet and smartwatch have been historically assumed or collectively lump into the same concept, although each smart product is different. This section provides insights for the audience to appreciate the difference and misconception between the two commonly available off the shelf commercial smart wrist-wearable product.

The smartwatch and smart bracelet often conveniently consolidated under the same concept (Chuah et al., 2016) even though there are significant differences between the two wrist-worn smart computers. According to Bruno (2015), smart wearable computers categorised into two distinct types; **single-purpose computer** or **multi-purpose computer**. A smart bracelet is a single purpose computer dedicated to tracking human physical activities (Rauschnabel, Krey, Chuah, Nguyen, Lade and Ramayah, 2016), while a smartwatch is a multi-functional computer that supports health and fitness applications (Dehghani et al., 2018) and also supports a variety of other utilitarian and hedonic benefits (Ernst and Ernst, 2016).

Based on form factor, human interface and system design characteristics, the smart bracelet support time-keeping, typically dedicated for fitness tracking, Geo Positioning System (GPS) access for location tracking, limited connectivity, for example, Wi-Fi or Bluetooth connectivity, has a small non-touchscreen display, inferior internal hardware capabilities such as lower computing power, limited random access memory, limited internal storage and cannot install or execute third-party applications (Curry, 2015; Kenney, 2014) (refer to Figure 2-7).

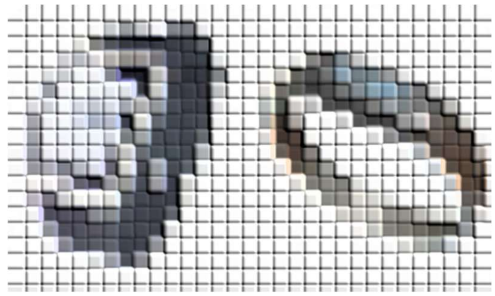


Figure 2-7 Smartwatch (left) and Smart Bracelet (right)
Source: Adapted from Kenney (2014)

A smartwatch, due to superior computing hardware system and operating software characteristics, can support a larger display and touch screen, multiple user interface commands (voice command and user hand gesture), media playbacks such as video and songs, GPS access for location tracking and navigation, video cameras and multiple connectivities such as NFC (near-field communications), Wi-Fi and Bluetooth, direct voice and data communications with other smart mobile subscribers over a mobile network (Hart, 2020; Silbert, 2020). Furthermore, the smartwatch with a smart operating system can support health and fitness applications and install third-party applications from the smartwatch applications eco-system (Chuah et al., 2016). More than 4,000 third-party applications available for a smartwatch on Google Andriod Wear operating system and approximately 10,000 third-party applications for Apple smartwatch (Curry, 2015; Chuah et al., 2016). In summary, a smart bracelet is a single function dedicated smart health and fitness device, while a smartwatch is a multi-functional smart device consist of smart health and fitness functionality and other lifestyle functionalities.

### 2.2.2 Smartwatch - Academic Definitions

Smartwatch technology is a recent smart technology; as can be seen from various selected academic literature, a smartwatch's academic definitions still evolving. A compilation of smartwatch definitions from various selected academic literature between 2014 until 2019 summarised in Table 2-1 below.

| Literature | Year | Definitions |
|---|---|---|
| McIntyre (2014) | 2014 | Smartwatch is a subset of smart wearable technology families that satisfied several consumer expectations and interests; it is a multi-function smart device that includes fitness and health management, location tracking, communications and more smart features. |
| Cecchinato et al. (2015) | 2015 | A computer-powered wrist-watch that interface to other information technology gadget via a short-range wireless connection. It can receive alert messages, continuously gather and store personal data measured by multiple sensors. |
| Kim and Shin (2015) | 2015 | Smartwatch serves as a satellite device pairing with the smartphone via wireless Bluetooth connection for amassing useful data. It provides convenience and a faster substitute to access data, mainly when it is impractical to use a smartphone. |
| Ernst and Ernst (2016) | 2016 | Smartwatch is a wrist-worn intelligent device that provides its users with multiple utilitarian benefits and hedonic benefits. |
| Choi and Kim (2016) | 2016 | A smartwatch is an information technology device that resembles a traditional wrist-watch. |
| Chuah et al. (2016) | 2016 | A smartwatch is similar to a traditional watch but a miniature intelligent device that allows installing and using third-party applications. |
| Hsiao (2017) | 2017 | A smartwatch is an intelligent device that can connect with smartphones to perform data and communications tasks. It can execute mobile applications and receive information, such as time, text messages, schedules, and GPS data. |
| Kalantari (2017) | 2017 | The smartwatch, similar to any other smart technology device, is an Internet of Things (IoT) device, which enables consumers to integrate with the digital world thru the use of intelligent sensing system and communications to facilitate real-time information exchange |

| | | |
|---|---|---|
| Dehghani et al. (2018) | 2018 | A smartwatch is a multi-functional wrist-worn device that supports Bluetooth or cellular connectivity to enable convenient and quick access to data and applications. |
| Krey et al. (2019) | 2019 | The smartwatch is a fashion technology time-piece device capable of notifications management, health and fitness activity management, making direct phone calls, and installing and executing a host of third-party applications. |
| Chuah (2019) | 2019 | The smartwatch is a fashion technology and health technology smart device. |

Table 2-1 Definitions of Smartwatch 2014 to 2019

Source: Compiled by the author for this research.

Based on the appreciation of the smartwatch definitions update between 2014 until 2019 from Table 2-1 above, this study summarises the smartwatch as a mini wrist-worn multi-functional smart computing IoT device that facilitates time-keeping, real-time smart sensing and communications between individuals and the digital world. It provides individuals with utilitarian and hedonic benefits, for example, notifications, messages, health and fitness application, installing and executing third-party applications, GPS access for location tracking and navigation, short-range wireless or Bluetooth tethering to a smartphone, cellular connectivity and direct phone calls. Besides, a smartwatch regarded by individuals as smart health technology and smart fashion technology.

### 2.2.3 Smartwatch - Consumer Product Characteristics

The smartwatch market classified into two distinct market sectors; the consumer and non-consumer market (Salah, MacIntosh and Rajakulendran, 2014) and this thesis focus on studying the consumer market segment. In the recent consumer market, there are two types of off the shelf commercial smartwatch.

The **companion smartwatch** typically depends on a smartphone for its wireless connectivity; it is designed for specific uses or purposes to extend or complement a smartphone's usage (Kenney, 2014). Health and fitness application is a standard feature, but the companion smartwatch may include specific purposes such as hiking, diving and flying applications (Silbert, 2020). For example, the first consumer smartwatch by Sony Corporation introduced in 2012 is a **smart companion watch** design for its Sony Ericsson Xperia smartphone (refer to Figure 2-8). Instead of continually checking for communications events or activities on the smartphone, the Sony Ericsson Xperia smartphone user can conveniently receive alerts, notifications, messages or email, receiving and initiating voice calls on the smartwatch.

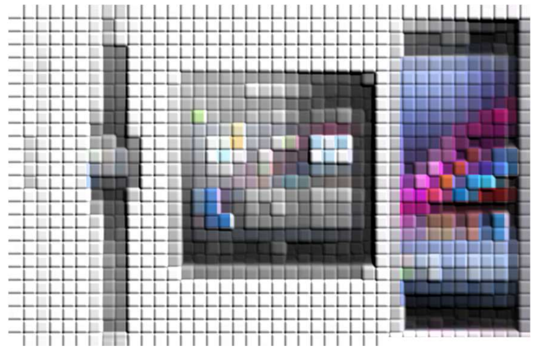


Figure 2-8 Sony Smartwatch
Source: Assembled from the Internet image – Sony Ericsson Corporation.

The second type of commercial off the shelf smartwatch is a **standalone smartwatch** or a general-purpose smartwatch (Kenney, 2014). This standalone smartwatch is recent and available after Apple commercially release the first standalone smartwatch at the end of 2015. The standalone smartwatch, albeit a smaller form factor, has capabilities and functionalities of both companion smartwatch and smartphone; therefore, it can serve as a companion smartwatch to a smartphone. The user can also opt to replace the smartphone with a standalone smartwatch because it operated as a smartwatch and served user communications needs without carrying any smartphone (Zhang, 2020). The example of functionalities supported by a standalone or general-purpose smartwatch shown in Figure 2-9.

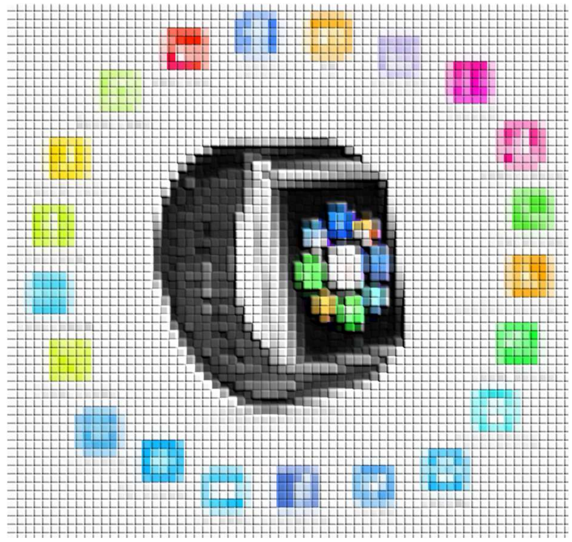


Figure 2-9 Standalone Smartwatch Functionalities

Source: Adapted from the Internet (https://www.diggegg.com/wp-content/uploads/2018/11/black-A1-smart-watch-funcation.jpeg)

2.2.4 Smartwatch Potential - The Next Generation Ubiquitous Technologies

Smartwatches are gaining acceptance as the next significant change that would impact consumers' daily lives (Cecchinato et al., 2015). Park et al. (2016) predicted that smartwatch could become the next-generation ubiquitous technologies after smartphone. Industry report such as the Global System for Mobile Communications Association (GSMA) (2015) and PriceWaterhouseCooper (PWC) (2016) also shares a similar view and optimism that smartwatch would become the next consumer electronic device of mass adoption after smartphones. From a global shipment quantity perspective, the smartwatch has continued to grow, and by Q4 2015, the global smartwatch shipment quantity outgrew the conventional watch (Richter, 2016) (refer to Chart 2-1).

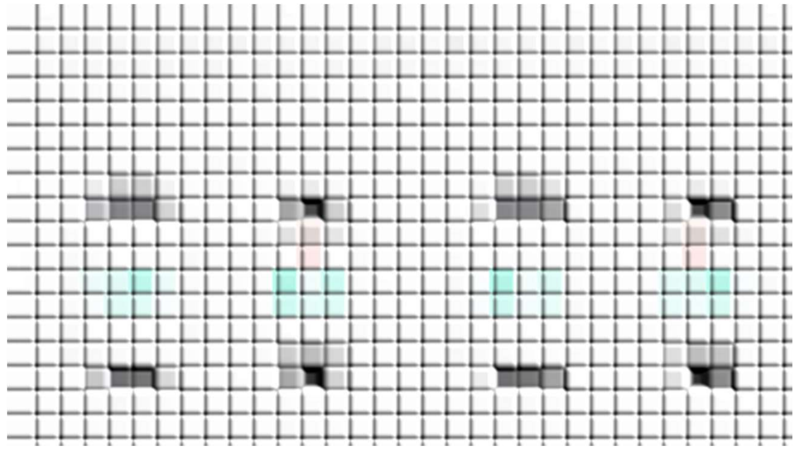


Chart 2-1 Global Smartwatch Vs Swiss Watch Shipment - Q4 14 Vs Q4 15

Source: Adapted from Richter (2016)

The future outlook of a smartwatch in the consumer market moving forward continued to remain bullish (Dehghani et al., 2018; Richter, 2018), and by the end of 2019, a single smartwatch supplier Apple Inc outgrew the entire conventional swiss watch industry (Richter, 2020) (refer to Chart 2-2).

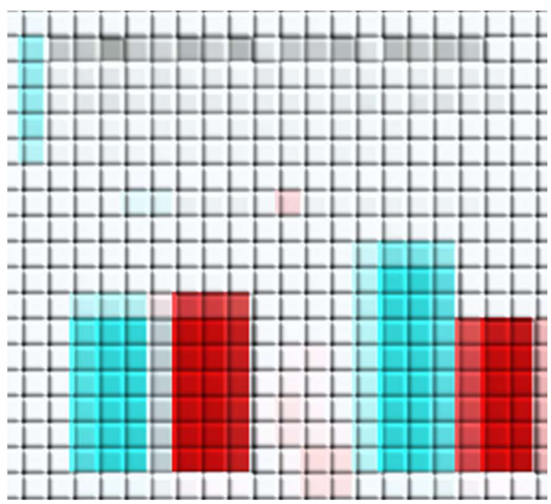


Chart 2-2 Apple Smartwatch Vs Swiss Watch Industry Shipment – 2018/2019

Source: Richter (2020)

The recent forecast shows that smartwatch expected to dominate the smart wearables consumer market, suggesting that smartwatch is the most popular choice among global consumers and expected to dominate approximately 40% of the total smart wearables market share by the end of 2022 (Richter, 2018) (refer to Chart 2-3).

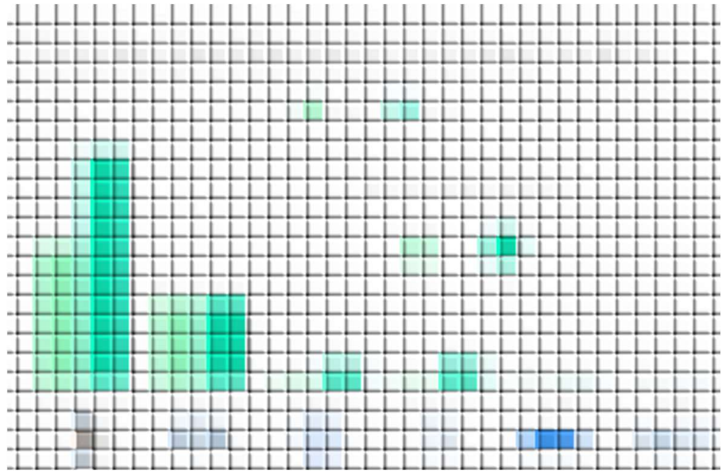


Chart 2-3 Global Wearables Products Forecast by Categories 2018 to 2022

Source: Adapted from Richter (2018)

## 2.3 How Consumers Use Smartwatch

The smartwatch tagged as “smart” because it is a miniature wireless digital computer equipped with environment sensors and ubiquitous communications that satisfy human sensing needs at an affordable price (Cheng and Mitomo, 2017). A smartwatch supports various wireless protocols such as Wi-Fi, Bluetooth, and Radio Frequency Identification (RFID) (Kao, Nawata and Huang, 2019). A smartwatch worn persistently on the human body enables seamless integration between humans, environments, smart computing, sensing, connectivity and ubiquitous communications to seamlessly address various tasks in our daily lives (Milosevic and Farella, 2017; Tehrani and Andrew, 2014). Due to its ubiquitous sensing, ubiquitous communications, and continuously in-contact with the human body, smartwatch extensively employed in lifestyle computing, health care, athletic, and human safety (Cheng and Mitomo, 2017; Hsiao and Chen, 2018; Peake et al., 2018). An individual also treats a smartwatch similar to a conventional watch where a smartwatch viewed as a fashion accessory for official and social events from a lifestyle and fashion perspective. Therefore, underscore the essence of smartwatch design and aesthetic appeal in attracting individual behavioural intention (Choi and Kim, 2016).

Insights from numerous smartwatch and smart wearables literature review based on consumer contexts suggested four applications categories from consumer context; there are four application categories of applications; **health and fitness technology**, **infotainment and communications, assisted living and safety** and **lifestyle and fashion** (Cheng and Mitomo, 2017; Choi and Kim, 2016; Chuah et al., 2016; Dehghani, 2018; Peake et al., 2018; Tehrani and Andrew, 2014). The **infotainment and communications** consist of mixed between work and personal information and communications activities. The standard **health and fitness technology** in a consumer smartwatch operates through sensors tracking and monitoring environmental and human biological data. Consumer smartwatches are capable of tracking and monitoring individual sleep patterns, continuous heartbeat rate monitoring, individual physical movement activities (including water sports support), fall detection, stroke detection, blood sugar level, blood oxygen level, and body temperature. Besides, standard consumer smartwatch supports IT functionalities that could interact over the internet with web applications or connected with a smartphone application where its users could retrieve insights and suggestion about personal health and fitness (Kamišalić, Fister, Turkanović and Karakatič, 2018).

The **assisted living** refers to how a smartwatch used to simplify individual daily life and improve individual productivity, such as intelligence home control and remote control for tv or radio discussed in the previous section. Recent research study indicates that smartwatches used for mobile contactless payment (Gu, Wei and Xu, 2016). Example of smartwatch mobile **contactless payments** are payment system offered by respective smartwatch producers such as Fitbit, Samsung, Garmin, Android, Apple, independent mobile application providers such as WeChat Pay and e-commerce providers, Ali Pay. These mobile contactless payments providers support Quick Response (QR) code enabling users to have the convenience of quick mobile contactless payments for purchases via a smartwatch. The **safety** can be in term of emergency assist (any individual emergency and distress alerts or elderly remote monitoring such as fall notifications or other medical emergencies) with location tracking and identification with the use of Global Positioning Systems. The GPS location and navigation also feature a double edge application where it can address safety as mention in the previous paragraph and satisfy assisted living by providing a useful navigational map to guide users routing.

The observation by an American consumers' survey of 5,000 smartwatch users conducted in June 2017 tabulated those participants used a smartwatch for **communications** (notifications/text, phone calls, and email), **health and fitness technology** (activities tracking), **infotainment** (news updates and view photo/video)**, and assisted living** (alarm clock, remote control for music and GPS tracking and navigation) **and safety** (GPS tracking and navigation) (Richter, 2017). The tabulation is congruent with academic classifications discussed in the earlier paragraph (refer to Chart 2-4).

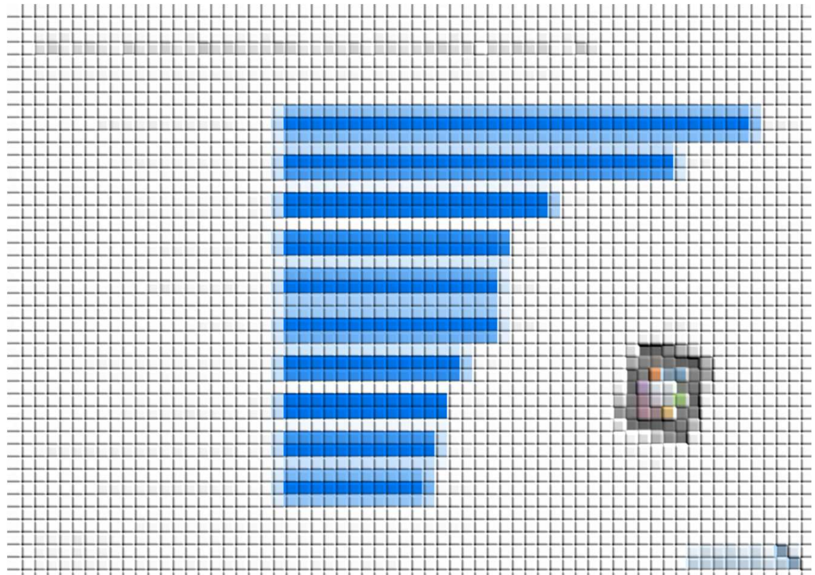


Chart 2-4 Daily Function Performed by Smartwatch Owner

Source: Adapted from Richter (2017)

## 2.4 Smartwatch and Societal Well-Being

This study made a logical assumption that every sane individual aspires to stay fit and healthy, and besides, as argued by Swan (2012), societal mindset is gradually changing toward adopting active management of personal health and fitness. The continuous awareness of the status of personal health and fitness through smartwatch technology enables smartwatch users to intervene or change behaviour toward a more active and healthier lifestyle.

### 2.4.1 Smartwatch – A Tool for Quantified Self-Tracking

The usage of smart digital technology is a practical way to interrupt undesirable habits or train toward a target behaviour (Hermsen et al., 2016). The evidence from smartwatch patents analysis suggested that a smartwatch is well-position for both consumer and health care industry applications (Dehghani and Dangelico, 2017), and the smartwatch usage as a quantified self-tracking tool had attracted many practitioners and academic researchers' attention (Aliverti, 2017). Numerous research literature has mentioned that a smartwatch is a quantified self-tracking device that can collect, track, monitor and deliver personal physical activity and health information (Hänsel et al., 2015; Jung et al., 2016; Lentferink et al., 2017).

Besides, the societal mindset has been gradually shifting away from the old believes in delegating personal health to physician toward a new paradigm where individuals take active control of personal health using consumer smartwatch by adopting quantified self-tracking of personal health and fitness. Mann (1998) hypothesis that the synergistic cooperation between individual and smart wearables enabled personal empowerment. The availability of affordable consumer smartwatch products with access to mobile internet empowers consumers and facilitates quantified self-tracking behaviour (Swan, 2012). Numerous practitioner surveys report also indicated that the top two interests for adopting a smartwatch are personal communications and personal health and fitness (Richter, 2017; PWC, 2015; PWC, 2016).

The quantified self-tracking paradigm entailed personal quantification of personal biological and environmental data to benchmark against pre-set goals or pattern for intervention. At a personal level, quantified self-tracking behaviour consists of self-knowledge and self-optimisation behaviour using smart wearables technology (example, smartwatch or smart bracelet) to track and monitor personal biological, physical, behavioural, or environmental information (Swan, 2013). Irrespective of the purpose, any competence children, teenagers, and adults of any ages can pick up the quantified self-tracking skills, with individual adopting quantified self-tracking movement because of the personal desire to maintain a healthy lifestyle (Hänsel et al., 2015; Lentferink et al., 2017).

This study reviewed smartwatches available on e-commerce websites such as Alibaba.com and Amazon.com indicated that most consumer smartwatches have a sedentary reminder function to detect and remind a passive user. The sedentary reminder serves as a handy feature to remind or trigger a passive user to become more active because it is not practical to assume that all smartwatch users would adopt quantified self-tracking. Hence, the sedentary reminder feature is vital to remind and encourage smartwatch users who are not into quantified self-tracking movement to stay active.

Both quantified self-tracking paradigm and sedentary reminder are essential features that could reduce excessive sedentary behaviour. This study believes that smartwatch technology through quantified self-tracking and sedentary reminder function empowers individual to change behaviour and enables intervention toward a more active and healthier lifestyle.

The take away from the discussion in this section is that a high diffusion of consumer smartwatch technology promotes social well-being. The section discussion concludes at this point, and the subsequent discussion deals with the discussion related to smartwatches adoption challenges.

## 2.5 Smartwatch Adoption Challenges

In its current form, a wristwatch as a technology gadget is not new to humankind, although it has evolved from mechanical to digital and in its recent form as a smartwatch. As presented in earlier sections, many researchers and practitioners remain bullish about smartwatch growth potential and evidence indicating that smartwatch usage brings enormous human society benefits. With plenty of evidence suggested that smartwatch usage brings enormous benefits for human society, this researcher naturally had assumed that smartwatch adoption is natural and easy for humankind because of historical affiliation and familiarity.

However, in reality, consumers acceptance and adoption of smartwatches still faces many challenges (Alrige and Chatterjee, 2015), and smartwatch diffusion remains passive and short of expected projections (Sultan, 2015). According to IPSOS (2018), the United States of America leads developed economies with a smartwatch diffusion rate estimated at 51%, followed by Spain estimated at 19.5%, while China at 28.1% and Russia at 23.8% are the leaders among developing countries. The growth data from IPSOS (2018) suggested that smartwatches' global diffusion rate is pale compared to smartphones.

The smartwatch adoption problems signal a research imbalance where smartwatch academic research focuses more on examining the technical aspects rather than technology adoption aspects suggesting that smartwatch technology adoption is under research (Choi and Kim, 2016; Dehghani, 2018). The research imbalance could stem from the need to prioritise smartwatch technical design and product development research before the product became mature for commercial launch; therefore, the consumer smartwatch adoption research is a lower priority in comparison. Since technology acceptance and use of technology research are relatively mature research areas from a historical perspective, the essence is to increase consumer smartwatch adoption study to supply insights that could advance consumers' smartwatch technology diffusion.

## 2.6 The Rationale for Studying Malaysia Residents' Smartwatches Adoption

Concerning the Malaysia context, the rationale for studying the Malaysia residents' behavioural intention to adopt a smartwatch stem from these reasons: (1) low diffusion of smartwatches in Malaysia (2) mortality and economic consequences of widespread sedentary behaviour among Malaysia residents and the believe that smartwatch technology adoption induces a healthier lifestyle among Malaysia residents through quantified self-tracking of personal health and fitness information and (3) the existence of smartwatch theoretical research gaps since smartwatch adoption in Malaysia is under research and still in its infancy stage.

### 2.6.1 The Low Smartwatch Diffusion in Malaysia

Malaysia offers an appropriate context for this study because, according to Ernst and Young, the Malaysia smartwatch penetration rate estimated at 7% (2016 cited in Krey et al., 2019; Chuah, 2019). The most recent data from IPSOS (2018) estimated that Malaysia's combined smartwatch and smart bracelet diffusion rate is less than 13%. Although there is an improvement, the Malaysia diffusion rate is still low compared to Malaysia's immediate neighbouring countries. For example, the Thailand smartwatch and fitness tracker diffusion rate estimated at between 13% to 21% and the Singapore smartwatch and fitness tracker diffusion rate estimated at between 21% to 29%.

On a global stage, the United States of America leads developed economies with a diffusion rate estimated at 51%, followed by Spain at 19.5%, while China at 28.1% and Russia at 23.8% leads developing countries (IPSOS, 2018). The diffusion rate of smart wearables technology in developed economies are faster than in developing economies. Despite the benefits, smartwatch potential, and a continuous uptrend in other developing and advanced economies, the Malaysia smartwatch diffusion lagging in contrast to its immediate neighbouring countries, other developing and advanced economies (IPSOS, 2018) (refer to Figure 2-10).

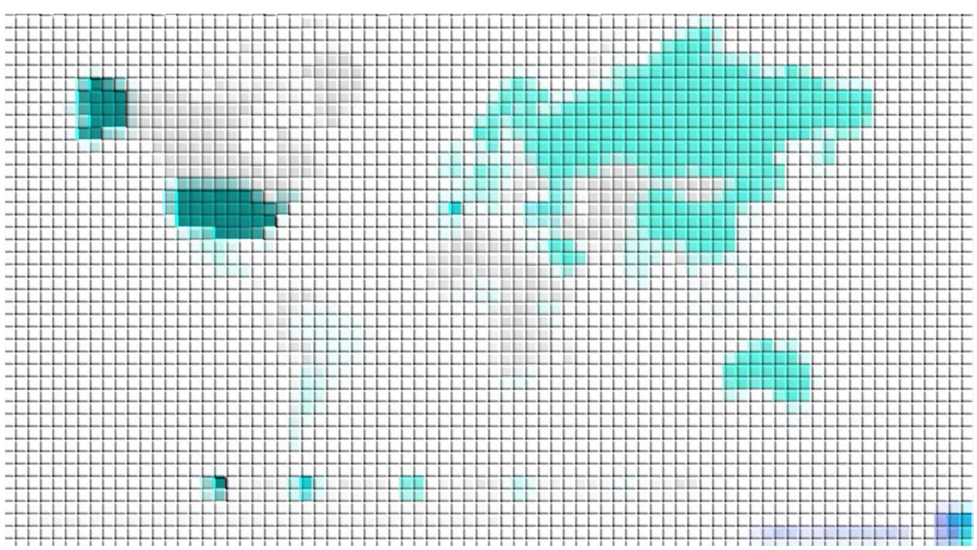


Figure 2-10 Estimated Smart Wrist Wearable Penetration

Source: Adapted from IPSOS (2018)

## 2.7 Research Gaps and Unresolved Questions from Past Literature

The commercial off the shelf smartwatch has a short history of just approximately seven years; hence, the smartwatch product is still evolving and considered a recent global phenomenon from a social science research perspective. The smartwatch technology as quantified self-tracking has been presented and argued in details in the prior section. Chuah (2019) postulated that smartwatch adoption and continuance usage among individuals in Malaysia could encourage Malaysia residents to adopt a healthy lifestyle. The increasing diffusion of smartwatch among Malaysia residents potentially empowers the adoption of quantified self-tracking behaviour and encourages personal intervention toward a more active, healthy lifestyle.

Based on the Internet search using the keyword "Malaysia Smartwatch smart wearable technology acceptance adoption" performed as an update to this chapter's content on 15th December 2020, the following Malaysia smartwatch technology acceptance and adoption literature were found (refer to Table 2-2).

| **Research Literature** | **Research Design** | **Theoretical Model** | **Country & Sample size** | **Technology Scope** | **Key Findings** |
|---|---|---|---|---|---|
| Baba, Baharuddin and Alomari (2019) | Quantitative (SEM) | TAM | Malaysia, *n = 501 (Malaysia university student)* | Smartwatch | Behavioural intentions: Perceived usefulness and Perceived ease of use supported. Cost, Privacy and Health risk not supported. |
| **Beh, Ganesan, Iranmanesh and Foroughi (2019)** | **Quantitative (SEM)** | **UTAUT2** | **Malaysia, *n = 271 (Malaysia public in Penang)*** | **Smartwatch** | **Behavioural Intention: PE, EE, FC and HM supported.** SI and PV not supported. |
| Chuah (2019) | Quantitative (SEM) | Net Valance Framework | Malaysia, *n = 324 (Malaysia public in Penang)* | Smartwatch | Inspiration to use: Perceived usefulness and perceived ease of use, hedonic, social and symbolic factors supported. Perceived risk not supported. |

| | | | | | |
|---|---|---|---|---|---|
| Chuah et al. (2016) | Quantitative (SEM) | TAM | Malaysia, *n = 226 (Malaysia university student)* | Smartwatch | This study suggested that individual perceived smartwatch from a cognitive-psychology point of view as both technology and fashion. Both perceived usefulness and perceived visibility found as determinants of individual attitude toward adoption intention. A direct relationship between perceived visibility and adoption intention is supported. |
| Krey et al. (2019) | Quantitative (SEM) | TAM, ELM and Schema Incongruity Theory | Malaysia, *n = 999 (Malaysia university student)* | Smartwatch | Findings among Malaysia universities participants confirmed that smartwatch is a technology and fashion product, in that fashion and technology attributes mutually determine individuals' attitude toward adoption intention. |
| **Niknejad, Hussin, Ghani and Ganjouei (2019)** | **Quantitative (CFA)** | **UTAUT2 and VAM** | **Malaysia, n = 100 (Malaysia university student)** | **Smart wellness wearables** | **The CFA model found to meet validity and reliability. The SEM path analysis not evaluated in the study.** |

Table 2-2 Malaysia Smartwatch & Smart Wearables Literature

Source: Compiled by the author for this study.

The manual compilation in Table 2-2 above was cross-reference with Krey et al. (2019) and Niknejad et al. (2020) smartwatch and smart bracelet compilation. The purpose is to ensure that content presented in this section accurately capture the on-going status of Malaysia smartwatch technology acceptance and adoption research development. Two Malaysia smartwatch adoption literature found applying the UTAUT2 theory to examine Malaysia smartwatch adoption; Beh et al. (2019) and Niknejad et al. (2019) (refer to Table 2-3, highlighted in bold). Beh et al. (2019), smartwatch adoption examines research findings based on SEM analysis and Niknejad et al. (2019) smartwatch adoption study only completed CFA analysis but did not perform SEM analysis.

No research study found examining Malaysia residents' behavioural intention to use a smartwatch applying the UTAUT2 theory, adapted the UTAUT2 theoretical model with smartwatch application construct. The research gaps identified offer this study an opportunity to pursue Malaysia smartwatch technology acceptance based on applying and adapting the UTAUT2 theory with relevant smartwatch constructs. These findings suggested that Malaysia smartwatch technology acceptance and adoption research study using the UTAUT2 theory is in an infancy stage.

This study also found two smartwatch and six smart fitness wearables academic literature applying the UTAUT2 theory or in combination with other theoretical frameworks from manual search and cross-reference to Krey et al. (2019) and Niknejad et al. (2020) smartwatch and smart fitness tracker compilation. The eight research studies compiled based on the following attributes: authors, study design, theory, country and sample size and technology scope (refer to Table 2-3). The findings in Table 2-3 below suggested that smartwatch adoption applying the UTAUT2 theory is also in an infancy stage.

| **Author(s)** | **Study Design** | **Theory** | **Country & Sample Size** | **Technology Scope** |
|---|---|---|---|---|
| Becker, Kolbeck, Matt and Hess (2017) | Qualitative (semi-structured interview) | UTAUT2, HITAM and HIPC model. | Germany, *n = 16* | Smart health and fitness wearables |
| **Beh et al. (2019)** | **Quantitative (SEM)** | **UTAUT2** | **Malaysia,** ***n = 271 (Malaysia public in Penang)*** | **Smartwatch** |
| Gao, Li and Luo (2015) | Quantitative (SEM) | UTAUT2, PMT and PCT theory | China, n = 462 (Healthcare users). | Healthcare wearable devices |

| | | | | |
|---|---|---|---|---|
| Kranthi and Ahmed (2018) | Quantitative (SEM) | Extended UTAUT2 | India, n = 386 (IT professional that users). | Smartwatch |
| **Niknejad et al. (2019)** | **Quantitative (CFA)** | **UTAUT2 and VAM** | **Malaysia, n = 100 (Malaysia university student).** | **Smart wellness wearables** |
| Talukder, Chiong, Bao and Malik (2019) | Quantitative (SEM) | IDT and UTAUT2 | China, *n = 392.* | Smart health and fitness wearables |
| Wiegard and Breitner (2017) | Quantitative (SEM) | Privacy calculus theory (PCT), UTAUT2 | Germany n = 353 (user and non-user of wearables). | Smart wearable devices |
| Yuan, Ma, Kanthawala and Peng (2015) | Quantitative (SEM) | UTAUT2 | The United States of America, *n = 326* | Smart health and fitness application |

Table 2-3 Smart Wearables and Smartwatch Study based on UTAUT2 theory

Source: Compiled by the author for this study.

Based on the Malaysia research gaps identified in above, the first Malaysia consumer smartwatch adoption literature published in 2016, and the remaining five published in 2019, suggesting that Malaysia consumer smartwatch adoption research study is still at the infancy stage. Some research literature suggests that the first step to understanding smartwatch diffusion problems is by first exploring and understanding what influences smartwatch's adoption behaviour (Jung et al., 2016). Fishbein and Azjen (1975) defined behavioural intention as a personal subjective likelihood to engage in a specific behaviour. In a later study, Ajzen (2002) suggested that behavioural intention is an immediate antecedent of actual behaviour, where behavioural intention linked to personal readiness to embrace or engage in a specific behaviour. Hence, measuring factors that influence Malaysia residents' behavioural intentions toward using a smartwatch is a proxy suggesting smartwatch technology's actual user behaviour (Venkatesh, Thong and Xu, 2012) and valuable to developing or establishing effective and efficient Malaysia smartwatch technology marketing or diffusion strategies (Jung et al., 2016).

The Unified Theory Acceptance and Use of Technology 2 (UTAUT2) theory, which covers technical, social and economic perspectives, offers a comprehensive base theory to study Malaysia residents' intention to adopt a smartwatch (Venkatesh et al., 2012). No Malaysia consumer smartwatch adoption literature found testing the UTAUT2 theory extended with health technology construct and design benefit construct in a consumer context; therefore, it was identified as the research gaps and unresolved questions for this study. However, this study also acknowledges that many factors or reasons could influence social acceptance of smartwatch and understood the importance of correctly identifying these influencing factors based on verifiable evidence from past relevant research literature and relevant practitioner reports.

Guided by the gaps and unresolved questions from past literature, this study intends to develop a conceptual model by adapting and extending the UTAUT2 theory with health technology construct and design benefit construct to test Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context. This research approach is based on theory to practice technique and empirical testing of hypotheses. With the study research gaps and unresolved questions approach and boundary clarified, the following broad section deal with the theoretical background that underpins the UTAUT and the UTAUT2 theoretical models.

## 2.8 Underpinning Theory

Technology has become pervasive in many aspects of human life, and the benefits derived from technology acceptance and usage within a society and country-level extensively documented in various research publications (Atkinson and Mckay, 2007). The study of individual's technology adoption in various information system (IS) and information technology (IT) literature phenomenon often broader than technology factors itself and involved factors from other research domain, for example, social-psychological domains (Venkatesh et al., 2012).

As the technology revolved or evolved, the relevance and effectiveness of existing technology acceptance and use theories versus present-day societal dynamic necessitates calibration and appraisal of its relevance and effectiveness (Sharma and Mishra, 2014). Consequently, as information technology become multi-disciplinary and complex, the desire to advance the predictive and the explanatory power of individuals' technology acceptance and use phenomena necessitates the inclusion of factors grounded in theory from other disciplines (Sharma and Mishra, 2014).

The technology acceptance domain is vast and consists of many theories and models; this study selects the UTAUT2 theory, a recent unified technology acceptance model. The approach taken by this study is to zoom directly into discussing technology acceptance theories that are related to the UTAUT2 theoretical model to prepare the groundwork to support this study's conceptual model and hypotheses development in a later section of this chapter. The eight social-psychology and technology adoption theories underpin the UTAUT theory because the UTAUT theory established from the grouping and associating related constructs from eight social-psychology and technology acceptance theoretical models (Venkatesh, Morris, Davis, and Davis, 2003). The UTAUT theory, which designed to study technology adoption in an organisational context, was extended by Venkatesh et al. (2012) into the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) theory to investigate technology adoption in a consumer context. This study approaches the discussion of technology adoption literature in the following sequential order; the eight social-psychology and technology acceptance theories and models, the UTAUT theory and finally, the UTAUT2 theory.

## 2.9 The Eight Technology Adoption Theories and Models

### 2.9.1 Theory of Reasoned Action (TRA)

The TRA model is among the earliest theoretical model available to study an individual's behavioural intention (Nor and Pearson, 2008), and the model hypothesised that the two underlying factors predicting and explaining individual behavioural intentions are individual **attitude** and **subjective norm** (refer to Figure 2-11), assuming that a person has volitional control over behaviour (Ajzen and Fishbein, 1980).

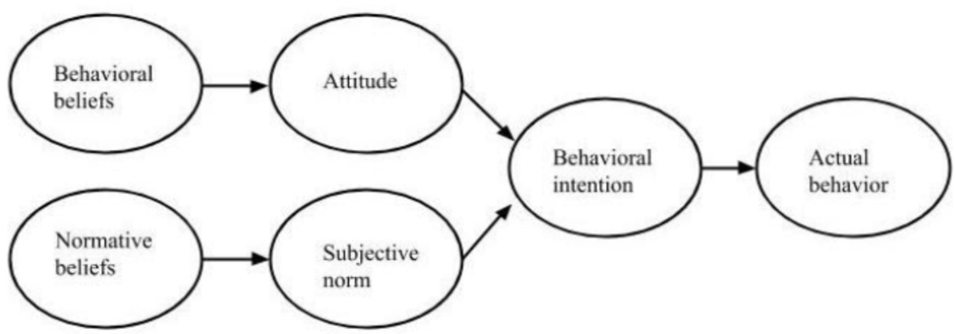



Figure 2-11 Theory of Reasoned Action
Source: Adapted from Ajzen and Fishbein (1980)

For the first underlying factor, an individual attitude, Ajzen and Fishbein (1980) presumed that individual **behavioural beliefs** rest on an individual being rational and able to systematically process information available to deliberate the **attitude** toward behavioural intention before any actual behaviour engagement decision. Incorporating the attitude variable enables a coherent explanation of why and how the attitude variable predicts behaviour intention (Hoyer, MacInnis and Pieters, 2013). For the second underlying factor, the subjective norm, Ajzen and Fishbein (1980) presumed that individuals possess **normative beliefs** and motivation tendency consistent with the subjective norm (social norm) toward behavioural intention to engage in a particular behaviour. Both factors influence individual **behavioural intention,** which is an indicator of personal readiness to participate or not to participate in certain **behaviour**.

Ajzen and Fishbein (1980) suggested that the TRA model was a fundamental human behavioural model suitable for studying human behaviour in any context. The TRA model, which characterises attitude and subjective norm (social pressure) into a structural linkage, offer improved clarity and explanation when predicting consumer behavioural intention (Schiffman, Kanuk and Hansen, 2012) and could explain if an individual acceptance or rejection of new information technology (El-Gayar, Moran and Hawkes, 2011). Consequently, owing to its simplicity and broad applications context, the TRA model is one of the most featured models in research literature studying behavioural intention and adoption (Venkatesh et al. 2003).

However, the critique of the TRA model argued that the TRA model, which has only two direct determinants to explain human behavioural intention, is too simplistic to represent human reality (Bagozzi, 2007) and the TRA model assumptions that individuals regularly evaluate their beliefs and being rational in decision making is questionable (Sharma and Chandel, 2013). When applied to this study's context, the TRA model with two social psychological constructs may require an extensive model extension to increase its predictive power and explanatory depth of behaviour intention to accept or reject a smartwatch technology.

### 2.9.2 Theory of Planned Behaviour (TPB)

Ajzen (1991) proposed the TPB by re-developing the TRA model to include perceived behavioural control factor to overcome limitation when dealing with the study of individuals who has incomplete volitional control. According to Ajzen (1991), the TPB theory is a generic social-psychological theoretical model probably closest possible to a real-world representation of personal behavioural intention to perform a particular behaviour, therefore suitable for various behavioural investigation context.

The TPB model consists of three factors; attitude toward behaviour and subjective norm adopted from TRA, and the extension is the perceived behavioural control where all three predictive factors in a covariance association toward the individual behavioural intention. The additional factor, perceived behavioural control, directly relates to behavioural intention and indirect relationship to behaviour (refer to Figure 2-12).

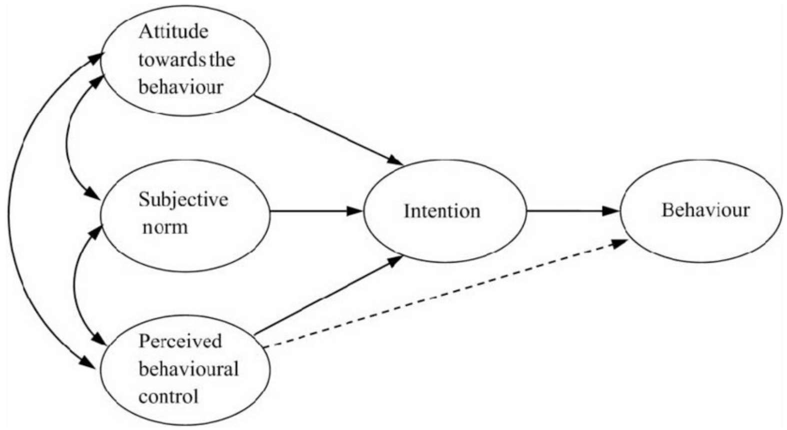



Figure 2-12 Theory of Planned Behaviour
Source: Adapted from Ajzen (1991)

Ajzen (1991) implies that through the TPB model's constructs, a rational individual with access to resources is in total control and capable of deciding to participate or not to participate in certain behaviour. Ajzen (1991) specified that the TPB model resources are people assistance, skills, time and money. The control in the TPB context reflects a personal decision span on a continuum range between an easy to perform behavioural intention until it is challenging to perform behavioural intention (Conner, Warren and Close, 1999). For example, it is easy to undertake a simple behaviour of taking a shower consistently every day for hygiene purpose to the other end of the continuum, where consistently keeping a healthy diet and performing health and fitness behaviour using a smartwatch could be more complicated and requires allocation of time for engaging in health and fitness activities and investment on owning a smartwatch, motivation, commitment and appropriate diet advice from a nutritionist. Ajzen (1991) also suggested a scenario where an individual performed or could not perform a behaviour due to factors beyond the individual's control. In such a case, behavioural intention governed by the perceived behavioural control instead of the individual's attitude or the social norm.

In an e-commerce research study predicting internet consumer's behavioural intention, the TPB model was found reliable and valid; however, in the same study by Pavlou and Fygenson (2006), the TPB alone found to have inadequate predictive and explanatory power to predict and explain an individual behaviour intention. The e-commerce conceptual framework based on the TPB theory, when extended with Technology Acceptance Model (TAM) constructs (perceived ease of use and usefulness) and other constructs specifics to e-commerce, lead to an improvement in the predictive and explanatory power of the e-commerce conceptual framework (Pavlou and Fygenson, 2006).

Since the TPB model is an improved version of the TRA model, the TRA model's criticism applies to the TPB model. However, since it is an improved version of the TRA model, it is also a widely applied model in technology acceptance literature studying behavioural intention and adoption. In later research studies, the TPB decomposed to become known as decomposed TPB (DTPB) model. However, the DTPB model is outside the scope of this study and not part of the eight theoretical models that underpin the UTAUT2 model and hence, not discussed in this chapter.

### 2.9.3 Technology Acceptance Model (TAM)

The TAM is an alternative model to the TRA model to study an individual attitude toward new innovative technology acceptance and actual use behaviour. The two underlying determinants that influenced and explained personal behavioural intentions to accept and adopt new innovative technology are **perceived usefulness** and **perceived ease of use (**Davis, 1989). The argument based on the TAM assumption that personal intentions to adopt technology better explained by the perceived usefulness (people consider using technology if there a belief that the technology improves the individual performance) and the perceived ease of use constructs (people consider using technology if it is intuitive and easy to learn) (Davis, 1989).

In the TAM model (refer to Figure 2-13), the first underlying determinant, which is the perceived usefulness, represents the degree to which a person trusts that a new innovative technology assists in job performance enhancement (Davis, 1989). The second underlying determinant, which is perceived ease of use, represents the degree to which a person trusts that it is easy to learn and use new innovative technology (Davis, 1989). Davis (1989) argued that both factors are related because when a new innovative technology is easier to learn and use, it leads to job performance enhancement. The perceived ease of use shown in Figure 2-13 directly influences the perceived usefulness construct.

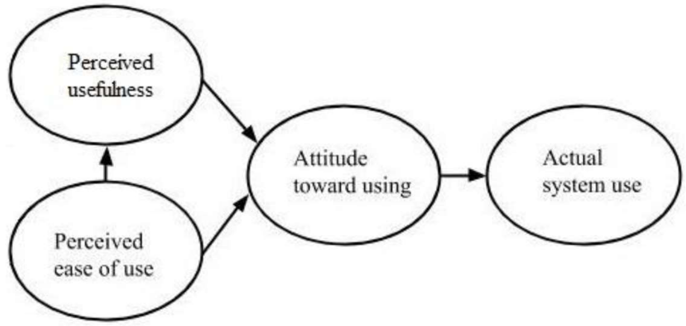



Figure 2-13 Technology Acceptance Model
Source: Adapted from Davis (1989)

Many empirical studies claimed the TAM model has superior predictive power (Venkatesh and Davis, 2000) and a widely used model to predict and explain the personal acceptance of technology and tested by many research studies in various contexts (Venkatesh et al., 2003). The TAM model's essential advantage is simplicity and parsimony (Bagozzi, 2007), potentially attracts many IS/IT researchers to favour the TAM theory when studying personal technology adoption (Taylor and Todd, 1995a).

However, the TAM criticised as a model that only focused on the technology being a material commodity (Taylor and Todd, 1995a) and did not include social-psychological constructs such as personal behaviour construct such as attitude, control and social construct such as subjective norm, which is necessary to understand individual behaviour (Mathieson, 1991; Taylor and Todd, 1995a). Some research study found that the TAM model by itself with perceived usefulness and perceived ease of use constructs limited when explaining adoption and usage of emerging technology, for example, mobile Internet (Kim, Chan and Gupta, 2007) and wireless commerce services (López-Nicolás, Molina-Castillo, and Bouwman, 2008). Both research studies argued that the TAM model, which focuses on a technical perspective, might require an extensive model extension to increase predictive and explanatory power. For example, in the previous section, Pavlou and Fygenson (2006), in the study of electronic commerce adoption and use, found that the TAM, when combined with the TPB model, leads to improvement in the predictive power, implying that personal behavioural and social constructs improve the predictive ability of the TAM model.

In later research studies, the TAM model evolved into E-TAM or TAM2 model (Venkatesh and Davis, 2000) and TAM3 model (Venkatesh and Bala, 2008); however, these variances of TAM models is outside the scope of this study and not part of the eight technology adoption theories and models employed to develop the UTAUT model; hence, not discussed in this chapter.

### 2.9.4 Combined TAM and TPB (C-TAM-TPB)

As discussed in an earlier section above, the TAM and the TRA (which later evolved into TPB) is the two extensively applied theoretical models in a research study that attempt to predicting users or consumers behavioural intention, acceptance and use of new technology. By itself, the TAM model is not sufficient to predict user acceptance of new technology or generate results that meaningful enough because of the lack of social and behavioural control variables consideration (Mathieson, 1991; Taylor and Todd, 1995a). The C-TAM-TPB model is a hybrid model combining the TPB model from the social psychology domain and the TAM from IS/IT domain to address each model's deficiency and increase the predictive and explanatory power (Taylor and Todd, 1995b) (refer to Figure 2-14). Taylor and Todd (1995b) hypothesised that perceived ease of use influences perceived usefulness. The attitude factor hypothesised to be influenced by the perceived usefulness and perceived ease of use. Behavioural intention hypothesised as collectively influenced by perceived usefulness, attitude, subjective norm and perceived behaviour control.

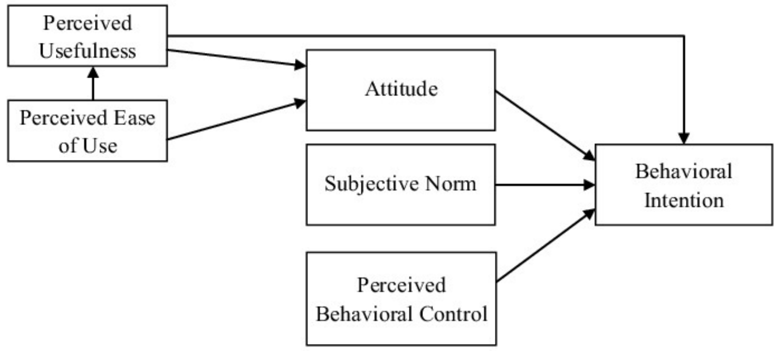



Figure 2-14 Combined Technology Acceptance Model and Theory of Planned Behaviours (C-TAM-TPB)
Source: Adapted from Taylor and Todd (1995b)

The empirical study by Taylor and Todd (1995b), applying the C-TAM-TPB model to study students use of computing resources, suggested that the C-TAM-TPB improves the explanation of individuals' new technology behavioural intention. Pavlou and Fygenson (2006) e-commerce technology adoption findings discussed in the previous section also found that combining TPB and TAM constructs can improve their study's predictive power and explanatory depth. The outcome of both studies suggested that the combination of different theoretical models improves predictive power and explanatory depth.

### 2.9.5 Model of Personal Computer Utilization (MPCU)

The MPCU model oriented toward IS and IT study context developed to study individuals' usage behaviour of a personal computer is an alternate model consisting of characteristics similar to the TRA and the TPB model (Dwivedi, Rana, Jeyaraj, Clement and Williams, 2019). The MPCU model proposed by Thompson, Higgins and Howell (1991) to study personal computer usage, a new information technology, when the study took place.

Thompson et al. (1991) used the MPCU model to study and explain the extent of knowledge worker personal voluntary computer usage outside an organisation or workplace mandate. Thompson et al. (1991) measured and analysed responses gathered from 212 knowledge workers using structural equation modelling. Based upon this investigation setting, Thompson et al. (1991) hypothesised that utilisation of personal computer by the knowledge worker outside of the organisation or workplace mandate influenced by six predictive constructs; **social factors, complexity, job-fit, long-term consequences, affect towards use** and **facilitating conditions** (refer to Figure 2-15).

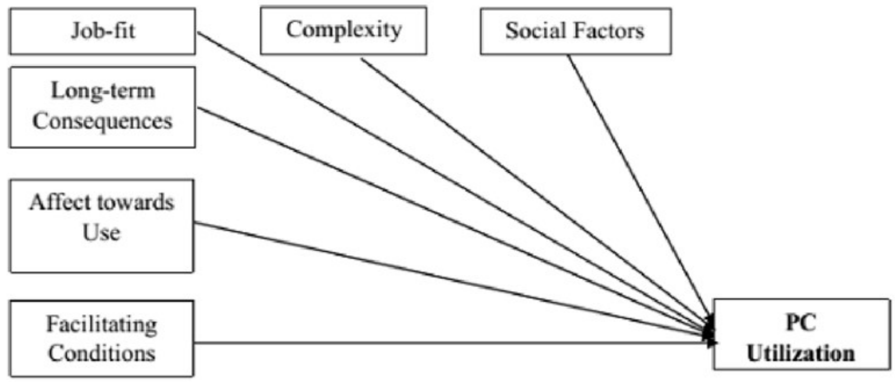



Figure 2-15 Model of Personal Computer Utilisation (MPCU)
Source: Adapted from Thompson, Higgins and Howell (1991)

The MPCU model constructs definitions are described in Table 2-4 below:

| Construct | Definition |
|---|---|
| Job-fit | "The extent to which an individual believes that using a technology can enhance the performance of his or her job." |
| Complexity | "The degree to which an innovation is perceived as relatively difficult to understand and use." |
| Long-term consequences | "Outcomes that have a pay-off in the future." |
| Affect Towards Use | "Feelings of joy, elation, or pleasure, or depression, disgust, displeasure, or hate associated by an individual with a particular act." |
| Social Factors | "Individual's internalization of the reference group's subjective culture, and specific interpersonal agreements that the individual has made with others, in specific social situations." |
| Facilitating Conditions | "Provision of support for users of PCs may be one type of facilitating condition that can influence system utilization." |

Table 2-4 Model of Personal Computer Utilisation Constructs Definitions
Source: Adapted from Thompson, Higgins and Howell (1991)

The MPCU model study outcomes suggested that social norms and expected consequences, which consist of three related constructs (complexity, job-fit, and long-term consequences), are determinants of personal computer utilisation. The study findings suggested that **social norm** and **the expected consequences factors** (**complexity**, **job-fit** and **long-term consequences**) are essential factors when predicting individual usage of new information technology. The remaining two constructs: **affect toward the use** and

**facilitating conditions,** found to have insignificant influence on knowledge workers' personal computer utilisation.

2.9.6 Motivational Model (MM)

According to Maslow (1954), humanity has two distinct needs: life survival and psychological and motivation mainly triggered by life survival and psychological needs. The Maslow theory assumed that human life survival and psychological needs consist of five hierarchical levels, where an individual is motivated to satisfactorily attain each level beginning from the lowest level before moving upward in the hierarchy until finally attain the highest level (refer to Figure 2-16). Each level of Maslow's hierarchy provides a motive that triggers individual intention and maintains the focus and goals toward a particular behaviour. In short, individual motivation factors explain why the individual performs a particular behaviour (Maslow, 1954). Similarly, Herbert (1981) also hypothesised that motivation is the crucial factor that pushes an individual toward achieving desired needs or mission.

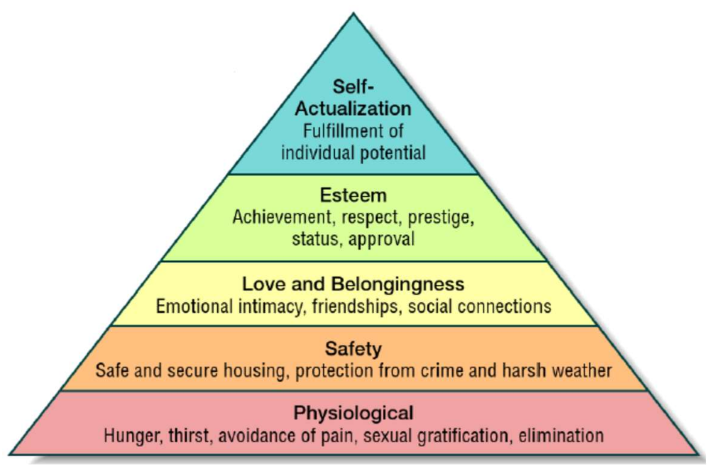



Figure 2-16 Maslow's Needs Hierarchy.
Source: Adapted from Nevid (2011).

In general, the MM theory borrows the idea from the theory of human personality and motivation, a branch of the psychology research domain (Vallerand, 1997), where the theory postulates a continuum between three inter-related human psychological contexts. The range of continuum start from amotivation (low motivation or non-self-determined behaviour) stage to extrinsic motivation (controlled motivation triggered by external rewards) stage and finally the intrinsic motivation (highest level of self-determined behaviour, exhibiting autonomy and a voluntary triggered behaviour) stage (Legault, 2017) (refer to Figure 2-17).

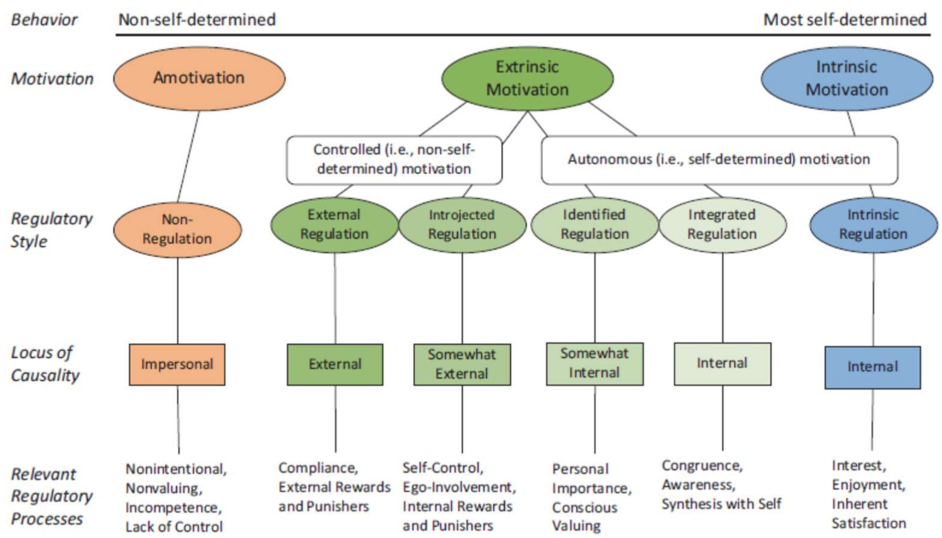



Figure 2-17 Continuum of Motivation – Amotivation, Extrinsic and Intrinsic. Source: Adapted from Legault (2017).

The self-determination theory widely applied in various domains, including consumer marketing, fitness, sport, health care and psychotherapy, with various studies linked both extrinsic and intrinsic motivation leads to better health, well-being, and performance (Deci and Ryan, 2008).

Davis et al. (1992) introduce the MM theory for IS/IT context to investigate the technology adoption and technology usage (Venkatesh et al. 2003). The MM theory is plausibly a competing model to the MPCU theory for studying personal computer acceptance and use. The MM theory posits two motivational concepts (extrinsic and intrinsic motivation) influence and shapes individual behaviour toward adopting and using new technology (refer to Figure 2-18). Extrinsic motivation refers to the inducement of external, tangible rewards that motivate an individual to voluntarily perform a behaviour, such as enhancing work performance, wage, or career advancements. The **extrinsic motivation** constructs are perceived ease of use, perceived usefulness, and subjective norm. The **intrinsic motivation** refers to the internal desires (not due to inducement of external, tangible rewards) within an individual to achieve a specific objective, therefore voluntarily performing a behaviour (Davis et al., 1992), for example, individual enjoyment of playing with a computer leading to being pleased and satisfied (Davis et al., 1992; Venkatesh, 2000).

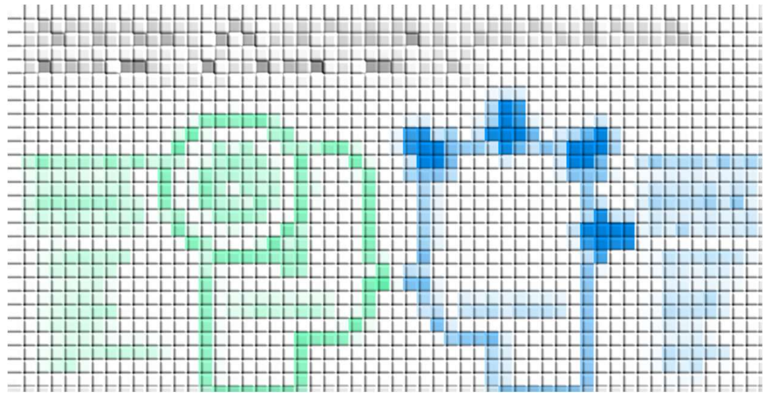


Figure 2-18 Human Motivation – Intrinsic and Extrinsic Motivation
Source: Adapted from the Internet (www.limeade.com)

Numerous research study adapted and employed motivational theories to study personal computer acceptance and use context, for example, Davis et al. (1992), Venkatesh and Speier (1999) and Venkatesh and Brown (2001). These studies' findings lead to the consensus that intrinsic and extrinsic motivation factors inspire workers to adopt and use innovation (Venkatesh et al., 2003).

### 2.9.7 Social Cognitive Theory (SCT)

The origin of Social Cognitive Theory (SCT) inception arguably came from the Stanford University Bobo Doll experiment conducted by Albert Bandura and colleagues, where it led to the introduction of the observational learning model. The social observational learning concept provides a pathway to understanding and predicting human behaviour that consists of interaction between individual intra-personal factors, behaviour, and the social environment (Bandura, 1977).

The observational learning model extensively employed to explain human behaviour, later renamed as SCT in 1986, in-line with the SCT framework, which focuses on cognitive components of observational learning, where it assumed that outcome of individual behaviour shaped through the cognitive process reciprocal determination, self-efficacy and outcome expectancy within the mutual collaboration between personal factors, behaviour and the social environment (Bandura 1986; Bandura, 1998) (refer to Figure 2-19). The SCT hypothesizes that a person intends to perform a certain behaviour determined by self-efficacy and outcome expectancy. The concept of self-efficacy rests on an individual believing in motivation and inspiration observed from other successful individuals. The individual is likely to change and imitate the observed behaviour with the hope of achieving a comparable outcome (Bandura, 1998).

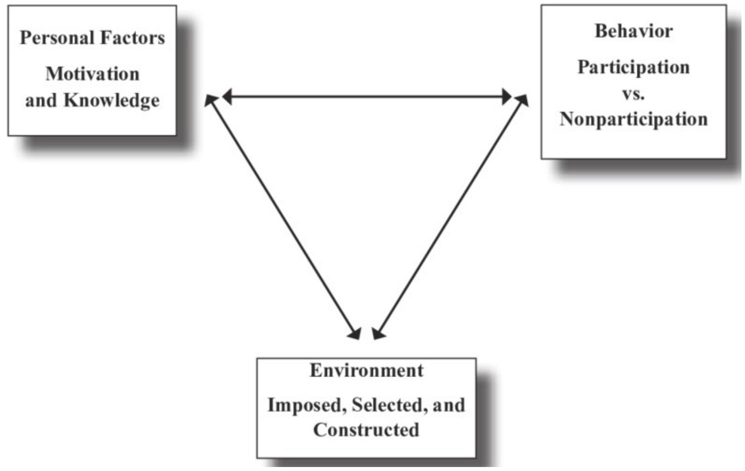



Figure 2-19 Social-Cognitive Theory's Triadic Reciprocality.
Source: Adapted from Bandura (1986).

Compeau and Higgins (1995a, 1995b) adapted the SCT to investigate the relationship between the concept of self-efficiency and computer utilisation among students, where five factors of self-efficacy influence individual computer utilisation (refer to Figure 2-20).

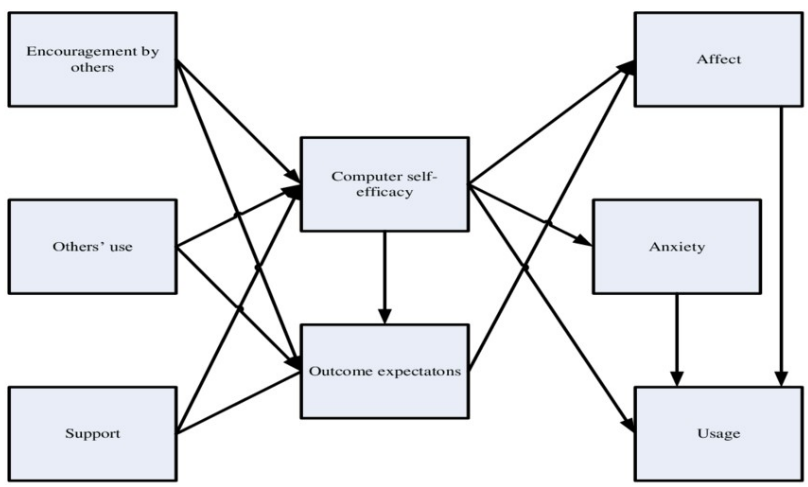



Figure 2-20 Computer self-efficacy model
Source: Adapted from Compeau and Higgins (1995a).

Venkatesh (2000) adapted the SCT model and confirmed that self-efficacy is an essential predictive factor toward individual behavioural intention to adopt new technology. The flexibility and nature of SCT theory enabled adaptation for use in an information system or information technology context (Venkatesh et al., 2003).

### 2.9.8 Innovation Diffusion Theory (IDT)

The innovation diffusion theory (IDT) (Rogers, 2003) came from the sociology branch of knowledge and possibly one of the early models available to study the individual acceptance of innovation from both diffusion and adoption perspective (Schiffman et al., 2012). The IDT explained the rationale how a new technology or innovation spread across society; from the analysis of historical IDT research publications, the IDT widely employed to study innovations in various domain ranging from industrial to farming innovation with determinants such as relative advantage, compatibility, and complexity reliably explained innovation diffusion and adoption (Tornatzky and Klein, 1982).

The IDT identified four core foundations that influence and spread the idea of changes in society. These elements are the social and cultural system, perceived characteristics of the innovation, the communication channels, and time cycle that influence or shape the degree of individuals acceptance of innovation over five states of diffusion sequence; knowledge, persuasion, decision, implementation, and confirmation (refer to Figure 2-21). The theory assumed that individual within the population with adequate knowledge of the relative advantage of the innovation, hands-on trial of the innovation, practical experience of the innovation, compatibility and complexity, and observation of the innovation in action within the social system; over time-cycle, the individual can decide to embrace or refuse the innovation. Hence, IDT highlighted the essence of appreciating the compatibility and interaction between personal preferences, technology or innovation benefits and societal influence when studying innovation diffusion.

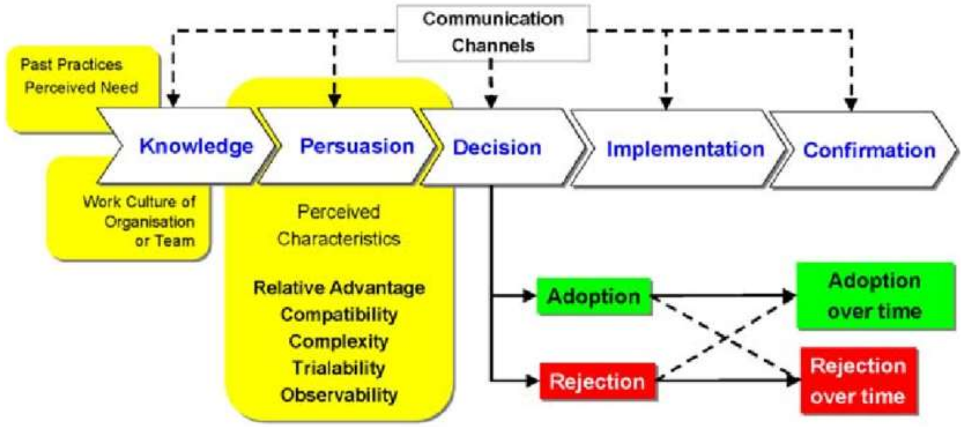



Figure 2-21 The Five Stages of Innovation Diffusion
Source: Adapted from Rogers (2003).

The perceived characteristics which sit between the knowledge and decision stage is where the individual in the population deliberate on whether to accept or refuse the innovation based on five predictive criteria: relative advantage, compatibility, complexity, trialability and observability (refer to Figure 2-22).

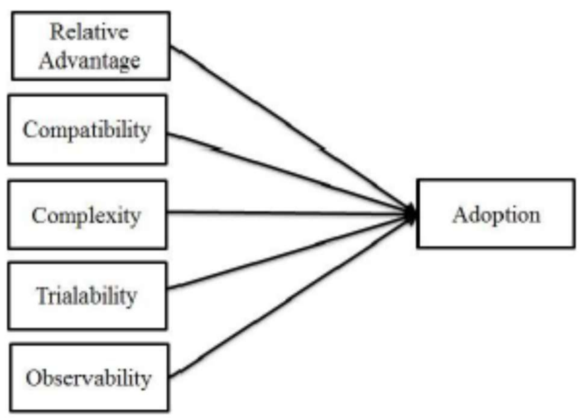



Figure 2-22 Five Perceived Characteristics - Diffusion of Innovation
Source: Adapted from Rogers (2003).

Technology diffusion rate varies depending on the type of individual adoption or rejection rate in the population; the innovation either continue to accelerate and spread to become a norm in the society or failed and rejected by society (Rogers, 2003). The IDT also posits that the diffusion of innovation process created five types of social personality: the innovators, the early adopters, the early majority, the late majority and the laggards (refer to Figure 2-23).

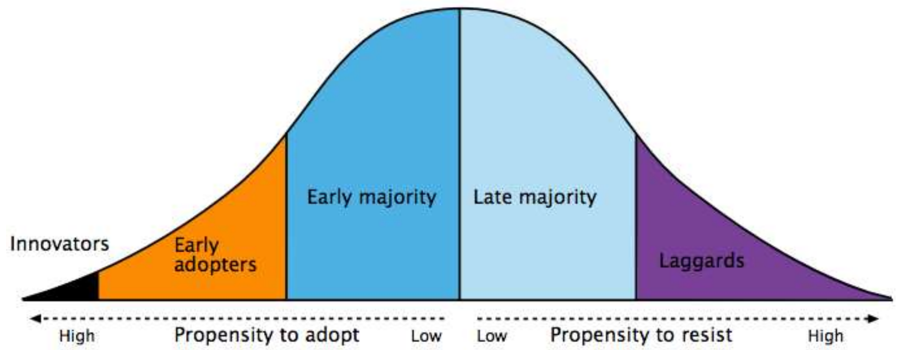



Figure 2-23 The Five Segmentation of Social System
Source: Adapted from Rogers (2003).

The IDT advocate that the adoption of innovation occurs along an analogue S-shaped curve where diffusion spread of the innovation among the population initially slow, then diffusion accelerates toward the mid-point and tapers off toward the end of diffusion, forming an S-shaped profile. The argument for an analogue S-shape diffusion rests with the observation that innovation initially needs to penetrate the social system, signalling that the number of people exposed to the innovation is low at the beginning of diffusion. Over time, when the population begin to perceive the innovation as able to satisfy the social system's needs, more member of the society begins to accept the innovation; therefore, the diffusion rate accelerated. Eventually, the innovation accepted and spread rapidly to most of the population, and the rate of diffusion begins to slow down and tapers off (refer to Figure 2-24).

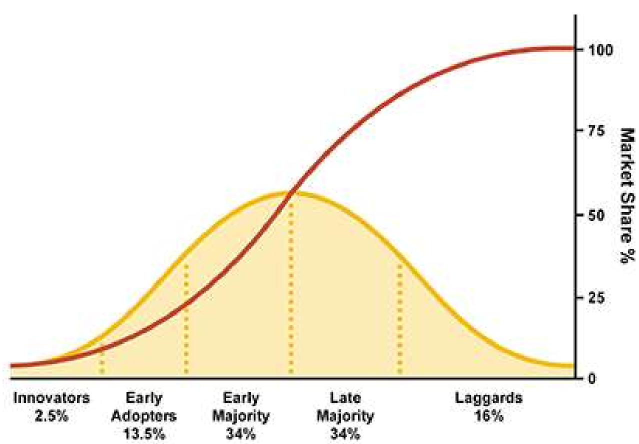



Figure 2-24 Innovation Diffusion Theory – S Curve and Personality Segmentation
Source: Adapted from Rogers (2003).

Moore and Benbasat (2001) refined and adapted IDT to study personal technology adoption using seven constructs: relative advantage, compatibility, ease of use, visibility, image, result demonstrability and voluntarism (refer to Figure 2-25).

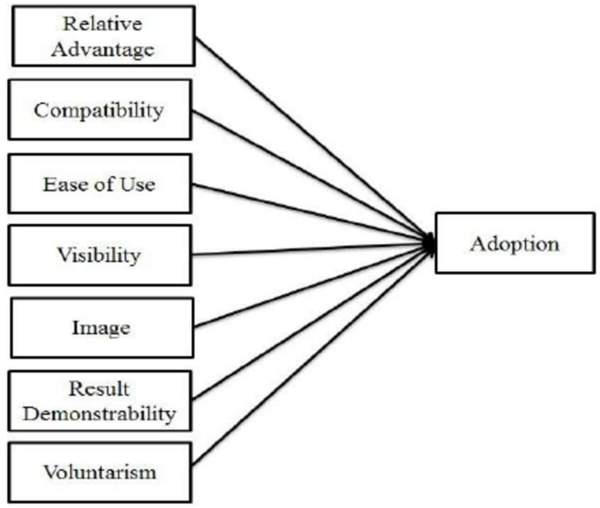



Figure 2-25 Refined Diffusion of Innovation Model
Source: Adapted from Moore and Benbasat (2001).

Explaining the model in relation to IDT, Moore and Benbasat (2001) claimed that relative advantage is associated with the individual perception that innovation provides advantages toward job performance in an organisational context. Therefore, the relative advantage is comparable to TAM perceived usefulness construct. The second construct, compatibility, is from IDT, where it is the degree that individual perceived the invention as coherent with personal values, needs, and experiences (Rogers, 2003). Moore and Benbasat (2001) argued complexity in IDT in the context of adoption is about how easy it is to learn and free of effort for an individual; therefore, complexity represented by TAM perceived ease of use construct. The fourth construct, image, represents how the individual perceived the innovation as potentially enhancing the individual's social image. The fifth construct, result demonstrability, is similar to trialability and the sixth construct, visibility, is similar to observability. The seventh construct, voluntarism, is about the degree individual perceived the use of innovation is within the individual control; therefore, it exhibits resemblance to the perceived behavioural control construct of TPB.

## 2.10 Unified Theory of Acceptance and Use of Technology (UTAUT)

Through empirical reviews of existing IS/IT technology acceptance and use research studies, Venkatesh et al. (2003) conceived and justified the basis for the Unified Theory of Acceptance and Use of Technology (UTAUT) theoretical model by unifying eight theoretical models from psychology, sociology, and IS/IT technology research domain. These underpinnings theories and models mainly originated from cognitive theories (Venkatesh et al., 2003) and focused on studying the thinking, beliefs, attitudes and intention of personal technology adoption and technology usage. The eight technology acceptance and use theories and models presented and discussed in details in the preceding sections; TRA, TPB, TAM, C-TAM-TPB, MPCU, MM, SCT and IDT. The new theory development process evolved around justification, amalgamation and unification of related technology adoption theories and the context in search of a comprehensive model that rest upon practical and relevant theories (Venkatesh et al., 2003; Venkatesh et al., 2007).

Venkatesh et al. (2003) group constructs with similar meanings and definitions from a theoretical perspective from the preceding eight theoretical models and consolidated into seven determinants that influence personal technology acceptance and usage behaviour. These determinants are Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions, Self-efficacy, Computer Anxiety, and Attitude Toward Using Technology. The key idea behind establishing the UTAUT theoretical model was introducing a comprehensive theoretical model for studying behavioural intention and usage behaviour of new information technology applicable across various applications in an organisational setting (Sharma and Mishra, 2014).

After the conclusion of Venkatesh et al. (2003) study, three determinants from the preceding eight theoretical models, namely, Attitude Toward Using Technology, Self-efficacy, and Computer Anxiety, are not determinants of behavioural intention and use behaviour. The remaining constructs - **Performance Expectancy, Effort Expectancy, Social Influence** found as direct determinants of **Behavioural Intention.** The **Facilitating Conditions** found as a direct determinant of **Behavioural Intention** and **Use Behaviour (UB)**. Venkatesh et al. (2003) also theorised that **age** moderates the relationship between all exogenous constructs with endogenous construct BI and the relationship between exogenous construct FC and endogenous construct BI in the UTAUT theoretical model. Except for the exogenous FC construct, **gender** moderate the relationship between all exogenous constructs with endogenous construct BI. Except for exogenous construct PE, **experience** moderates the relationship between all exogenous constructs with endogenous construct BI and the relationship between exogenous construct FC with exogenous construct UB. **Voluntariness of use** moderate the relationship between exogenous construct SI with BI (refer to Figure 2-26).

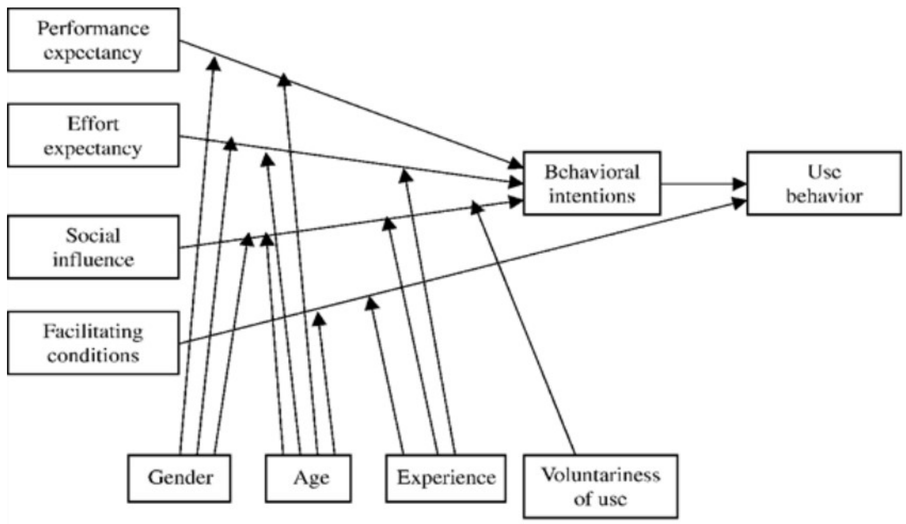



Figure 2-26 The UTAUT Theoretical Model

Source: Adapted from Venkatesh et al. (2003).

2.10.1 Performance Expectancy (PE)

The PE construct conceptualised from the empirical review of five constructs that belong to five different theoretical models: the TAM perceived usefulness, MM extrinsic motivation, MPCU job-fit, and the IDT relative advantage and SCT outcome expectations. The concept behind the PE construct stems from the belief that these five constructs described earlier influence personal intention to accept and use innovation (Venkatesh et al., 2003). The UTAUT theoretical model suggests that PE construct moderated by gender and age.

The PE construct represents the degree to which a person trust that innovative technology assist in work performance improvement. Various technology acceptance research literature suggested that PE is an essential and vital determinant of behavioural intention to use innovative technology. For example, mobile internet (Venkatesh et al., 2012), mobile commerce (Alkhunaizan and Love, 2012; Zhou, 2008), mobile banking (Zhou, Lu and Wang, 2010), mobile advertisement (He and Lu, 2007), smartphone (Park, Yang and Lehto, 2007; Carlsson, Carlsson, Hyvonen, Puhakainen and Walden, 2006) and smartphone applications (Shi, 2009).

### 2.10.2 Effort Expectancy (EE)

The EE construct motivation stem from the belief that an innovation perceived by the individual as easy to use, more likely to gain acceptance and promote intention to use the innovation (Davis, 1989). The EE construct conceptualised from the empirical review of three constructs that belong to three different theoretical models: the TAM perceived ease of use, the MPCU complexity, and the IDT complexity. The UTAUT theoretical model suggests that EE construct moderated by gender, age, and experience (Venkatesh et al., 2003).

The EE construct represents the degree to which a person felt that it is easy to learn or use innovative technology (Venkatesh et al., 2003). Various technology acceptance research literature suggested that EE is an essential and vital determinant of behavioural intention to use innovative technology. For example, mobile internet (Venkatesh et al., 2012), mobile commerce (Alkhunaizan and Love, 2012), smartphone (Park et al., 2007; Carlsson et al., 2006) and smartphone applications (Shi, 2009).

### 2.10.3 Social Influence (SI)

The SI construct stem from the integration of two unique constructs from five different theoretical models: the subjective norm construct, which assumed that an individual's behaviour intention and use of innovation shaped by influence from the individual social circle (Fishbein and Ajzen, 1975) and the image construct where an individual's behaviour intention and use of innovation shaped by the degree the individual believes having used an innovation improves the individual image or status within the individual social circle (Moore and Benbasat, 1991).

The SI conceptualised from the empirical review of three constructs that belong to five different theoretical models: a subjective norm from three theoretical models, which are TRA, TPB, C-TAM-TPB, the MPCU social concept, and the IDT image concept (Venkatesh et al., 2003). Venkatesh et al. (2003) explained that the SI construct significantly influences the perceived usefulness construct and theorised that individuals perceived the use of new information technology enhances job performance and enhances social status and influence within a workgroup. The UTAUT theoretical model suggests that SI construct moderated by gender, age, the voluntariness of use and experience (Venkatesh et al., 2003).

The SI construct represents the degree to which a person believes that behavioural intention to accept innovative technology influenced or encouraged by society (Venkatesh et al., 2003). Various technology acceptance research literature suggested that SI is an essential and vital determinant of behavioural intention to use innovative technology. For example, mobile advertisement (He and Lu, 2007), smartphone (Park et al., 2007), mobile commerce (Zhou, 2008), mobile banking (Zhou et al., 2010), and mobile internet (Venkatesh et al., 2012),

### 2.10.4 Facilitating Conditions (FC)

The FC stem from the belief that resources and a supportive environment required to minimised barriers and encourage use behaviour (Ajzen, 1991; Thompson et al., 1991) and also from an individual perception that the use of innovation is coherent with the individual desires and aspirations (Moore and Benbasat, 1991). The FC conceptualised from the empirical review of three constructs that belong to four different theoretical models: a perceived behavioural control construct from two theoretical models, which are the TPB and C-TAM-TPB, the MPCU facilitating conditions construct, and the IDT compatibility concept. The UTAUT theoretical model suggests that FC construct moderated by age and experience (Venkatesh et al., 2003).

The FC construct represents the degree to which a person trusts that the availability of support resources from an organisation influenced or encouraged personal intention to use or continuance information technology usage (Venkatesh et al., 2003). Various technology acceptance research literature suggested that FC is an essential and vital determinant of behavioural intention to use innovative technology. For example, mobile advertisement (He and Lu, 2007), mobile commerce (Zhou, 2008), smartphone applications (Shi, 2009) and mobile internet (Venkatesh et al., 2012).

### 2.10.5 Behavioural Intention (BI)

BI represents the degree of willingness to consider the use of information technology. An individual’s perceived willingness or personal readiness to engage in a behaviour to use information technology influenced by behavioural intention determinants (Mafé, Blas and Tavera-Mesías, 2010). In the preceding section, the four determinants of the UTAUT theory: PE, EE, FC, and SI, found by various research study essential and significant determinants that influence BI to use information technology.

The BI construct originated from the TRA model. Fishbein and Azjen (1975) defined behavioural intention as a personal subjective likelihood to engage in a specific behaviour. In a later study, Ajzen (2002) suggested that behavioural intention is an immediate antecedent of actual behaviour, where behavioural intention linked to personal readiness to embrace or engage in a specific behaviour. Depending on the construction of the technology acceptance and use conceptual research model, a BI construct can become an endogenous or exogenous variable. Numerous past technology acceptance studies examine BI as an endogenous variable, for example, the TRA, TPB and C-TAM-TPB model discussed earlier in this chapter, Venkatesh et al. (2003) and Venkatesh et al. (2012).

#### 2.10.6 Use Behaviour (UB)

In the context of the UTAUT theoretical model, UB defined as an indication of personal interaction with information technology based on usage patterns, length of use, and intensity of use (Venkatesh et al. 2003). From a measurement perspective, the UB construct represents the degree to which a person repeats the actual usage of certain technology (Compeau and Higgins, 1995b).

### 2.11 Unified Theory of Acceptance and Use of Technology 2 (UTAUT2)

The review of foundations technology adoption theories and models until the UTAUT theory's birth presented and discussed in the earlier section of this chapter. The UTAUT theoretical model focused on an organisational context and did not address the consumer’s perspective. In 2012, Venkatesh et al. (2012) conducted empirical studies to identify constructs influencing personal behavioural intention and technology usage in a consumer context.

The outcome of Venkatesh et al. (2012) study is a UTAUT2 theoretical model that inherited the UTAUT theoretical model with four constructs and three extended constructs: Hedonic Motivation, Price Value and Habit**.** Besides, the number of moderators in the UTAUT2 model reduced to three by removing the voluntariness of use. The justification for the removal was unlike in an organisational context where an individual does not have any liberty in choice; consumers’ behaviour, in reality, is often voluntary (Venkatesh et al., 2012). The UTAUT2 theoretical model suggested that **age** and **gender** moderate the relationship between all seven determinants of BI and the relationship between exogenous construct HB and endogenous construct UB. Except for exogenous construct PE, **experience** moderates all the relationship between six exogenous constructs and endogenous construct BI. The relationship between exogenous construct HB and endogenous construct UB and the relationship between construct BI and endogenous construct UB (refer to Figure 2-27).

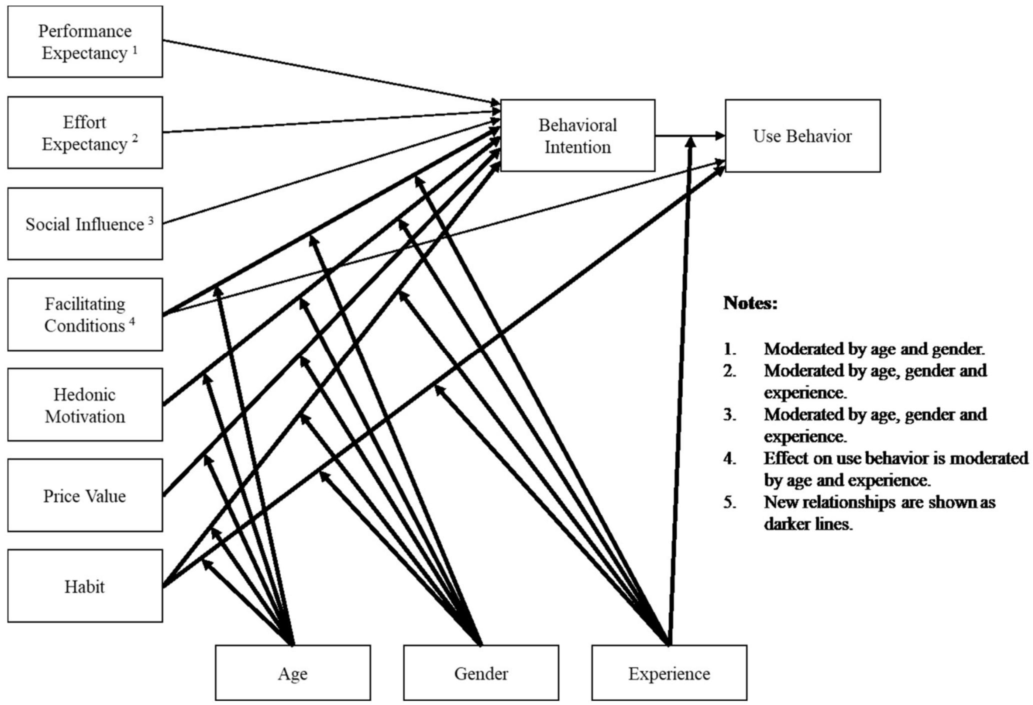



Figure 2-27 The UTAUT2 Theoretical Model

Source: Adapted from Venkatesh et al. (2012).

The six constructs (performance expectancy, effort expectancy, social influence, facilitating conditions, behavioural intention and use behaviour) already discussed in the UTAUT theory section presented earlier. The three new constructs of the UTAUT2 theory: **Hedonic Motivation**, **Price Value** and **Habit** presented in this section.

2.11.1 Hedonic Motivation (HM)

Hedonic motivation is described as an individual emotional expression, such as joy, fun, excitement and incentives, when individuals engaged in certain activities such as shopping and buying products (Solomon, Bamossy, Askegaard and Hogg, 2013). An earlier study by Brown and Venkatesh (2005) suggested that the HM construct is an essential predictor of technology adoption and usage. Various literature across different research domains have concentrated on studying HM construct in technology acceptance from a cognitive perspective (Rocznik, Goffart and Wiesche, 2017), suggesting that hedonic motivation is an essential factor associated with excitement, delight, joy, fun, and satisfaction (Solomon et al., 2013) resulting from using new information technology (Brown and Venkatesh, 2005).

A meta-analysis of mobile commerce technology acceptance literature conducted by Zhang, Zhu and Liu (2012) found that perceived enjoyment or perceived entertainment construct (which is related to hedonic aspects of technology acceptance and use) is an essential predictor of consumer intention to use innovation. Various technology acceptance research literature suggested that HM is an essential factor influencing behavioural intention to adopt information technology. For example, mobile internet (Venkatesh et al., 2012), mobile commerce (Li, Dong and Chen, 2012), mobile wallet (Megadewandanu, Suyoto and Pranowo, 2016), mobile government services (Baabdullah, Dwivedi and Williams, 2014) and online hotel booking (Chang, Liu, Huang and Hsieh, 2019).

### 2.11.2 Price Value (PV)

Venkatesh et al. (2012) argued that in an organisational context, technology paid by the organisation; therefore, there is no sensitive impact on any individual in any corporation when considering technology acceptance and use. In reality, an individual paying for the technology is sensitive to price and value; hence the price and value composition mix influences consumer decision when considering technology adoption (Venkatesh et al. 2012). An individual decision represents a personal intellectual trade-off evaluation comparing the product technology benefits versus the cost of owning and using the innovation (Dodds, Monroe and Grewal, 1991).

Therefore, PV's concept involved personal cognitive evaluation as described in the previous paragraph, where a person assesses the value of the technology proposition versus the cost of owning or using it. The cognitive evaluation could have two directions; for example, when perceived benefits outweigh the monetary cost, the PV construct positively influences personal technology adoption intention. Consequently, when the perceived monetary cost outweighs perceived benefits from a personal perspective, the PV construct negatively influences personal technology adoption intention (Venkatesh et al., 2012). Various technology acceptance research literature suggested that PV is an essential factor influencing personal technology adoption intention. For example, mobile internet (Venkatesh et al., 2012), mobile government services (Baabdullah et al., 2014) and online hotel booking (Chang et al., 2019).

### 2.11.3 Habit (HB)

Venkatesh et al. (2012) introduce HB construct and hypothesised it as an individual's past behaviours or experiences predicting future behaviour. Ajzen (2002) posits that past behaviour's repetitiveness is one of the primary antecedents of present actions. An individual habit represents the degree to which individuals automatically repeat past learning behaviours (Limayem, Hirt and Cheung, 2007). Hence HB is directly associated with past behaviour and can be inferred as the antecedents that predict the future propensity to use innovation (Limayem et al., 2007). Similarly, Venkatesh et al. (2012) also find that consumers behaviour changed as new technology become integrated into their daily activities. Various technology acceptance research literature suggested that HB is an essential factor influencing behavioural intention to adopt information technology. For example, mobile internet (Venkatesh et al., 2012), mobile wallet (Megadewandanu et al., 2016) and online hotel booking (Chang et al., 2019).

## 2.12 Objective Review of Eight Theoretical Models/UTAUT/UTAUT2 Model

### 2.12.1 The Support of UTAUT Theory

Since the UTAUT theory introduction in 2003, many other researchers employed the theory to investigate new information technology acceptance and technology usage in various countries and applications context. The UTAUT model widely cited and applied by information system research communities and researchers in other fields (Venkatesh, Thong and Xu, 2016) to study organisational technology adoption (Lewis, Fretwell, Ryan and Parham, 2013) and many different domains such as behavioural science, system engineering, management, computer science, and education (Huang and Kao, 2015).

The consensus of past research studies employing UTAUT theory is that the UTAUT theoretical model and its primary constructs are robust and support the UTAUT model's generalisability (Venkatesh et al., 2016). Various researchers employed and tested the UTAUT theory and its extension concluded that UTAUT theoretical model is valid and reliable. For examples, mobile commerce (Alkhunaizan and Love, 2012; Zhou, 2008), mobile banking (Zhou et al., 2010), mobile advertisement (He and Lu, 2007), smartphone (Park et al., 2007; Carlsson et al., 2006) and smartphone applications (Shi, 2009).

### 2.12.2 The Criticism of the UTAUT Theory

A critical review of research literature requires a balanced and holistic reading and review of the supporting and opposing opinions toward the UTAUT theory. In the previous section, the support of the UTAUT presented, and in this section, this study will present and discuss researchers’ criticisms of the UTAUT theory.

Williams, Rana, Dwivedi and Lal (2011) studying 450 research publications that cited the UTAUT theoretical model and opine that majority cited the UTAUT theoretical model for literature review instead of using the UTAUT theoretical model to conduct their study or investigation; only 43 research studies identified as employing the UTAUT theoretical model or the UTAUT constructs. Many research studies have extended the UTAUT theoretical model suggesting that the UTAUT model is not comprehensive or limited (Negahban and Chung, 2014). Jasperson, Carter and Zmud (2005) contrast that the UTAUT or extended UTAUT theory though reliable in explaining individual intention and use behaviour of innovation at system level examination, is not practical for studying individual technology adoption at product design feature level. Van Raaij and Schepers (2008) critique the UTAUT theoretical model as less parsimonious and complicated because of the attempt to group multiple items/constructs into reflecting a few single psychometric constructs.

Thomas, Singh and Gaffar (2013) discovered that attitude constructs an essential predictor of behavioural intention in their study of mobile learning based on the UTAUT theoretical model, which contradicts Venkatesh et al. (2003) UTAUT theory. The combination of meta-analysis and structural equation modelling based on 162 historical IS/ IT acceptance and use research studies reviewed by Dwivedi et al. (2019) found that attitude is an essential construct that predicts behavioural intention to use technology. Dwivedi et al. (2019) argued that attitude directly influences user behaviour and partially mediates performance expectancy, effort expectancy, facilitating conditions, and social influence toward behavioural intention. Thus, Dwivedi et al. (2019) critique the UTAUT model accuracy and mooted a reframed model as an alternative for UTAUT theory.

Al-Gahtani, Hubona and Wong (2007), which conduct a simultaneous study across two different countries (Saudi Arabia and the United States of America), found differing behaviour, performance and outcome when applying the same theory and conceptual model. Similarly, Im, Hong and Kang (2011) conducted a simultaneous study across two different countries (South Korea and the United States of America) also found different effects when applying the same theory and conceptual model. As observed by Al-Gahtani et al. (2007) and Im et al. (2011) study and postulated by Thomas et al. (2013): population culture, country-specific differences, socioeconomic profile, and choice of data analysis techniques may influence the constructs relationship and empirical performance of the UTAUT model.

In conclusion, the UTAUT theory criticisms provide this study with varying perspectives that can help this study understand the limitations, issues of contention, and opinions of opposing researchers regarding the UTAUT theory.

### 2.12.3 The Support of UTAUT2 Theory

The UTAUT theory, which is proven practical, reliable, and valid (Venkatesh et al., 2016), underpins the theoretical foundation for the UTAUT2 theory. In 2012, Venkatesh et al. (2012) reviewed past UTAUT research studies and introduced the UTAUT2 theory with seven constructs that expand UTAUT theory's scope from organisational context into covering consumer context. In comparison with preceding technology acceptance theories, Venkatesh et al. (2012) argued that the UTAUT2 theoretical model covers broader perspectives (technical, social and economic) and empirically verified theory delivering better predictive power and explanatory depth for individual’s technology acceptance and use.

To better understand the behaviour and empirical performance of the UTAUT2 theory, Venkatesh et al. (2012) encourage the research communities to apply the UTAUT2 theory in varying cultural and applications contexts. Various researchers employed and tested the UTAUT2 theory and its extension found the UTAUT2 theoretical model is valid, reliable and demonstrated enough predictive and explanatory power to address consumers’ adoption and information technology usage. For examples, mobile internet (Venkatesh et al., 2012), mobile wallet (Megadewandanu et al., 2016), mobile government services (Baabdullah et al., 2014) and online hotel booking (Chang et al., 2019).

### 2.12.4 Theoretical Models Empirical Performance

As presented in the previous section, the UTAUT theoretical model (justified through the unification of eight theoretical models) focuses on studying behavioural intention and using new information technology in an organisational context (Venkatesh et al., 2003). The proponent of UTAUT theory - Venkatesh et al. (2003), claimed the UTAUT as a unified model offers researcher simplicity by reducing the development effort, challenges, and complexity of constructing a technology adoption conceptual model. The UTAUT theoretical model is more superior to the eight technology adoption theories and models and can explain approximately 69% of the total variance in behavioural intention versus the eight technology acceptance and use theories and models that explain approximately between 36% and 52% of the total variance (Venkatesh et al. 2003). The findings suggested that the UTAUT model had significantly higher predictive power than the eight theoretical models.

The UTAUT2 theoretical model, a recent theory introduced in 2012, is new and has limited research publications. The UTAUT2 theoretical model expands the UTAUT theoretical model into seven predictive constructs to explain personal behavioural intention to adopt technology and technology usage in a consumer context. The UTAUT2 theoretical model with seven constructs covers a broader perspective (technical, social and economic) than the UTAUT theoretical model and considered comprehensive because it consists of constructs that represent technical, social and economic perspective (Venkatesh et al., 2012).

Based on the mobile internet adoption study in Hong Kong, Venkatesh et al. (2012) claimed that the UTAUT2 model is an empirically more robust model than the UTAUT when studying personal technology adoption and technology usage behaviour in a consumer context. The UTAUT2 theory empirically explained approximately 74% of the total variance in consumer behavioural intention to use new information technology and approximately 52% of the total variance in information technology usage in a consumer context. In comparison, the UTAUT model, when applied in a similar study, only explained approximately 56% of the total variance in behavioural intention to use innovation and approximately 40% of the total variance in innovation use.

In contrast with the UTAUT model, the UTAUT2 theory delivers an 18% higher total variance on behavioural intention and 12% higher total variance on user behaviour. Based on the comparative outcome, the UTAUT2 theory potentially delivers the best total variance explained. As explained earlier, this study seeks a sound consumer technology acceptance empirical theory to build a smartwatch adoption concept for empirical testing and selecting an appropriate anchor theory is an essential problem-solving step for this research study. Based on the insights reviewed in this chapter, the UTAUT2 theoretical model accepted by this study to anchor the study conceptual model development because of its has solid underpinning theories and the model's exhibited good empirical performance and parsimony.

## 2.13 The Study Problem Solving Approach

From the literature review in previous sections, the UTAUT2 theory determined as an appropriate theory to anchor the development of the conceptual smartwatch adoption model for this study. This study approaches research problem-solving from theory to practice, where deductive reasoning is applied to develop a conceptual model and derived hypotheses to facilitate the development of research methods to collect and measure empirical data for hypotheses testing. The development process guided by the research questions, research objectives of this study and the need to seek external validity by testing empirical data collected from Malaysia resident. The conceptual smartwatch adoption model served as a measurement model at a conceptual level to guide the translation into an operational level; the process of its development presented in the next section.

## 2.14 The Study Conceptual Model Development

In the previous section, the UTAUT2 theory and its underpinnings technology acceptance and use theories presented, discussed and empirically evaluated; the UTAUT2 theory with constructs that represent technical, social, and economic context justified based on the comprehensiveness of the technology acceptance theory and its empirical predictive power in comparison to its underpinning's theories and models. This section aims to adapt the UTAUT2 theory and transform the UTAUT2 model according to this study's setting to develop a conceptual model and hypotheses to address RQ1 to RQ8. Furthermore, since the UTAUT2 theory is new and recent, Venkatesh et al. (2012) encouraged researchers to replicate more study using the UTAUT2 theory in different country and technology applications contexts to understand the UTAUT2 theory performance and characteristics under different cultural and application contexts.

### 2.14.1 The Basis for Study Conceptual Model and Hypotheses Development

The initial high-level conception of a conceptual model for this study draws upon the following surveys' findings: The PWC (2015) survey report that surveyed 1,000 American consumers identified that **affordability** is the huddle for smartwatch adoption; a high price without meaningful applications is an obstacle to adoption. Survey participants believe smartwatch will strengthen the **social** connection with family and friends. Factors identified as motivating survey participants to use a smartwatch are **health and fitness** (exercise smarter, collect and track medical information and eat better), **infotainment** (controlling home appliances) and **social media access and communications** (retails deal notifications and access to social media). This study cross-mapped findings identified by PWC (2015) against the UTAUT2 theory constructs. The construct in the UTAUT2 theoretical model found reflective of PWC (2015) survey findings are **Price Value** (affordability and value) and **Social Influence** (connectivity with family and friends, social media access to social media communications), **Hedonic Motivations (**infotainment and controlling of home media). **Health Technology** (exercise smarter, collect and track medical information and eat better) is a new construct specific to the smartwatch application, which does not exist in the UTAUT2 theoretical model.

The PWC (2016) survey report that surveyed 500 participants from Australia, England, Mexico and Singapore indicated that **personal activity tracking, affordability,**

**personal performance/productivity, seamless connectivity with other smart devices** and **look fashionable/cool** are the top five essential factors that motivate consumers adoption of a smartwatch. This study cross-mapped findings identified by PWC (2016) against the UTAUT2 theory constructs. Constructs in the UTAUT2 theoretical model found reflective of PWC (2016) survey findings are **Performance Expectancy** (personal performance/productivity) and **Effort Expectancy** (seamless connectivity with other smart devices). The personal activity tracking related to **Health Technology** and fashionable/cool, which relates to Design Benefit, is a new construct specific to the smartwatch application, which does not exist in the UTAUT2 theoretical model and a candidate for this study's conceptual model.

The Richter (2017) survey observation learned from 5,000 American smartwatch users conducted in June 2017 identified **communications** (notifications/text, phone calls, and email), **health and fitness technology** (activities tracking), **infotainment** (news updates and view photo/video)**, and assisted living** (alarm clock, remote control for music and GPS tracking and navigation) **and safety** (GPS tracking and navigation) (refer to section 2.3). This study cross-mapped findings identified by Richter (2017) against the UTAUT2 theory constructs. Constructs in the UTAUT2 theoretical model found reflective of Richter (2017) findings are **Performance Expectancy** (communications and safety), **Hedonic Motivation** (infotainment, communications and assisted living) and **Health Technology** (activities tracking) is a new construct specific to smartwatch application which does not exist in the UTAUT2 theoretical model and a candidate for this study's conceptual model.

The survey findings of PWC (2015), PWC (2016) and Richter (2017) form the preliminary basis of how this study determines the essential constructs that relevant to the development of the conceptual smartwatch adoption model. In summary, based on findings of PWC (2015), PWC (2016) and Richter (2017), the UTAUT2 theory constructs **Performance Expectancy, Hedonic Motivations, Price Value** and identified two new smartwatch application constructs; **Health Technology** (personal activity tracking) and **Design Benefit** (fashionable/cool look) as relevant for the development of the conceptual study model. Together with insights derived from academic literature presented in the latter part of this chapter, these factors identified in this section provide the basis to develop the proposed study conceptual model and hypotheses.

### 2.14.2 The Initial Adaptation of the UTAUT2 Theoretical Model

Based on Internet search results and reference to research literature, the Malaysia smartwatch adoption research literature just started in 2016 and still in an infancy stage to the best knowledge of this study. The information available to guide this study on Malaysia smartwatch's current status is rare and limited, particularly concerning user behaviours and habits. Furthermore, the current Malaysia low smartwatch diffusion potentially represents a challenge for this study to collect enough sample response from experience smartwatch users. This likelihood of not gathering adequate sample response from Malaysia smartwatch users presents uncertainty for this study. This study decided to include perceptions and opinions of a smart bracelet and a smartphone (health and fitness application) user who have the intention to upgrade to a smartwatch.

The first step to understanding Malaysia smartwatch adoption problems is by understanding factors that influence Malaysia residents' behavioural intention to use a smartwatch (Jung et al., 2016). Fishbein and Azjen (1975) defined behavioural intention as a personal subjective likelihood to engage in a specific behaviour. In a later study, Ajzen (2002) suggested that behavioural intention is an immediate antecedent of actual behaviour, where behavioural intention linked to personal readiness to embrace or engage in a specific behaviour. Hence, measuring factors that influence Malaysia residents' behavioural intentions toward using a smartwatch is a proxy suggesting smartwatch technology's actual user behaviour (Venkatesh, Thong and Xu, 2012) and valuable to developing or establishing effective and efficient Malaysia smartwatch technology marketing or diffusion strategies (Jung et al., 2016).

Based on the research circumstances presented above and since this study focusses on behavioural intention to use a smartwatch because past behaviour intention is a reliable yardstick to gauge an actual user behaviour (Ajzen and Fishbein, 2002). Hence, the conceptual study model constructed to examine Malaysia residents' behaviour intention to use a smartwatch. Since use behaviour not part of this study; hence its direct determinant Habits construct excluded from the proposed conceptual model. The proposed study conceptual model study moderating factors such as age and gender.

The Facilitating Conditions construct measured the degree to which a person trusts that the availability of support resources from an organisation influenced or encouraged personal intention to adopt technology or continuance technology usage (Venkatesh et al., 2003). The researcher opines that the facilitating condition concept is not applicable in the current study setting and excludes Facilitating Conditions construct from the conceptual study model.

Summarising the discussion in this section, the initial transformation of the UTAUT2 theoretical model involved removing **Facilitating Conditions, Habits** and **Use Behaviour** constructs, **experience** moderators and relationships between the affected constructs shown in dash line shown in Figure 2-28.

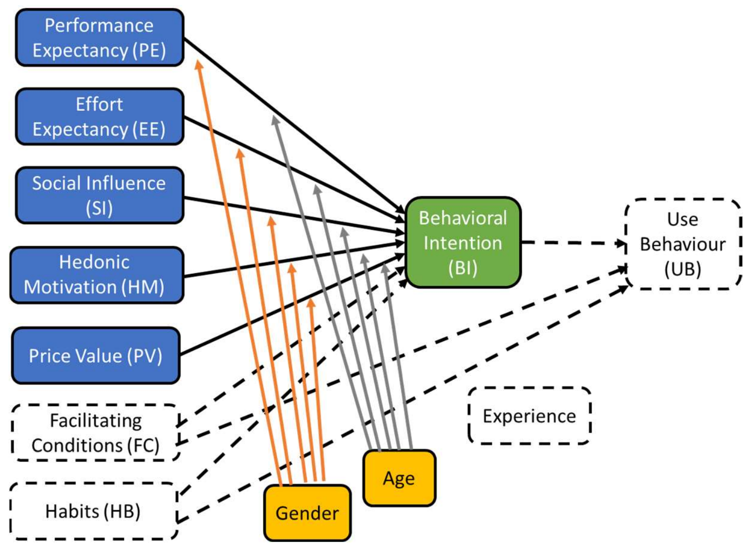



Figure 2-28 The Initial UTAUT2 Transformation

Source: Adapted from Venkatesh et al. (2012) for this study.

### 2.14.3 The Interim Adaptation of the UTAUT2 Model with Smartwatch Context

This study identified two smartwatch specific constructs through referencing various academic literature review and practitioner surveys. Smartwatches possess dual positioning value rooted in both information and communications technologies and traditional wristwatch space. The smartwatch is a technology product that usually governs by a short life-cycle. Simultaneously, a smartwatch also perceived as a social and fashion product similar to traditional watches that exhibit aesthetic appeal and a long life-cycle (Choi and Kim, 2016). Therefore, a smartwatch potentially viewed by consumers as a product that spans between two continuums: that means the interest of individuals can span between appraising a smartwatch as an IT innovation and appraising the aesthetic and feasibility of a smartwatch design, for example like a fashion product (Choi and Kim, 2016; Dehghani, 2018; Dehghani, and Kim, 2018). Qualitative studies have demonstrated that smartwatch utilitarian, hedonic (Canhoto and Arp, 2016), aesthetic appeal, and attribute like being unobtrusive in daily use (Cecchinato et al., 2015) drive individual interest to adopt a smartwatch technology.

To develop a meaningful conceptual model, this study sees the essence of adapting the UTAUT2 theoretical model to address smartwatch specific constructs that may influence personal behavioural intention to use a smartwatch. The first construct is the health technology factor (Adapa, Nah, Hall, Siau and Smith, 2018**;** Dehghani, 2018; Dehgani et al., 2018; PWC, 2015; PWC, 2016; Richter, 2017) which is term as **health technology construct** in this study. The second construct is the aesthetic design, fashion and convenient construct (Choi and Kim, 2016; Cecchinato et al., 2015; Dehghani and Kim, 2019; Hsiao, 2017; Hsiao and Chen, 2018; Jung et al., 2016; PWC, 2016), which is term as **design benefit construct** in this study. The empirical evidence seen from these academic literature and practitioner surveys suggests that both constructs are essential and likely to influence Malaysia residents' cognition, beliefs, and behavioural intentions to use a smartwatch. Both constructs perceived by this study as smartwatch specific constructs relevant to the conceptual model of this study. Hence, this study expects that the extension could improve the total variance explained by this study's conceptual model.

Finally, wrapping up the discussion in this section, the second transformation involved taking the initial UTAUT2 model (refer to Figure 2-28) into the interim conceptual model by extending the initial UTAUT2 model with two smartwatch specific constructs (Health Technology and Design Benefits, highlighted in yellow and dash line) as predictors of personal behavioural intention to use a smartwatch (refer to Figure 2-29). The basis for the relationship in the interim conceptual model above will be discussed and justify in the next section.

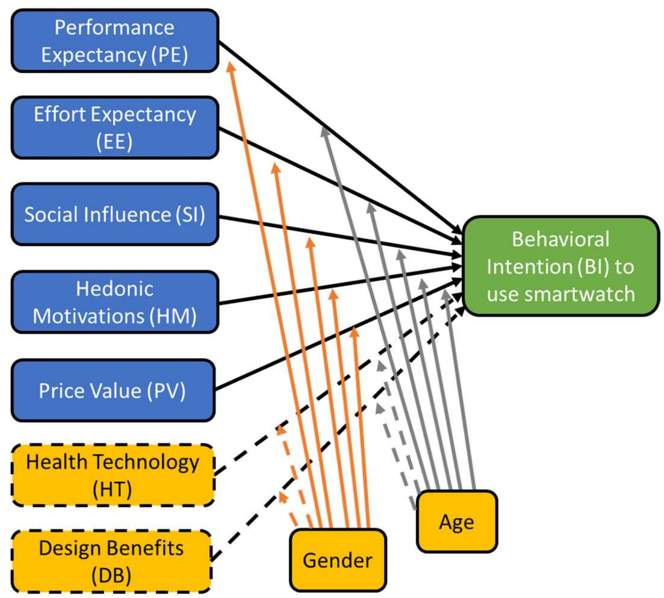



Figure 2-29 The Interim Conceptual Model

Source: Adapted from Venkatesh et al. (2012) for this study.

## 2.15 The Study Hypotheses Development

### 2.15.1 H1 - Performance Expectancy (PE)

The PE construct reviewed, discussed, and presented earlier during theoretical background discussion is a direct determinant toward an individual's behavioural intention in the UTAUT2 theory. In this section, the study focuses on linking evidence from preceding smartwatch research studies that lent support to the PE construct as a determinant of personal behavioural intention to use a smartwatch.

A qualitative study by Canhoto and Arp (2016) postulated that the utilitarian factor influenced personal behavioural intention to use smart health and fitness wearable. A smart wearables meta-analysis research study by Niknejad et al. (2020) tabulated that the perceived usefulness and the relative advantage construct relationship toward behavioural intention was found significant 17 times out of 21 times. The PE construct shared a similar concept with perceived usefulness and relative advantage (Venkatesh et al., 2003).

Technology acceptance study that employed a combination of the TAM, IDT and UTAUT theory confirmed the relationship between the relative advantage construct toward personal behavioural intention to use a smart fitness wearable (Wu, Wu, and Chang, 2016). Two other technology acceptance study that employed the TAM theory also confirmed the relationship between perceived usefulness construct toward personal behavioural intention to use a smart fitness wearable (Park et al., 2016; Park, 2020). Hsiao (2017), based on IDT with other theories, also confirmed the relationship between relative advantage and smartwatch adoption intention. However, Bölen (2020), which employed ECM theory, discover that perceived usefulness is not a determinant of personal behavioural intention to use a smartwatch.

Besides, technology acceptance research study that employed the TAM theory or combination with other theory to investigate Malaysia smartwatch technology acceptance also confirmed the relationship between perceived usefulness construct toward personal behavioural intention to use a smartwatch (Baba et al., 2019; Chuah, 2019; Chuah et al., 2016; Krey et al., 2019).

A qualitative study by Becker et al. (2017), based on the UTAUT2 theory, postulates that PE influenced personal behavioural intention smart health and fitness wearable. Numerous smartwatch and smart wearables technology acceptance quantitative research studies that employed the UTAUT2 theory confirmed the relationship between the PE construct and personal behavioural intention to use a smartwatch and smart wearable (Gao et al., 2015; Kranthi and Ahmed, 2018; Talukder et al., 2019; Yuan et al., 2015). Finally, a recent quantitative research study investigating the Malaysia smartwatch technology acceptance based on the UTAUT2 theory also confirmed the PE construct a relationship with personal behavioural intention to use a smartwatch (Beh et al., 2019).

Based on the above academic literature insights, this study argued that the PE construct is crucial and has a direct positive influence on the Malaysia residents' behavioural intention to use a smartwatch. The first hypothesis, **H1,** consistent with this study's conceptual model, is that **PE has a significant and positive influence on Malaysia residents' behavioural intention to use a smartwatch.**

### 2.15.2 H2 - Effort Expectancy (EE)

The EE construct reviewed, discussed, and presented earlier during theoretical background discussion is a direct determinant that can explain an individual's behavioural intention in the UTAUT2 theory. In this section, the study focuses on linking evidence from preceding smartwatch research studies that lent support to EE construct as a determinant of personal behavioural intention to use a smartwatch.

A smart wearables meta-analysis research study by Niknejad et al. (2020) tabulated that the combination of effort expectancy and perceived ease of use construct relationship toward behavioural intention was found significant 5 times out 10 times. The EE construct shared a similar concept with perceived ease of use (Venkatesh et al., 2003). The findings indicate that the perceived ease of use construct may have an average influence on behavioural intention to use smart wearables technology. Two technology acceptance and use research studies that employed the UTAUT2 theory confirmed the relationship between the EE construct toward an individual's behavioural intention to use a smartwatch and smart wearable (Gao et al., 2015; Talukder et al., 2019). However, Kranthi and Ahmed (2018) and Yuan et al. (2015) discover that EE is not a determinant of personal behavioural intention to use a smartwatch. The EE construct found significant, 2 times out of 4 times seems in-line with Niknejad et al. (2020) tabulation.

In contrast, three technology acceptance research study that employed the TAM theory or combination with other theory to investigate Malaysia smartwatch technology acceptance also confirmed the relationship between perceived ease of use construct toward personal behavioural intention to use a smartwatch (Baba et al., 2019; Chuah, 2019; Krey et al., 2019). A recent research study investigating the Malaysia smartwatch technology acceptance based on the UTAUT2 theory also confirmed the EE construct relationship toward personal behavioural intention to use a smartwatch (Beh et al., 2019). However, Chuah et al. (2016) also discover that perceived ease of use is not a predictor of Malaysia residents' behavioural intention to use a smartwatch.

The findings from Malaysia smartwatch technology acceptance studies show that perceived ease of use and EE variable likely to influence Malaysia residents' behavioural intention to use a smartwatch. Four Malaysia smartwatch technology acceptance studies (Baba et al., 2019; Beh et al., 2019; Chuah, 2019; Krey et al., 2019) confirm the relationship versus a single study (Chuah et al., 2016). Furthermore, Beh et al. (2019) study, which applies the UTAUT2 theory, confirmed the EE construct relationship toward Malaysia residents' behavioural intention to use a smartwatch.

Based on these research insights, this study argued that the EE construct has a direct positive influence on the Malaysia residents' behavioural intention to use a smartwatch. The second hypothesis, **H2**, consistent with this study's conceptual model, is that **EE has a significant and positive influence on Malaysia residents' behavioural intention to use a smartwatch.**

### 2.15.3 H3 - Social Influence (SI)

The SI construct reviewed, discussed, and presented earlier during theoretical background discussion is a direct determinant that can explain an individual's behavioural intention in the UTAUT2 theory. In this section, the study focuses on linking evidence from preceding smartwatch research studies that lent support to the SI construct as a determinant of personal behavioural intention to use a smartwatch.

A smart wearables meta-analysis research study by Niknejad et al. (2020) tabulated that the SI construct relationship toward behavioural intention was found significant 8 times out of 10 times. Numerous smartwatch and smart wearables technology acceptance quantitative research studies that employed the UTAUT2 theory confirmed the relationship between the SI construct and behavioural intention to use a smartwatch (Gao et al., 2015; Kranthi and Ahmed, 2018; Talukder et al., 2019); only one study Yuan et al. (2015) discover that SI is not a determinant of personal behavioural intention to use a smartwatch. The majority of studies finding suggested that SI construct influence personal behavioural intention to use smart wearables technology.

A study based on TAM and the net valence framework by Chuah (2019) found that social factors are a significant predictor of Malaysia residents' smartwatch continuance intention. However, another study based on the UTAUT2 theory by Beh et al. (2019) found that the SI construct is not a predictor of Malaysia residents' behaviour to use a smartwatch technology. The findings observed from the two Malaysia smartwatch acceptance study is in-conflict. This study intends to take an opportunity to re-examine and understand the impact of the SI construct on Malaysia residents' behavioural intention to use a smartwatch.

The SI construct has shown good resiliency in predicting individuals' behavioural intention to use a smartwatch compared to the statistic compiled by Niknejad et al. (2020) and other recent smartwatch technology acceptance studies based on the UTAUT2 theory. Based on these research insights, this study argued that the SI construct is essential and has a direct positive influence on the Malaysia residents' behavioural intention to use a smartwatch. The third hypothesis, **H3**, consistent with this study's conceptual model, is that **SI has a significant and positive influence on Malaysia residents' behavioural intention to use a smartwatch.**

#### 2.15.4 H4 - Hedonic Motivation (HM)

The HM construct reviewed, discussed and presented earlier during theoretical background discussion is a direct determinant that can explain an individual's behavioural intention in the UTAUT2 theory. In this section, the study focuses on linking evidence from preceding smartwatch research studies that lent support to HM construct as a determinant of personal behavioural intention to use a smartwatch.

A qualitative study by Canhoto and Arp (2016) postulated that the hedonic factor influenced personal behavioural intention to use smart health and fitness wearable. A smart wearables meta-analysis research study by Niknejad et al. (2020) tabulated that the perceived enjoyment construct relationship toward behavioural intention found significant 7 times out 9 times. The HM construct shared a similar concept with perceived enjoyment (Venkatesh et al., 2003).

Numerous smartwatch and smart wearables technology acceptance studies that employed the TAM theory or combination confirmed the relationship between perceived enjoyment and behavioural intention to use a smartwatch (Choi and Kim, 2016; Dehgani, Kim and Dangelico, 2018; Park, 2020). Two Malaysia smartwatch technology acceptance studies that employed the TAM theory or combination with other theories also confirmed the relationship between the hedonic factor and behavioural intention to use a smartwatch technology (Chuah, 2019; Krey et al., 2019). The findings suggested that the perceived enjoyment construct strongly influences behavioural intention to use smartwatch and smart wearables technology.

A qualitative study by Becker et al. (2017) based on the UTAUT2 theory postulated that the HM construct influenced an individual's behavioural intention to use smart health and fitness wearable. Numerous smartwatch and smart wearables technology acceptance studies that employed the UTAUT2 theory confirmed the relationship between the HM construct and behavioural intention to use a smartwatch technology (Kranthi and Ahmed, 2018; Yuan et al., 2015). Beh et al. (2019) reported that the HM construct is significant in their Malaysia smartwatch technology acceptance study based on applying the UTAUT2 theory. However, Gao et al., 2015 and Talukder et al. (2019) discover that HM is not a predictor of personal behavioural intention to use a smartwatch. Overall, the smartwatch or smart fitness wearable research findings based on TAM and UTAUT2 theory suggested that HM construct influences personal behavioural intention to use a smartwatch.

Based on these research insights, this study argued that the HM construct is essential and has a direct positive influence on the Malaysia residents' behavioural intention to use a smartwatch. The fourth hypothesis, **H4**, consistent with this study's conceptual model, is that **HM has a significant and positive on influence Malaysia residents' behavioural intention to use a smartwatch.**

#### 2.15.5 H5 - Price Value (PV)

The PV construct reviewed, discussed, and presented earlier during theoretical background discussion is a direct determinant that can explain an individual's behavioural intention in the UTAUT2 theory. In this section, the study focuses on linking evidence from preceding smartwatch research studies that lent support to the PV construct as a determinant of personal behavioural intention to use a smartwatch.

Price, aesthetic appeal, standalone functionality, and brand are five key attributes that make South Korea individuals decide to buy a smartwatch (Jung et al., 2016). Park (2020) empirically confirmed the relationship between price construct and South Korea individuals' intention to adopt a smartwatch. An empirical study in Indonesia by Anggraini, Kaburuan, Wang and Jayadi (2019) confirmed the positive relationship between perceived price toward Indonesia individuals' intention to purchase a smartwatch. In contrast, Baba et al. (2019) found that perceived cost did not influence Malaysia university student behavioural intention to use a smartwatch.

Choi and Kim (2016) argued that South Korea individuals seek values instead of purely evaluating price factors alone; it is a continuous and conscious appraisal of price versus other beneficial attributes such as aesthetic appeal, functionalities, brand, reputation and durability when purchasing a smartwatch. Hsiao and Chen (2018) group price and these beneficial attributes and argued it as perceived price values. In the same study, Hsiao and Chen (2018) empirically confirmed the significant relationship between price value construct toward Taiwanese individuals' intention to purchase a smartwatch.

Numerous smartwatch and smart wearables technology acceptance studies that employed the UTAUT2 theory confirmed the positive relationship between the PV construct and behavioural intention to use a smartwatch technology (Kranthi and Ahmed, 2018; Yuan et al., 2015). However, Talukder et al. (2019) discover that the PV construct is not a predictor of personal behavioural intention to use a smartwatch. Beh et al. (2019), which study the Malaysia smartwatch technology acceptance based on UTAUT2 theory, also found that the PV construct is not a predictor of personal behavioural intention to use a smartwatch.

Since other countries demonstrate that the PV construct is significant and there only a single study in Malaysia that revealed that the PV construct did not influence Malaysia residents, this study intends to examine the PV construct again to understand the effect on Malaysia residents' behavioural intention to use a smartwatch in a consumer context. Thus, this study argued that the PV construct is essential and has a direct positive influence on predicting and explaining Malaysia individual's behavioural intention to use a smartwatch. The fifth hypothesis, **H5**, consistent with this study's conceptual model, is that **PV has a significant and positive influence on Malaysia residents' behavioural intention to use a smartwatch.**

### 2.15.6 H6 - Health Technology (HT)

The review of smart wearable device patents by Dehghani and Dangelico (2017) suggested that the smartwatch strategically positions for use within the medical and health care industry. Besides, Hsiao and Chen (2018) argued that a smartwatch worn around a human wrist enables the device to continuously in-contact with the human body is perceived as why the smartwatch extensively adopted in the fields of health care and athletic activities.

The smartwatch technology enables personal self-monitoring with the potential to support personal health activity tracking in everyday living (Reeder and David, 2016). As a quantified self-tracking motivational tool that encourages individuals to lead a healthy lifestyle, the smartwatch has attracted many practitioners' and academic researchers' interest (Aliverti, 2017). Numerous research literature mentions that a smartwatch is a quantified self-tracking device that can collect, track, monitor and deliver personal physical activity and health information (Hänsel et al., 2015; Jung et al., 2016; Lentferink et al., 2017). Numerous practitioner surveys report also indicated that the main reason for adopting a smartwatch is to manage personal health and fitness tracking (Richter, 2017; PWC, 2015; PWC, 2016).

A longitudinal study by Stiglbauer, Weber, and Batinic (2019) suggested that as the result of quantified self-tracking using health application, individuals become more aware and conscious about their health, leading these individuals to experience a sense of meaning and accomplishment. Thus, a smartwatch health technology and application could potentially attract interest from individuals concerned about their health and fitness and stay conscious about their health through quantified self-tracking of personal physical and well-being.

A qualitative research study by Adapa et al. (2018) postulates that health and fitness application is a deciding factor for individual intention to use a smartwatch. A quantitative study by Dehgani et al. (2018) hypothesised that the health technology factor is an essential predictor of personal behavioural intention to use a smartwatch.

Based on these research insights, this study argued that the HT construct is a predictor of Malaysia residents' behavioural intention to use a smartwatch. The sixth hypothesis, **H6**, consistent with this study's conceptual model, is that **HT has a significant and positive influence on Malaysia residents' behavioural intention to use a smartwatch.**

### 2.15.7 H7 - Design Benefit (DB)

Dehgani et al. (2018) and Dehgani and Kim (2019), based on the TAM theory, confirmed the relationship between the aesthetic appeal construct influence user and non-user of a smartwatch toward continuance intention and usage behaviour. Dehgani and Kim (2019) also found that the need for uniqueness toward behavioural intention is significant for non-user of a smartwatch.

Hsiao (2017), based on the IDT and a combination of other theories, also confirmed the relationship between a design aesthetic and personal intention to accept a smartwatch technology. In a later study, Hsiao and Chen (2018), based on the TRA theory, also confirmed the relationship between design aesthetic toward attitude to use a smartwatch technology. In the same study, Hsiao and Chen (2018) also confirmed the relationship between a design aesthetic with social value (social image of having a smartwatch) construct, which is similar to findings of Dehgani and Kim (2019) study, which confirm the relationship between the need for uniqueness toward intention to adopt a smartwatch. Both Hsiao and Chen (2018) and Dehghani and Kim (2019) also revealed that smartwatches size, shape, and uniqueness are determinants of smartwatch purchase intention and continuance intention.

A study by Jung et al. (2016) on the composition of 123 South Korea individuals' decision when considering a smartwatch revealed that 51.6% of participants selected design aesthetic (display size and shape), suggesting that slightly more than half determined that aesthetic design factor as vital in their decision making. 20.1% of participants a smartwatch with smartphone capabilities (not a companion device to a smartphone). A plausible explanation is that 20.1% of participants prefer a standalone smartwatch because, compared to a smartphone, a smartwatch design is a lightweight device attached to the human body; therefore, it offers convenience and accessibility that suit its design purposes (Cecchinato et al., 2015; Kalantari, 2017). Besides, Canhoto and Arp (2016) also argued that smart health and fitness wearables' portability is an essential adoption consideration. The remaining two attributes received lower emphasis from participants, with16.6% participants select price factor and 11.7% select brand factor (Jeong et al., 2016).

Smartwatch adoption studies in Malaysia context such as Chuah et al. (2016) and Krey et al. (2019), although they did not directly investigate aesthetic design, discover that Malaysia university students did acknowledge the existence of dual dimensional view when considering the use of a smartwatch; the smart technology dimension and fashion dimension. Chuah et al. (2016) revealed that Malaysia students who see a smartwatch as an innovation place significantly higher weightage to perceived usefulness instead of perceived visibility. On the other perspective, Malaysia university students who consider the smartwatch as a fashion innovation emphasise perceived visibility toward adoption consideration. While Krey et al. (2019) confirmed that symbolic value expressed from smartwatch product visibility is a significant attribute that influences Malaysia student to adopt a smartwatch product. This study argued that the confirmation of perceived visibility and the symbolic value from Malaysia smartwatch studies is because participants in both studies appreciate smartwatch aesthetic appeal and design compatibility.

Overall, this study postulated that attributes such as aesthetic appeal and design compatibility: securely attached to the human body, portability, lightweight and unobtrusive, represented by the DB construct, potentially influence personal behavioural intention to use a smartwatch. The seventh hypothesis, **H7**, consistent with this study's conceptual model, is that the **DB construct has a significant and positive influence on Malaysia residents' behavioural intention to use a smartwatch.**

## 2.16 The Proposed Study Conceptual Model and Hypotheses

The proposed conceptual smartwatch adoption model consists of five original UTAUT2 theory predictors (Performance Expectancy, Effort Expectancy, Social Influence, Hedonic Motivation, Price Value) and two smartwatch specific predictors (Health Technology and Design Benefit) predicting personal behavioural intention to use a smartwatch (refer to Figure 2-30), and the seven hypotheses listed after the proposed conceptual model. The proposed conceptual model and seven hypotheses of this chapter served as inputs and reference framework to define the next chapter's work.

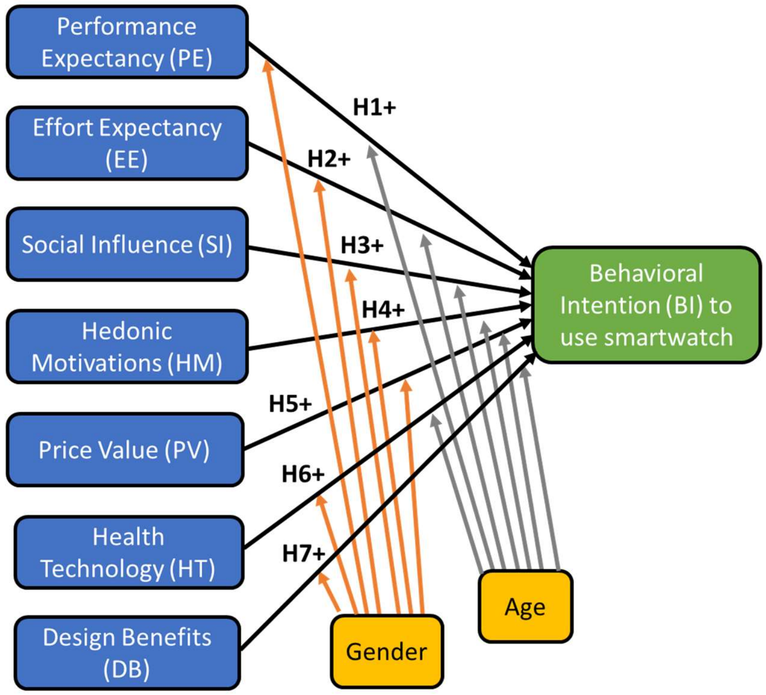



Figure 2-30 The Proposed Conceptual Model for This Study

Source: Adapted from Venkatesh et al. (2012) for this study.

The proposed hypotheses for this study are:

- **H1 – Performance Expectancy has a significant and positive influence on Malaysia residents' behavioural intention to use a smartwatch.**
- **H2 – Effort Expectancy has a significant and positive influence on Malaysia residents' behavioural intention to use a smartwatch.**
- **H3 – Social Influence has a significant and positive influence on Malaysia residents' behavioural intention to use a smartwatch.**
- **H4 – Hedonic Motivation has a significant and positive influence on Malaysia residents' behavioural intention to use a smartwatch.**
- **H5 – Price Value has a significant and positive influence on Malaysia residents' behavioural intention to use a smartwatch.**
- **H6 – Health Technology has a significant and positive influence on Malaysia residents' behavioural intention to use a smartwatch.**
- **H7 – Design Benefit has a significant and positive influence on Malaysia residents' behavioural intention to use a smartwatch.**

The study proposed a conceptual model with seven hypotheses representing the theoretical level. The conceptual model and hypotheses are a simplified and structured representation of reality that becomes the frame of reference that guide the development of a research measurement instrument to measure and collect primary empirical data in Chapter 3.

## 2.17 Chapter Summary

The chapter begins with section 2.0, which provides an overview of this chapter's organisation and overview. The first broad section, which ranges from section 2.1. to 2.7 aims at providing the audience with enough understanding of smartwatch from the historical evolution of watch until present day smartwatch technology, explained the differences between a smartwatch and a smart bracelet, provide academic definitions, smartwatch product characteristics, the potential of the smartwatch as a next-generation ubiquitous communications device and what motivate consumers to use a smartwatch. After the smartwatch overview and introduction, this study links smartwatch technology benefits and the prevalent problems. The observed smartwatch adoption challenges and Malaysia research gaps and unresolved questions from past literature provide the rationale and justifications for this study.

The second broad section range from sub-section 2.8 to 2.12 discussed the study underpinning theory; in total, ten different technology acceptance and use models reviewed, beginning from the eight theoretical models to the UTAUT and finally, the UTAUT2 theory. Based on the literature insights discussed in this chapter, each of the eight technology adoption theories and models introduced, discussed, and depending on the research area of focus may involve multi-disciplinary research domains such as technology, social, and psychology. Each of the eight technology adoption theories and models has its own merits and deficiencies. Apparently, through continuous development by the research communities, these theories and models evolved from a simple model of two or three constructs at the expense of complexity into an amalgamation of multiple theories with a higher number of constructs to improve the empirical performance.

The UTAUT theoretical model created through the unification of eight technology acceptance and technology use theories and models. The UTAUT theory was an example triggered by the research community continuing motivation to seek improvement in empirical performance when predicting technology adoption in an organisational context (Venkatesh et al., 2003). The UTAUT2 theory is a recent unified technology acceptance and technology use model created due to the motivation to extend the UTAUT theory to address consumer context (Venkatesh et al., 2012). The UTAUT2 model is comprehensive, in contrast with its underpinning's theories, empirically superior in predictive and explanatory power; therefore, expected to explain a higher total variance. Many researchers found that the UTAUT/UTAUT2 theory reliable and valid. These are the basis why this study selects the UTAUT2 model as the base theory for smartwatch research conceptual model development.

The final or third broad section ranges from section 2.13 to section 2.15 discussed the development approach of this study's conceptual model and hypotheses. The conceptual model employed the UTAUT2 theory as an anchor model, justified by referencing past technology acceptance and smartwatch adoption literature. The conceptual model and its hypotheses are a simplified and structured representation of this study's real-world problem at the theoretical level to address research questions. This study's conceptual model and its hypotheses become the frame of reference to guide the subsequent chapter, where the conceptual model and its hypotheses operationalised using appropriate research methodology to induce, measure and gather reliable and valid empirical data to address the research questions of this study.

# CHAPTER 3: RESEARCH METHODOLOGY

## 3.0 Introduction

Any research project is only taken seriously if it can address the test and scrutiny of other researchers' and practitioners' test and scrutiny. This research project's credibility lies with the evidence that it has adopted an appropriate and consistent research methodology to effectively and efficiently deal with research problem solving (Creswell and Creswell, 2018). This study is an applied research seeking external validity by applying information technology adoption theory in a social science context. An appropriate research methodology framework is essential to guide this study toward achieving a consistent and structured approach toward designing and developing an effective research measurement instrument, data collection method, and data analysis method. A sound application and execution of appropriate research methods enable this study to effectively deal with this thesis's problem-solving, objectives, and research questions. This study adopted the Creswell and Creswell (2018) research methodology framework because it is robust and straightforward (refer to Diagram 3-1).

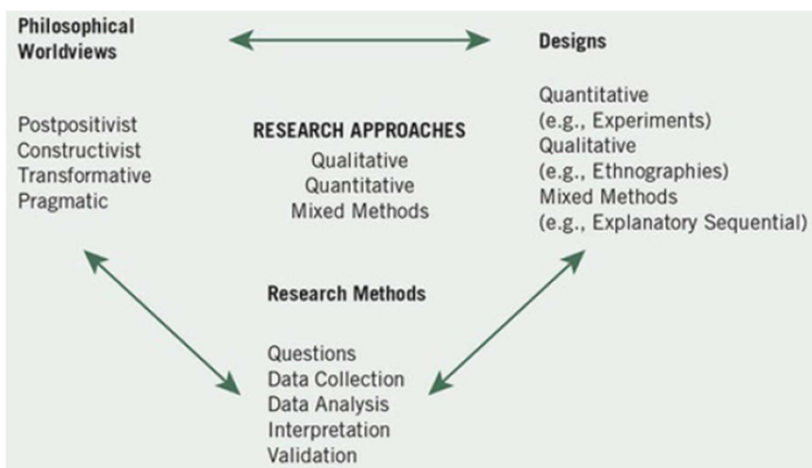



Diagram 3-1: Research Methodology Framework

Source: Adapted from Creswell and Creswell (2018)

As this chapter progresses, the Creswell and Creswell (2018) research methodology framework used to guide this study stays consistent and coherent across the research project's journey. Besides Creswell and Creswell (2018) research methodology framework, this study also draws supporting insights and arguments from various research methodology scholars to guide research methodology design and development (where appropriate) to support presentation and argument throughout this chapter.

## 3.1 Research Paradigm

The idea or the usage of the term "paradigm" believed to originate from the ancient Greece Latin word "paradeigma"; in English, the word is synonymous with the term "pattern" (Mackenzie and Knipe, 2006). Researchers also associate worldviews, beliefs and assumptions with research paradigm (Creswell and Creswell, 2018; Lincoln, Lynham, and Guba, 2011; Mackenzie and Knipe, 2006; Mertens, 2010).

Before pursuing this study, the researcher academic credential was in engineering and information technology, with working experience mainly in the wireless communications industry across multiple countries in the Asia Pacific region. The researcher's academic and professional background shape the researcher to prioritise a structured approach to problem investigation, practising objective in presenting possible solutions and prefer scientific logic or evidence. In the context of this thesis, the researcher background cultivates an inclination for a research style that focuses on applying scientific research methods as a path to knowledge discovery (Bhattacherjee, 2012). The researcher ontology, epistemology, and axiology assumptions in this study (refer to Table 3-1), therefore skewed toward **objectivism** (Saunders, Lewis, and Thornhill, 2019).

**Ontology** – the researcher's ontological assumptions are objectivism, where the external world is an actual and single reality, and the world event is systematic, granular where it is possible to observe and measure knowledge (Saunders et al., 2019). **Epistemology** - the epistemology assumptions of the researcher is objectivism, the usage of a scientific method to observed and examining the empirical data collected from the sample population to explain and generalise a phenomenon (where practical), drawing a similarity to the research practices adopted by natural science research community (Saunders et al., 2019). **Axiology** - the researcher's axiological assumption is objectivism. Social and physical phenomena assumed as universal and existed independently of the social actor views; thus, the research adopts a value-free attitude by being objective, neutral and emotionally detached from each participant's value (Saunders et al., 2019).

| Assumption type | Questions | Continua with two sets of extremes | | |
|---|---|---|---|---|
| | | Objectivism | ⇔ | Subjectivism |
| Ontology | • What is the nature of reality? | Real | ⇔ | Nominal/decided by convention |
| | • What is the world like? | External | ⇔ | Socially constructed |
| | • For example:<br>– What are organisations like?<br>– What is it like being in organisations?<br>– What is it like being a manager or being managed? | One true reality (universalism)<br>Granular (things)<br>Order | ⇔<br>⇔<br>⇔ | Multiple realities (relativism)<br>Flowing (processes)<br>Chaos |
| Epistemology | • How can we know what we know? | Adopt assumptions of the natural scientist | ⇔ | Adopt the assumptions of the arts and humanities |
| | • What is considered acceptable knowledge? | Facts<br>Numbers | ⇔<br>⇔ | Opinions<br>Written, spoken and visual accounts |
| | • What constitutes good-quality data? | Observable phenomena | ⇔ | Attributed meanings |
| | • What kinds of contribution to knowledge can be made? | Law-like generalisations | ⇔ | Individuals and contexts, specifics |
| Axiology | • What is the role of values in research? Should we try to be morally-neutral when we do research, or should we let our values shape research? | Value-free | ⇔ | Value-bound |
| | • How should we deal with the values of research participants? | Detachment | ⇔ | Integral and reflexive |

Table 3-1 Philosophical Worldview Continua Reference

Source: Saunders et al. (2019).

The objectivist paradigm consciously and subconsciously influences this study’s assumptions, conduct, and decisions on problem-solving approaches throughout this thesis in general. While this study’s paradigm bias toward objectivism, this study also acknowledges another competing paradigm known as subjectivism. Subjectivism proponent critique that objectivism research loses the meaning of human experiences, context settings and perhaps cultural influences in their research evaluation. In contrast, objectivism advocates argued that the subjectivist as an active actor in the research inquiry potentially contaminate the research evaluation with the researcher personal viewpoint and values (Dudovskiy, 2018) and weak in supporting theory formulation without empirical data (Saunders et al., 2019).

However, both paradigms are unique, differ in approaches, and each paradigm has its inherent strengths and weaknesses (Dudovskiy, 2018). Therefore, this study acknowledges that each competing paradigm offers unique merits, value and significance toward contribution and development of knowledge by realistically represents and addresses the world reality from a different angle (Morgan 2007).

## 3.2 The Philosophical Worldviews – Post-positivism

Saunders et al. (2019) clarify that a study philosophy refers to its research beliefs and assumptions when dealing with knowledge development. When dealing with the source, nature, and knowledge development, the positivism philosophy employed an objective problem-solving strategy (Saunders et al., 2019). Therefore, this study assumed a research philosophy associated with positivism philosophy.

In the context of social science, Phillips and Burbules (2000), as cited in Creswell and Creswell (2018), explained that post-positivism philosophy emerged from challenging the positivism concept of the absolute truth of knowledge. Creswell and Creswell (2018) explained that both positivist and post-positivist shared common beliefs in using a scientific method, objectivity and empirical evidence as a research approach to problem-solving. However, unlike positivist, where the claim of knowledge is absolute, the post-positivist subscribed to the idea that a researcher cannot be absolute on knowledge claims when studying human attitudes and behaviours.

Since this research study deals with the social science research discipline, examining the Malaysia residents' behavioural intentions to use a smartwatch in a consumer context, this study agreed with Creswell and Creswell (2018) and Phillips and Burbules (2000) argument. It, therefore, adopted a more pragmatic philosophical worldview which is **post-positivism**.

## 3.3 Quantitative Approach

The three common research approaches available for a research study are qualitative, quantitative, and mixed methods (Creswell and Creswell, 2018). The quantitative and qualitative approach are the two popular methods employed to solve any given research problem (Dudovsky, 2018). The mixed-methods research inquiry involved the employment of both quantitative and qualitative methods in a single study. The fundamental assumption behind advocating the mixed-method inquiry is that it can yield additional insight that is not possible using a single method (Creswell and Creswell, 2018).

Earlier in Chapter 2 of this study, the study uses **quantitative inquiry and deductive reasoning** problem-solving approach to formulate a conceptual study model to represent real-world problems**.** This study acknowledged that although the quantitative approach has the advantages of abundant secondary research literature references (Dudovskiy, 2018). The outcome of the development works in Chapter 2 is a simplified conceptual model and seven hypotheses at the theoretical plane representing this study's real-world problems. This chapter attempts to operationalise the study model and hypotheses from a theoretical plane into an empirical plane. The empirical plane enables this study to measure, test, verify and explain hypothesis relationships to achieve the study mission (Bhattacherjee, 2012) (refer to Diagram 3-2).

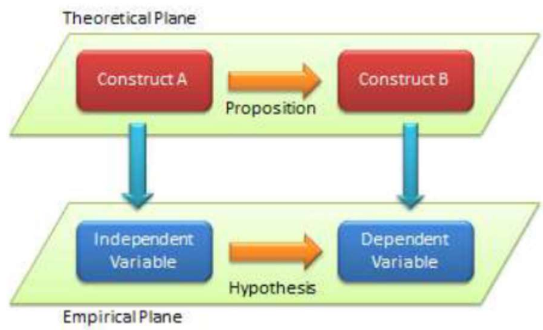



Diagram 3-2 Distinction between Theoretical and Empirical Concepts

Source: Adapted from Bhattacherjee (2012)

This chapter's objective is to operationalise design and development refers to the conceptual study model, seven hypotheses, ethical practices approved for this study, and the objectivism paradigm. The study's operationalisation process focus on defining an appropriate research design to guide research methods development. This chapter focuses on identifying and developing an effective research measurement instrument, data collection procedure, data analysis technique, and data analysis interpretation.

## 3.4 Research Design

### 3.4.1 Cross-sectional Nonexperimental Design

This study selects a research design consistent with study research approaches, circumstances and objectives (Creswell and Creswell, 2018). Since the study approach is quantitative, the research design options available for selection are experimental designs, nonexperimental designs and longitudinal designs (refer to Table 3-2).

| Quantitative | Qualitative | Mixed Methods |
| --- | --- | --- |
| • Experimental designs | • Narrative research | • Convergent |
| • Nonexperimental designs, such as surveys | • Phenomenology | • Explanatory sequential |
| • Longitudinal designs | • Grounded theory | • Exploratory sequential |
| | • Ethnographies | • Complex designs with embedded core designs |
| | • Case study | |

Table 3-2 Research Design Choices

Source: Creswell and Creswell (2018)

This study is a self-funded academic pursuit and faced timeline, budget and resources pressure; a cross-sectional design is preferred instead of a longitudinal design. This study's objectively collect and measure participant responses as it naturally came in during the primary data collection to empirically test hypotheses without manipulating any variables or control any group; therefore, this study research design is consistent with a **nonexperimental research design** (Creswell and Creswell, 2018).

3.4.2 Cross-sectional Survey Design

Creswell and Creswell (2018) suggested that cross-sectional nonexperimental design is generally associated with survey strategy employment. A cross-sectional survey strategy suited this study; an applied research study that seeks external validity instead of internal validity (Bhattacherjee, 2012; Dudovsky, 2018). Furthermore, the unit analysis is an individual residing in Malaysia, and the target sample population spread over a wide geographical area across Malaysia which present direct administration and observation challenges for this study.

Adopting a survey strategy for this study also offers merits such as flexible and highly customisable (Dudovsky, 2018), fast turnaround, low cost way to deal with a collection of a large sample of population behaviours data (Crano, Brewer and Lac, 2015; Dudovsky, 2018). However, despite the survey's merits, this study is aware that the survey's downside is a low response rate (Dudovsky, 2018). This study plan to mitigate potential risks during the study primary data collection design and execution based on these insights.

## 3.5 Research Instrument Design

### 3.5.1 Survey Measurement Instrument Design

According to Novikov and Novikov (2013), the empirical instrument available for social science inquiry is oral and written inquiries. There are two types of survey instrument: a written questionnaire survey and an interview survey. Written questionnaire as a survey instrument is often employed in survey research and found compatible with this study; hence, the study decided to adopt a written questionnaire as a research measurement instrument to measure smartwatch variables (Creswell and Creswell, 2018; Jackson, 2016; Novikov and Novikov, 2013; Sekaran and Bougie, 2016).

This study's ideal survey measurement instrument must enable the study to objectively, effectively and remotely administer and gather primary research data to answer the research questions and comply with ethics practices approved for this study (Sekaran and Bougie, 2016). This study needs a written, structured survey questionnaire that can effectively articulate, communicates and induce appropriate empirical responses from the participant (Sekaran and Bougie, 2016) because the researcher roles are neutral, objective and detached from the survey. The written, structured questionnaire also must function effectively as a remote communication instrument between the researcher and each survey participant and, at the same time, comply with the research ethics practices of this study.

The above characteristics suggested that this study need a **self-administered structured survey questionnaire** as a measurement instrument. Before approaching the self-administered structured survey questionnaire design, this study noted the inherent challenges of developing a structured questionnaire; therefore, this study intends to mitigate the design challenges during method development. For example, it is challenging to formulate written questions that are neutral and unambiguous, sample population reluctance to participate, failure to obtain enough participants' response, and incomplete information (Dudovskiy, 2018). The possibility of **respondent bias** if the participant is not familiar or has a biased opinion about the phenomenon of interest (Bhattacherjee, 2012; Dudovskiy, 2018) and cross-sectional data collection strategy and single measurement strategy potentially lead to **common method bias**, which can affect construct reliability, validity, and the covariation between constructs (Podsakoff, MacKenzie, and Podsakoff, 2012).

This study drawing on the researcher's technical and project management knowledge and experience, felt that the survey questionnaire development should start with planning and thought through alignment of survey questions design with study objectives and research questions before jumping into developing and writing the questionnaire. With such framing in mind, this study embarks on iterative planning and thought cycles to define the study self-administered structured survey questionnaire's scope; questions design and high-level definition of operative items:

- The **self-administered** questionnaire strategy must comply with ethical practices and enable this study to attain neutrality, objectivity, value-free, and the researcher detached from the survey process. The expectation is that the self-administered survey questionnaire can induce, measure and collect the participant natural responses as they come naturally during the survey without any intervention from the researcher.

- To comply with ethical practices, a **cover page** that introduces the researcher, the university, the purpose of the survey, data usage, assurance of participant confidentially and participation is voluntary. The researcher should explicitly request **consent** from the participant before administering the survey. A **gratitude statement or page** to appreciate the participant for volunteering their time provided after completing the self-administered survey or when the participant declined participation or prematurely abandon the survey.

- This study intends to collect opinions or perceptions from Malaysia residents who have experience using a smartwatch or currently using a smart band or a smartphone with health technology apps (but interested in upgrading to a smartwatch in the future). This study noted the possibility of **respondent bias** if Malaysia residents not familiar with or interested in smartwatch technology (Bhattacherjee, 2012; Dudovskiy, 2018). Therefore, to prevent participants from wasting their time and effort and minimise bias in this survey, a filtering question required to identify inexperienced or disinterested participants. A gratitude page to thank nonexperience and disinterested participant for showing interest and volunteering time required. Visual aid or explanation message included (where appropriate) to correctly induce participant experience or interest.

- This study's approach is to collect demographic segmentation information based on justifiable need without identifying the survey participant. There are **two** marketing demographic questions; **smartwatch brand** and **device usage pattern** for descriptive and **six** general demographic segmentation questions, which collect participant **gender, nationality, age, income, education, work industry,** for descriptive and statistical testing. Consistent with ethical practices, this study must respect participant privacy and exercise careful consideration of what demographic variables to ask and refrain from asking any sensitive question or collecting personal information unless necessary. Visual aid or explanation message added (where appropriate) to improve remote communications between the researcher and participant.

- This study's initial assumption is to establish a total of twenty-four observed latent measurement statements with three observed measurement questions assigned to measure each hypothesis (PE, EE, SI, HM, PV, HT and DB) and one endogenous (BI) constructs. Visual aid or explanation message added (where appropriate) to improve remote communications between the researcher and participant. There is also a need to manage the threat of **common method bias** during variables measurement.

The above definition provides this study's self-administered structured survey questionnaire with a high-level design scope and structure that focuses on addressing research questions, providing descriptive information, minimising bias and method bias, and complying with ethical practices and objectivism.

## 3.6 Research Instrument Development

### 3.6.1 Survey Measurement Instrument Development

This study noted that developing an effective **self-administered written survey questionnaire** is a delicate and tedious process. The self-administered structured survey questionnaire must operate as an off-line private conversation between the researcher and potential participant. The expectation is a self-administered survey questionnaire capable of remotely inducing, reliable, valid and low bias empirical responses to facilitate the measurement of participants' perceptions, experiences, motivations, and beliefs. Furthermore, the overall self-administered survey questionnaire development must be consistent with this study's conceptual model, seven hypotheses and comply with quantitative inquiry practices and ethical practices.

The self-administered survey questionnaire design presented in the earlier section undergo iterative development to create appropriate written inquiry statements pair with appropriate measurable variables or indicators. The development goal is to create a self-administered survey questionnaire that could adequately represent this study's conceptual model, hypotheses and comply with ethical and quantitative practices while effectively collecting reliable, valid and low bias responses to address the study's research questions at an operational level (Sekaran and Bougie, 2016). The study refers to Sekaran and Bougie (2016) guidelines for questionnaire development (refer to Diagram 3-3) to develop an effective and robust self-administered survey questionnaire.

This study noted that applying the principles of wording and principles of measurement involved numerous iterative cycles during an actual development scenario. The iterative cycles were necessary to improve the self-administered survey questionnaire with written statements to prevent bias, vague, threatening, complicated, pointless, and social desirability question (Stockemer, 2019). The general makeover is the last process; it deals with cosmetic, touch-up, and improvised remote communications clarity, instruction, appearance touch-up, and pruning to keep this study's total survey time within ten minutes.

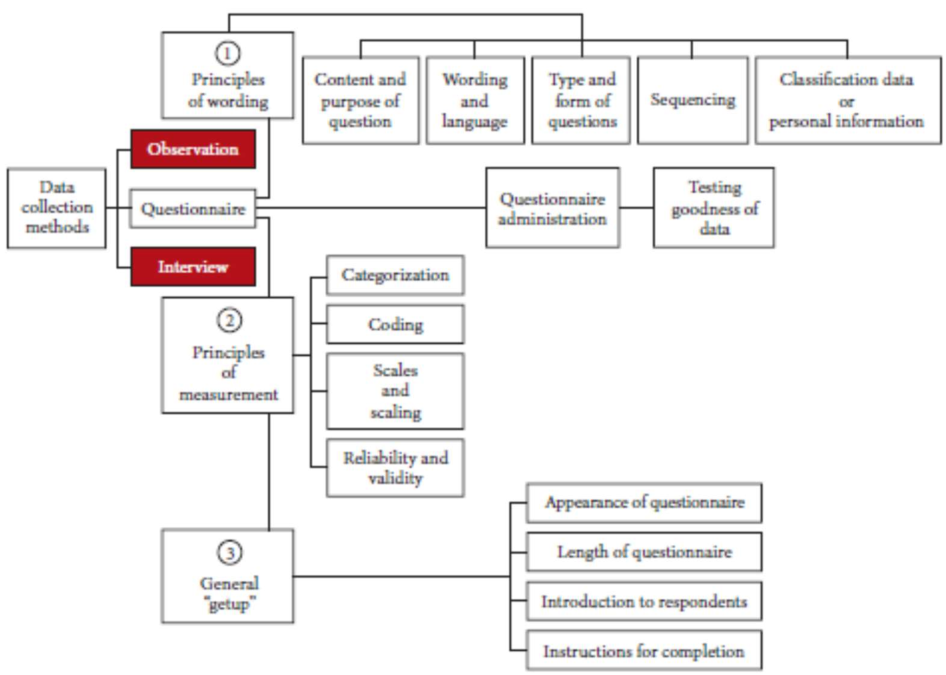



Diagram 3-3 Guidelines for Questionnaire Development

Source: Adapted from Sekaran and Bougie (2016)

#### 3.6.1.1 The Principles of Wording

The survey question development and writing in this section refer to the questionnaire design and apply "Principles of Wording" in Diagram 3-3. The development language used is English. The priority is to use simple and easy to understand standard English **wording** where possible. Each question kept as short as possible, frame objectively to reduce ambiguity, avoid double barrel and loaded question, and, where possible, reviewed and reframe to improve clarity and avoid social desirability responses (Sekaran and Bougie, 2016).

The type of question can consist of either a **closed-ended** question or a close-ended statement. The **form of question** employed depends on question need. This study employed a series of closed-ended questions that attempt to induce a single answer response from a binary choice, a single answer from a multiple-choice and a single answer from a possible choice on a measurement scale representing participant interest, intention, and opinion toward a positive tone statement. Where appropriate, a closed-ended question may have text input to address limitation where the possible answer is more comprehensive than the choices provided.

The **purpose** of each survey questionnaire required by this study deal with hypotheses, demographics and demographics marketing variables collection. Each survey question's content purposefully directed at articulating and communicating the need and context to gather accurate responses from Malaysia residents. This study recognised that **participant personal data** is a sensitive matter for many people. In this study (which adopt quantitative approaches), no sensitive personal data required, consistent with the definition in smartwatch structured questionnaire design, only two marketing demographic (**smartwatch brand and device usage pattern)** and six personal demographic data (**gender, nationality, age, income, education, work industry**) required without identifying the participant identity.

Before administering the survey, **consent** requested from the targeted participant. The survey starts after participant formally agree to grant consent, and the **question sequence** begins with an easy question to classify participant by device experience and filter out nonexperience and disinterest participant to reduce response bias. The question intends to save nonexperience and disinterest participant personal time in answering the questionnaire and the researcher personal time dealing with managing potentially bias responses. Subsequently, two demographic marketing questions (smartwatch brand and device usage pattern) are ice-breaking warm-up and easy for the participant to respond before administering twenty-four opinions measurement questions hypothesis by hypothesis in sequence and orderly manner that demand more attention and energy from the participant. In the end, six demographic questions (**gender, nationality, age, income, education, work industry**). The iterative process applies the principles of wording resulted in the realisation of a preliminary structured questionnaire presented in Table 3-3 below.

| Order | Question Content | Question Purpose | Type | Form | Remark |
|---|---|---|---|---|---|
| 0 | Please confirm your participation in this online survey. | Recording the participant consent variable | Close-ended | Binary response | Addressing requirement in the ethic proposal |
| 1 | Please select a statement that matches your experience. | Collect participant experience variables and filter out nonexperience and disinterest participant. | Close-ended | Multi-choices response | Addressing participant response bias. |
| 2 | What is the current brand of your smartwatch? | Collect the participant smartwatch brand | Close-ended | Multi-choices response | Descriptive. Ice-breaking question. |
| 3 | Which statement best described the usage pattern of your device? | Measure and collect usage pattern according to device experience | Close-ended | Multi-choices response | Descriptive. Ice-breaking question. |
| 4 | I find that smartwatch is useful in my daily | Measure and collect a response to | Close-ended | Rank order Agreement / disagreement | Addressing RQ1 |

| | | | | | |
|---|---|---|---|---|---|
| | life compared to an ordinary watch. | observed latent variable #1 for exogenous variable PE (Hypothesis 1). | | | |
| 5 | I find that using smartwatch can helps me to accomplish my daily goals more efficiently compared to an ordinary watch. | Measure and collect a response to observed latent variable #2 for exogenous variable PE (Hypothesis 1). | Close-ended | Rank order Agreement / disagreement | Addressing RQ1 |
| 6 | I find that using smartwatch can increase my productivity compared to an ordinary watch. | Measure and collect a response to observed latent variable #3 for exogenous variable PE (Hypothesis 1). | Close-ended | Rank order Agreement / disagreement | Addressing RQ1 |
| 7 | I find that learning how to use smartwatch is easy for me. | Measure and collect a response to observed latent variable #1 for exogenous variable EE (Hypothesis 2). | Close-ended | Rank order Agreement / disagreement | Addressing RQ2 |
| 8 | I find that the touch screen menu of a smartwatch is clear and understandable. | Measure and collect a response to observed latent variable #2 for | Close-ended | Rank order Agreement / disagreement | Addressing RQ2 |

| | | | | | |
|---|---|---|---|---|---|
| | | exogenous variable EE (Hypothesis 2). | | | |
| 9 | I find that it is easy for me to become skilful at using a smartwatch. | Measure and collect a response to observed latent variable #3 for exogenous variable EE (Hypothesis 2). | Close-ended | Rank order Agreement / disagreement | Addressing RQ2 |
| 10 | People in my social circle encourage the use of a smartwatch. | Measure and collect a response to observed latent variable #1 for exogenous variable SI (Hypothesis 3). | Close-ended | Rank order Agreement / disagreement | Addressing RQ3 |
| 11 | People whom I trust in my social circle encourage the use of smartwatch. | Measure and collect a response to observed latent variable #2 for exogenous variable SI (Hypothesis 3). | Close-ended | Rank order Agreement / disagreement | Addressing RQ3 |
| 12 | People around my social space (expert opinions, forum discussions and smartwatch advertisement) increase my | Measure and collect a response to observed latent variable #3 for exogenous | Close-ended | Rank order Agreement / disagreement | Addressing RQ3 |

| | | | | | |
|---|---|---|---|---|---|
| | awareness and consideration about using a smartwatch. | variable SI (Hypothesis 3). | | | |
| 13 | I find that interaction with a smartwatch is entertaining. | Measure and collect a response to observed latent variable #1 for exogenous variable HM (Hypothesis 4). | Close-ended | Rank order Agreement / disagreement | Addressing RQ4 |
| 14 | I find that interaction with a smartwatch can bring enjoyment. | Measure and collect a response to observed latent variable #2 for exogenous variable HM (Hypothesis 4). | Close-ended | Rank order Agreement / disagreement | Addressing RQ4 |
| 15 | I find that interaction with a smartwatch can bring satisfaction. | Measure and collect a response to observed latent variable #3 for exogenous variable HM (Hypothesis 4). | Close-ended | Rank order Agreement / disagreement | Addressing RQ4 |
| 16 | At the current price, I find that smartwatch is reasonably priced. | Measure and collect a response to observed latent variable #1 for exogenous | Close-ended | Rank order Agreement / disagreement | Addressing RQ5 |

| | | | | | |
|---|---|---|---|---|---|
| | | variable PV (Hypothesis 5). | | | |
| 17 | At the current price, I find that smartwatch offers good value relative to its cost. | Measure and collect a response to observed latent variable #2 for exogenous variable PV (Hypothesis 5). | Close-ended | Rank order Agreement / disagreement | Addressing RQ5 |
| 18 | At the current price, I find that a smartwatch price is affordable. | Measure and collect a response to observed latent variable #3 for exogenous variable PV (Hypothesis 5). | Close-ended | Rank order Agreement / disagreement | Addressing RQ5 |
| 19 | I find that using smartwatch (by tracking my heartbeat patterns, sleep patterns, blood pressure patterns, etc.) can motivate a healthy lifestyle. | Measure and collect a response to observed latent variable #1 for exogenous variable HT (Hypothesis 6). | Close-ended | Rank order Agreement / disagreement | Addressing RQ6 |
| 20 | I find that using smartwatch (by tracking my physical movement goals: distance travelled, movement step, | Measure and collect a response to observed latent variable #2 for exogenous | Close-ended | Rank order Agreement / disagreement | Addressing RQ6 |

| | | | | | |
|---|---|---|---|---|---|
| | stair climb count) can motivate a physically active lifestyle. | variable HT (Hypothesis 6). | | | |
| 21 | I find that using smartwatch (by tracking my calories and water intake) can help the achievement of a balanced diet. | Measure and collect a response to observed latent variable #3 for exogenous variable HT (Hypothesis 6). | Close-ended | Rank order Agreement / disagreement | Addressing RQ6 |
| 22 | I find that the overall look and feel of a smartwatch is visually appealing. | Measure and collect a response to observed latent variable #1 for exogenous variable HT (Hypothesis 7). | Close-ended | Rank order Agreement / disagreement | Addressing RQ7 |
| 23 | I find that smartwatch design attributes (size, weight, touch display, colour and materials) are attractive. | Measure and collect a response to observed latent variable #2 for exogenous variable HT (Hypothesis 7). | Close-ended | Rank order Agreement / disagreement | Addressing RQ7 |
| 24 | I find that smartwatch design which is securely strapped on a human wrist is light, convenient to | Measure and collect a response to observed latent variable #3 for exogenous | Close-ended | Rank order Agreement / disagreement | Addressing RQ7 |

| | | | | | |
|---|---|---|---|---|---|
| | carry, non-intrusive, easily accessible and less likely to be misplaced compared to a loosely held smartphone. | variable HT (Hypothesis 7). | | | |
| 25 | I intend to consider using a smartwatch in the future. | Measure and collect observed latent variable #1 for endogenous variable BI. | Close-ended | Rank order Agreement / disagreement | Addressing RQ1 to RQ7 |
| 26 | I would be willing to use a smartwatch if I possess one. | Measure and collect observed latent variable #2 for endogenous variable BI. | Close-ended | Rank order Agreement / disagreement | Addressing RQ1 to RQ7 |
| 27 | I find smartwatch useful; I would be willing to use smartwatch frequently in my daily life. | Measure and collect observed latent variable #3 for endogenous variable BI. | Close-ended | Rank order Agreement / disagreement | Addressing RQ1 to RQ7 |
| 28 | What is your gender? | Collect the participant gender variables. | Close-ended | Binary choice | Descriptive, generalisation and statistical inference. |
| 29 | Please choose a statement that best described your current status. | Collect the participant nationality status variables. | Close-ended | Multi-choices | Descriptive, generalisation and statistical inference. |

| | | | | | |
|---|---|---|---|---|---|
| 30 | What is your age group? | Collect the participant age group variables | Close-ended | Multi-choices | Descriptive, generalisation and statistical inference. |
| 31 | What is your highest educational level? | Recording the participant educational level variables | Close-ended | Multi-choices | Descriptive and statistical inference. |
| 32 | What is your gross monthly income? | Recording the participant monthly income group variables | Close-ended | Multi-choices | Descriptive and statistical inference. |
| 33 | Which category best describes your current employment? | Recording the participant employment group variables | Close-ended | Multi-choices | Descriptive and statistical inference. |

Table 3-3 Principles of Wording - Smartwatch Structured Questionnaire
Source: Developed for this thesis

The study noted that randomly sequenced questions could reduce the influence of systematic bias (Sekaran and Bougie, 2016). In consultation with the studies director, it is more prudent to transition survey participant with two easy broad demographic marketing questions as ice-breaking questions. A continuous sequence of twenty-four specific questions administered to measure participant opinions, interest, and behaviour toward smartwatch adoption while survey participants still fresh and engaged. Toward the end of the survey, the survey administered six personal demographic questions. The rationale of placing the demographic question at the end of the survey is that providing demographic details is natural and comfortable for participants, even if they are tired after a long survey. This study believed that this study's survey questionnaire arrangement makes the survey less confusing and easy to understand for survey participant. Besides, it is also friendly for this study because it is easy to locate questions to perform coding, transformation, and analysis.

The preliminary smartwatch structured questionnaire presented in Table 3-3 above further undergo additional development in the next section to classify and equip it with the measurement attributes necessary to become operational.

3.6.1.2 The Principles of Measurement

This study noted that, unlike scientific or technology research, social science research does not have a perfect measurement instrument for collecting personal data and measuring personal interest, opinions and perception; therefore, this study makes a logical assumption about the most appropriate data type and measurement scale. When each question assigned a specific data type and measurement scale, it can operatively behave like a pseudo-scientific measurement instrument to measure observable variables of interest (Sekaran and Bougie, 2016).

In this section, the study continues the work achieved in the principles of wording section using the principles of measurement to equip each question with the most appropriate type of measurement scale and data indicator (Sekaran and Bougie, 2016). The researcher aims to take the work achieved in Table 3-3 forward by assigning each question with the appropriate data type, choices and measurement scale that can remotely induce valid and reliable responses with minimal bias. The study continues to approach question construction with a mindset that it is a self-administered question; hence, each question content and measurement scale kept as simple as possible, unambiguous and self-explanatory. The activities in this section refer to “Principles of Measurement” shown in Diagram 3-3.

Question #4 to #27 (refer to Table 3-3) represent this study’s hypotheses to measure the participant perceptions, opinions, and intention to collect empirical data based on the relationship depicted in this study’s conceptual model. Based on the guidance in Sekaran and Bougie (2016), this study selected an **ordinal measurement scale** as a measurement tool to induce systematic rank order ordinal data for question #4 to #27. This study is aware of the debates about which type of Likert scale considered appropriate (ranging from two points up to as large as eleven points); decided to employed **five points Likert scale** for question #4 to #27 because it is the middle ground between the low and high (Sekaran and Bougie, 2016).

Due to the inability to source enough expert for face validity, this study decided to skip face validity. The alternative based on Sekaran and Bougie (2016) suggestion is **content validity** strategy by adopting or adapting questions from successful smartwatch or technology adoption studies. The study attempts to adopt or adapt as many questions as possible from past successful smartwatch or technology adoption studies and keep any self-designed question to an absolute minimum. Twenty-three questions from past smartwatch or technology adoption studies met reliability assessment in their respective studies were adapted, with only one out of a total of twenty-four hypotheses related question designed by this study (refer to Table 3-4 below).

| Order | Question Content | Content Source | Data Type | Measure Scale | Rank Order Label |
|---|---|---|---|---|---|
| 4 | I find that smartwatch is useful in my daily life compared to an ordinary watch. | Adapted from Venkatesh et al. (2012) | Ordinal | Five-point Likert Scale. | 1=Strongly Disagree 2= Disagree 3=Neutral 4=Agree 5=Strongly Agree |
| 5 | I find that using smartwatch can helps me to accomplish my daily goals more efficiently compared to an ordinary watch. | | | | |
| 6 | I find that using smartwatch can increase my productivity compared to an ordinary watch. | | | | |
| 7 | I find that learning how to use smartwatch is easy for me. | | | | |
| 8 | I find that the touch screen menu of a smartwatch is clear and understandable. | | | | |
| 9 | I find that it is easy for me to become skilful at using a smartwatch. | | | | |
| 10 | People in my social circle encourage the use of a smartwatch. | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 11 | People whom I trust in my social circle encourage the use of smartwatch. | | | | |
| 12 | People around my social space (expert opinions, forum discussions and smartwatch advertisement) increase my awareness and consideration about using a smartwatch. | This question designed by this study to measure social influence perceptions. | | | |
| 13 | I find that interaction with a smartwatch is entertaining. | Adapted from Wu et al. (2016) | | | |
| 14 | I find that interaction with a smartwatch can bring enjoyment. | | | | |
| 15 | I find that interaction with a smartwatch can bring satisfaction. | | | | |
| 16 | At the current price, I find that a smartwatch is reasonably priced. | Adapted from Hsiao and Chen (2018) | | | |
| 17 | At the current price, I find that smartwatch offers good value relative to its cost. | | | | |
| 18 | At the current price, I find that a smartwatch price is affordable. | | | | |
| 19 | I find that using smartwatch (by tracking my heartbeat patterns, sleep patterns, blood pressure patterns, | Adapted from Dehgani, Kim and | | | |

| | | | | | |
|---|---|---|---|---|---|
| | etc.) can motivate a healthy lifestyle. | Dangelico (2018) | | | |
| 20 | I find that using smartwatch (by tracking my physical movement goals: distance travelled, movement step, stair climb count) can motivate a physically active lifestyle. | | | | |
| 21 | I find that using smartwatch (by tracking my calories and water intake) can help the achievement of a balanced diet. | | | | |
| 22 | I find that the overall look and feel of a smartwatch is visually appealing. | Adapted from Hsiao and Chen (2018) | | | |
| 23 | I find that smartwatch design attributes (size, weight, touch display, colour and materials) are attractive. | | | | |
| 24 | I find that smartwatch design which is securely strapped on a human wrist is light, convenient to carry, non-intrusive, easily accessible and less likely to be misplaced compared to a loosely held smartphone. | Adapted from Chau, Lam, Cheung, Tso, Flint, Broom, Tse and Lee (2019) | | | |
| 25 | I intend to consider using a smartwatch in the future. | Adapted from Venkatesh et al. (2012) | | | |

| | | | | | |
|---|---|---|---|---|---|
| 26 | I would be willing to use a smartwatch if I possess one. | Adapted from Wu et al. (2016) | | | |
| 27 | I find smartwatch useful; I would be willing to use smartwatch frequently in my daily life. | | | | |

Table 3-4 Principles of Measurement - Hypotheses Measurement Questions
Source: Developed for this thesis

The remaining questions are consent statement #0, question #1 to #3 and #28 to #33, requiring a **nominal data** type. The nominal variable collected by this study has no order, comparative value or intrinsic value; the purpose is to collect participant marketing and personal demographic profiles for descriptive, generalisation and independent group statistical inference purposes. This study assigned either a **dichotomous scale** or a **categorical scale** for nominal data collection depending on the needs. Where applicable, the participant is given the options to a text input if their choice not found within the standard list of items. The participant text input (if any) reviewed, categorised and coded as appropriate for data analysis (Sekaran and Bougie, 2016).

This study adopted a simple numeric sequence use for nominal data **coding**; for example, category label male assigned a numeric value of 1, and the category female is assigned a numeric value of 2 to differentiate. Similarly, a simple numeric coding sequence applies to nominal data that use a category scale, such as Malaysia citizen = 1, Malaysia Permanent = 2 and Foreign Citizen = 3, where a convenient numeric sequence used to differentiate. The result of applying principles of measurement on question #0, #1 to #3 and #28 to #33 presented in Table 3-5 below. All questions presented in Table 3-5 below developed by the researcher for this study.

| Order | Question Content | Measurement Purpose | Data Type | Measure Scale | Categorical Label |
|---|---|---|---|---|---|
| 0 | Please confirm your participation in this online survey. | Compliance with Ethics Practices | Nominal | Dichotomous | Yes or No |

| | | | | | |
|---|---|---|---|---|---|
| 1 | Please select a statement that matches your experience. | Descriptive statistic | Nominal | Categorical | 1=Smartwatch<br>2=Smart band<br>3=Smartphone<br>4=No experience<br>5=Not Interested |
| 2 | What is the current brand of your smartwatch? | Descriptive statistic | Nominal | Categorical | 1=Apple,<br>2=Fitbit<br>3=Garmin,<br>4=Huawei,<br>5=LG,<br>6=Motorola,<br>7=Samsung,<br>8=Xiaomi,<br>9=Other (manual input) |
| 3 | Which statement best described the usage pattern of your device? | Descriptive statistic. | Nominal | Categorical | 1=Daily<br>2=Frequent (5 to 6 days)<br>3=Moderate (a few days a week)<br>4=Seldom (a few days a month)<br>5=Stop Use |
| 28 | What is your gender? | Descriptive, generalisation and statistical inference. | Nominal | Dichotomous | Male or Female |
| 29 | Please choose a statement that best described your current status. | Descriptive, generalisation and statistical inference. | Nominal | Categorical | 1=Malaysia Citizen<br>2=Malaysia PR<br>3=Foreign Citizen |

| | | | | | |
|---|---|---|---|---|---|
| 30 | What is your age group? | Descriptive, generalisation and statistical inference. | Nominal | Categorical | 1=Below 15 years<br>2=15 to 24 years<br>3=25 to 54 years<br>4=55 to 64 years<br>5=65 years & above |
| 31 | What is your highest educational level? | Descriptive and statistical inference | Nominal | Categorical | 1=School Cert.<br>2=Vocational Cert./Diploma<br>3=First Degree.<br>4=Postgraduate |
| 32 | What is your gross monthly income? | Descriptive and statistical inference | Nominal | Categorical | 1=No Income<br>2= < RM2K<br>3=2K to 5K<br>4=<RM5K to RM10K<br>5=< RM10K |
| 33 | Which category best describes your current employment? | The collected data consolidated according to industry for descriptive and statistical inference. | Nominal | Categorical | 1=Bank/Finance<br>2= Construction<br>3=Education<br>4= Entrepreneur<br>5=IT<br>6=Mfg.<br>7=Student<br>8=Telecom,<br>9=unemployed/retired.<br>10=Other (manual input) |

Table 3-5 Principles of Measurement - Smartwatch Nominal Questionnaire

Source: Developed for this thesis

The work of assigning ordinal and nominal measurement scale using the principles of measurement concluded. The following section deals with additional general makeover development to improve ethical practices and improve the clarity, appeal, and effectiveness of the self-administered structured survey questionnaire.

#### 3.6.1.3 The General Makeover

The discussion in this section refers to the General "get up" shown in Diagram 3-3. The general makeover section intends to incorporate ethical practices, improve the clarity, appeal, and effectiveness of the self-administered survey questionnaire as a remote research measurement instrument. As suggested by the general makeover (refer to Diagram 3-3), a cover page, insertion of pictures for clarity and additional guiding instruction were included. The inclusion of additional pictural diagrams or additional instructions where appropriate can helps make the intent of the self-administered survey questionnaire clearer beyond written statements. The general makeover employed to test the self-administered questionnaire survey operative logic, for example, providing navigation instructions or landing pages such as gratitude page at the end of the survey or when participant decline invitation and during filtering inexperience or disinterest participant.

A concise and purposeful cover page is the first page that appears in the invitation to a potential participant. The introduction page consists of a message that addresses ethical concerns, builds rapport, and persuades participants to participate in the smartwatch survey. The introduction page encapsulated with a polite beginning and ending on a courteous note, thanking for volunteering time and assures that the researcher does not collect sensitive personal information and respect personal data confidentiality (Sekaran and Bougie, 2016). It introduces the researcher, the university, the purpose of the smartwatch survey, how it used the research data, the estimated duration required for the survey, and the participant's consent.

A participant is volunteering their time; therefore, regardless of how significant or exciting the topic survey, a participant is unlikely to tolerate spending more than 10 minutes of personal time, and participant tend to avoid or withdraw from a survey that needs a duration that longer than 15 minutes (Bhattacherjee, 2012). The total time required to complete the smartwatch structured questionnaire kept as short and efficient as possible (not more than 10 minutes) by collecting what is necessary for this study. The estimated time required to complete the smartwatch survey included in the introductory page as part of socialisation information for the potential participant.

Applying the general makeover, principles of wording, and measurement principles created a preliminary version ready for a pilot test. Upon satisfying the pilot study requirement, the self-administered survey questionnaire deployed for primary data collection. (refer to Appendix A: Survey Questionnaire used for collecting primary data for this thesis).

## 3.7 Research Data

This study needs **secondary data** and **primary data** and applies both secondary data and primary data to address the research objectives and research questions. This study is dependent on applying insights derived from both secondary and primary data to achieve the mission of this study. Availability and employment of appropriate, reliable and valid data are essential to the success of this study. Both types of data are essential throughout this thesis's journey to support research definitions, justifications, problems identification, problem-solving formulation, methodology, findings, discussions and conclusion of this study. Consistent with the umbrella research methodology identified earlier, the secondary and primary data application adheres to quantitative inquiry practices and research ethics approved for this study.

### 3.7.1 Secondary Data Collection

Secondary data already exists and available from various sources such as reputable research journals, reference books, governmental and reputable industry publications, white papers, published newspapers or magazines, and online articles. This study applies guidelines recommended by Sekaran and Bougie (2016) to filter, decide and justify secondary data collected for this thesis:

- Focus on quality and accuracy of secondary references, especially the publication's credibility, author credential, purposes (for example, if it is bias-free or neutral).
- Use the latest relevant secondary data to ensure that this thesis refers to the latest available information applicable to the research objectives and questions.
- The cost of obtaining the secondary data, if the source of secondary data is not affordable, consider other equivalent sources of secondary data at an affordable cost or use another way to collect different type of data to satisfy the research objectives and questions, for example, consider using primary data collection.

The researcher refers to Sekaran and Bougie (2016) secondary data selection guidelines to filter, select and acquire relevant secondary data (throughout this thesis) to identify research gaps, definitions and formulation of research problems, justifying research questions and objectives, construct the theoretical framework, hypotheses, research methodology construction and justifying research findings, discussion and conclusions.

#### 3.7.2 Primary Data Collection Design

Unlike secondary data, where it is a readily available source of reference, primary data is a data source that is not readily available. Before the actual primary data collection execution, it is necessary to define the primary data collection design, which serves as a logical foundation and reference for data collection methods. In this study, the data collection design consists of two key considerations. The first consideration is the sample size required for this study and the second consideration is a sampling plan consisting of target population identification and the sampling design (Levy and Lemeshow, 2013).

##### 3.7.2.1 Sample Size Estimate

This section communicates the confidence level and minimum sample size required to support a research study's validity. It is unrealistic, not economical and practical to measure Malaysia's entire resident in a survey, more so for this self-funded academic research study, which faces time, budget, and human resources constraints. A more practical and viable solution is to collect sample data from Malaysia resident, where the sample data size should statistically represent the entire population (Dudovsky, 2018; Levy and Lemeshow, 2013).

The research study's reliability assumption is to achieve a confidence level of 95% with a margin of error of ±5%. This study plan to perform data analysis using confirmatory factor analysis and structural equation modelling; the general rule of thumb suggests a minimum valid sample size of 200 (Hair, Black, Babin and Anderson, 2010). However, this study plan to collect a larger valid sample size to account for unforeseen circumstances and gain unbiased research findings.

##### 3.7.2.2 Sampling Plan

The previous section communicated the study's confidence level and the minimum valid sample size requirement. This section provides the data collection sampling plan of this study, consisting of the sample population identity and the sampling approach. This study's **population** is Malaysia residents, and the **sample population** is any individual resident who resides in Malaysia, preferably aged 15 years and above. The study unit of analysis is an individual residing in Malaysia.

Due to smartwatch technology being a recent phenomenon in Malaysia, this study faced challenges deploying probability sampling because the researcher does not have an adequate number of known personal and business Malaysia resident contacts that use a smartwatch, smart band and smartphone with health apps to support the implementation of probability sampling. Furthermore, the researcher has no way to know which personal and business contact own a smartwatch, a smart band and a smartphone with a health application. Assembling a list consists of experience smartwatch, smart band and smartphone with health application user for probability sampling are tedious, time-consuming, and consider intrusive by some people. The researcher tried and found that people become apprehensive and defensive during the inquiry process; therefore, this study decided to abandon the process and seeks an alternate sampling solution. This study is aware of the generalisation benefit of using probability sampling but faced difficulties implementing probability sampling. This study is aware of the potential risk of this study being not generalisable if the sample population collected by chance is not representative of the population distribution (Dudovsky, 2018).

This study adopts **convenience sampling,** which is low cost and easy to apply to reach a broader Malaysia resident base. This study also adopted a **snowball sampling** to get a referral from any survey participant by asking each personal and business contacts to recommend other people in their personal and business network. The use of both convenience and snowball sampling helps this study reach a broader audience base and improve the chances of engaging participants with relevant experience and knowledge.

3.7.2.3 Collection Method Plan

Internet survey and online administration gaining popularity (Sue and Ritter, 2012). An online self-administered structured questionnaire is consistent with quantitative approaches where the researcher is objective and neutral. The distribution of online self-administered structured questionnaire over the internet and smartphone has become a possibility since broadband Internet and smartphone ownership has become pervasive in Malaysia. A self-administered online structured questionnaire survey offers the advantages of needing minimal resources, low cost, fast, easy administration, analysis, and distribution over a wide geographical area (Sue and Ritter, 2012). It is also an unobtrusive option where participants can respond to the online survey questionnaire at their convenience (Sekaran and Bougie, 2016).

Based on the MCMC (2019), at the end of 2019, the Malaysia population penetration for broadband internet per 100 inhabitants is 131.7%, while smartphone penetration is 135.4% of the population, respectively. Besides, 3G and 4G/LTE coverage in Malaysia expanded to 95.5% and 82.2% population coverage, respectively, which extend smartphone services' availability over a large geographical area. Both internet and smartphone, an online mode, offer an excellent medium for online survey questionnaire distribution via email and many mobile applications to reach Malaysia residents, such as Facebook, LinkedIn, WeChat and email.

Based on the above background and merits, the researcher selects an **online self-administered structured questionnaire hosted by the Google cloud platform** to implement this study's primary data collection. The Google form platform is selected because it came at no cost, supports a data download format compatible with the IBM SPSS data analysis tool, and provides seamless online data collection, governance, security, and storage execution without the researcher intervention. The employment of Google form for the online survey also enables the researcher to resolve issues associated with missing responses because Google forms an online platform that offers functionality to compel survey participants to respond to questions. Since this study does not collect sensitive personal data or ask embarrassing questions, in the researcher opinion, deploying this feature is appropriate and does not violate ethical practice. Finally, this study's primary data collection method is consistent with the quantitative characteristics of being neutral, objective, and satisfy ethical practices approved in the ethics proposal (Dudovsky, 2018).

## 3.8 Primary Data Collection

### 3.8.1 Pilot Data Collection

In this study, the pilot test employed a similar data collection method used in the primary data collection, except the pilot data collection of this study invited targeted a small sample size of 30 participants. The pilot test main focus is to verify question #4 to question #27 scale reliability based on Cronbach's α internal consistency before the self-administered survey questionnaire is certified fit for full-scale primary data collection. It also employed to gather feedback (if any) on the self-administered survey questionnaire's operative readiness ranging from operational system access issue (if any), question in term of wording, clarity, language and selection labels, the overall time required to respond to the survey and other issues faced by the pilot test participants during the pilot survey. In addition to verifying the self-administered survey questionnaire's readiness, the pilot run execution also provides trial experience to gauge the readiness and management of any potential problems encountered using the Google online cloud platform. In short, the pilot study act as a go/no go verification checkpoint; it is a pre-requisite before committing to roll-out the study primary data collection. This study's pilot test was conducted using the self-administered survey question and satisfied Cronbach α internal consistency assumption. The outcome of the pilot study presented in Chapter 4, Data Analysis and Findings.

### 3.8.2 Primary Data Collection

This study's success depends on deploying a practical primary data collection project to obtain relevant, reliable, valid, and low bias empirical data from the target population to address research objectives and research questions. However, the primary research data required by this study is not readily available and requires a coherent project to collect sample data from the target population. After the approval of this study's research proposal, an ethics proposal submitted to the university ethic board for review and approval. In consultation with the director of this study, this study will not commence the primary data collection until the study's ethics proposal is duly approved. Upon approval ethics proposal and meeting this study pilot test requirements, the primary data collection executed using the self-administered survey questionnaire of this study to gather data from Malaysia residents.

Consistent with the definitions provided during the primary data collection design, the **target population** is individual residing in Malaysia, preferably age 15 and above. The unit of observation and unit of analysis is an individual residing in Malaysia. The cross-sectional survey aims to achieve a **confidence level** of 95% with an error margin of ±5%. This study's minimum **sample size** based on structural equation modelling is 200 valid samples; however, it aims to attain larger valid samples to gain unbiased research findings.

The primary data collection method is an online **cross-sectional survey** hosted and administered by the Google form platform. Two touch points utilised for distribution of self-administered structured questionnaire survey to Malaysia residents: smartphone and email. The potential participants are Malaysia residents invited online via WhatApps, Facebook, LinkedIn, Email and WeChat using an online digital link that seamlessly points to the Google form platform. This study employed convenience and snowball, a **non-probabilistic sampling plan** to invite potential Malaysia residents to participate in the cross-sectional survey. In total, 120 initial invitations distributed using a convenience sampling approach to the researcher's personal and business contact. In the invitation, this study employed a snowball sampling approach to encourage personal and business friends to invite their networks that have a similar experience to participate.

The operation of the online self-administered structured questionnaire survey fully automated using the Google Form platform. There is no intervention required from the researcher except initiation and closing of the survey. This study customised an automated notification from Google to provide a periodic status update so that the researcher is up to date with the survey progress. Finally, when the primary data collection target achieved, the study closed the online survey; the outcome of the primary data collection presented in Chapter 4, Data Analysis and Findings.

## 3.9 Primary Data Analysis Plan

There are three types of framework available for validating structural equation modelling; (1) strictly confirmatory, (2) alternative model, and (3) model generating (Jöreskog, 1993). This study reviewed various data analysis strategy; after deliberation, this study opted for a **strictly confirmatory** strategy. A data analysis strategy based on confirmatory factorial analysis and structural equation modelling is the most appropriate to test the study's model, seven hypothesis relationships, and multiple constructs simultaneously in a single, systematic and comprehensive way to address this study's research objectives and research questions (Hair et al., 2010). The application of a strictly confirmatory approach before hypotheses β path analysis using structural equation modelling also permits a robust implementation of multivariate regression analysis for this study (Hair et al., 2010).

The application software tools select to perform data analysis for this study are the International Business Machine (IBM) Statistical Package for Social Science (SPSS) version 23, IBM SPSS Analysis of Moment Structure (AMOS) version 24 and G*Power version 3.1.9.6. Three AMOS version 24 plugins from Gaskin and Lim (2016) utilised to extend the IBM SPSS AMOS version 24 analysis and reporting capabilities. The rationale for adopting both data analysis application software is intuitive, user-friendly, provide easy to digest report format and adequate to address the data analysis requirements of this study. This study intends to employ the following steps to deal with data analysis and interpretation of findings:

- This study employed parametric and non-parametric statistical analysis using IBM SPSS version 23 software depending on the data analysis requirements and context. The IBM SPSS version 23 deal with empirical data assessment for duplicate, missing, outliers, normality, linearity, homoscedasticity, multicollinearity, Cronbach's α internal consistency and communalities. IBM SPSS version 23 also used by this study to deals with descriptive statistics, common method bias assessment, inferential statistical testing, the $X^2$ test for generalisation, and statistical inference between two groups and multiple groups.

- This study implements a two-stage structural equation modelling; the first stage is the confirmatory factor analysis. The second stage is structural equation modelling β path analysis and observation of the $R^2$ coefficient determinant. Before commencing the confirmatory factor analysis, the primary data subjected to Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett's test of sphericity assessment using IBM SPSS version 23.

- The IBM SPSS AMOS version 24 is the software application tool employed for first stage structural equation modelling. The first AMOS version 24 plugins, "Master Validity Tool", enable the generation of statistical analysis report to determine the composite reliability, average variance extracted, convergence validity, discriminant validity of this study. The second AMOS version 24 plugins, "Model Fits," is employed to assess the "goodness of fits" between the study's primary dataset and measurement models. The third AMOS version 24 plugins "Multigroup Analysis" to assess if there any moderating effect of age and gender on the IVs relationship to DV. The goodness of fits report from second AMOS version 24 plugins, "Model Fits", cross-validated using standardised residual diagnostic before second stage structural equation modelling, which is structural equation modelling β path analysis and observation of $R^2$ coefficient determinant. The study's model ability to achieve substantial power verified using G*Power version 3.1.9.6 before linking the data analysis and findings to relevant research questions.

To facilitate and systematically guide the execution of this thesis's data analysis activities, a data analysis interpretation table constructed for use by this study presented in the next section.

### 3.9.1 Data Analysis Interpretation Plan

This section provides a data analysis interpretation reference for this study (refer to Table 3-6 below). The reference information in Table 3-6 begins as a preliminary version and continues to evolve during the study and mature at the end of this research study. The information presented in Table 3-6 is the updated version after data analysis and findings.

| Statistical Assessment | Software Tool | Assessment Purpose | Interpretation Threshold | Threshold Reference |
|---|---|---|---|---|
| Cronbach's α coefficient | IBM SPSS version 23 | Measurement scale internal consistency | Cronbach's α coefficient value ≥ 0.7 | Hair, Black, Babin and Anderson (2010); Pallant (2016). |
| Mahalanobis distance ($D^2$), ($D^2/df$) | IBM SPSS version 23 | Outlier determination. | ($D^2/df$) threshold ≤ 3. | Hair, Black, Babin and Anderson (2010) |
| Kolmogorov-Smirnov (Non-parametric) | IBM SPSS version 23 | Normality assessment | $p$-value > .05 | Pallant (2016) |
| Linear Regression Analysis | IBM SPSS version 23 | Linearity assessment | Visual check on Observed Probability vs – Expected Probability plot | Pallant (2016) |
| Linear Regression Analysis | IBM SPSS version 23 | Homoscedasticity assessment | Visual check on z residual vs z predicted Scatter Plot | Pallant (2016) Gaskin (2016) |
| Multicollinearity Assessment | IBM SPSS version 23 | Collinearity Diagnostic | Tolerance > 0.1 and VIF < 10 | Hair, Black, Babin and |

| | | | | |
|---|---|---|---|---|
| | | | | Anderson (2010); Miles (2014) |
| Descriptive Analysis | IBM SPSS version 23 | Presentation of demographic and demographic marketing profile | Report according to the content of the primary data set. | Reported based on actual observation |
| χ2 Goodness of Fit (Non-parametric) | IBM SPSS version 23 | Population profile generalisation | *p*-value > .05 | Pallant (2016) |
| Mann-Whitney U test (Non-parametric) | IBM SPSS version 23 | Independent testing between two group | *p*-value (two tails) > .05 | Pallant, (2016) |
| Kruskal-Wallis test (Non-parametric) | IBM SPSS version 23 | Independent testing between multiple group | *p*-value (two tails) > .05 | Pallant, (2016) |
| Unroatated Principal Component Analysis Factor Loading | IBM SPSS version 23 | Factor loading value of each measurement item. | Factor loading ≥ 0.5 | Hair, Black, Babin and Anderson (2010) |
| Kaiser-Meyer-Olkin Sampling Adequacy | IBM SPSS version 23 | Sampling Adequacy test for Factorial Analysis | Sampling adequacy > 0.6 | Hair, Black, Babin and Anderson (2010); Pallant (2016) |
| Bartlett's Sphericity | IBM SPSS version 23 | Sphericity test for Factorial Analysis | *p*-value < .001 | Hair, Black, Babin and Anderson (2010); Pallant (2016) |
| Composite Reliability | IBM SPSS AMOS version 24, AMOS plugin "Master Validity Tool" | Measurement model reliability | Composite Reliability ≥ 0.7 | Hair, Black, Babin and Anderson (2010) |

| | | | | |
|---|---|---|---|---|
| | by Gaskin and Lim (2016) | | | |
| Convergent validity | IBM SPSS AMOS version 24, AMOS plugin “Master Validity Tool” by Gaskin and Lim (2016) | Measurement model convergent validity | Composite reliability ≥ 0.7, factor loading for each measurement items for related construct ≥ 0.5 and AVE for each measurement construct ≥ 0.5 | Hair, Black, Babin and Anderson (2010) |
| Discriminant validity | IBM SPSS AMOS version 24, AMOS plugin “Master Validity Tool” by Gaskin and Lim (2016) | Measurement model discriminant validity | The square root of AVE of construct > correlation value with other constructs. | Fornell and Larcker (1981) |
| Discriminant validity | IBM SPSS AMOS version 24, AMOS plugin “Master Validity Tool” by Gaskin and Lim (2016) | Measurement model discriminant validity | Heterotrait-Monotrait ratio of correlations (HTMT) < 0.9 | Henseler, Ringle and Sarstedt (2015) |
| Standardised residuals diagnostic | IBM SPSS AMOS version 24 | Measurement model standardised | Standardised residuals between ≤ ±2.5 ideal, | Hair, Black, Babin and Anderson (2010) |

| | | | | |
|---|---|---|---|---|
| | | residuals diagnostic | above ±2.5 and below ±4.0 problems and ≥ ±4.0 indicated major problems. | |
| $\chi2/df$ | IBM SPSS AMOS version 24, AMOS plugin "Model Fits Measures" by Gaskin and Lim (2016) | CFA GoF Approximate Fit Index | $\chi2/df < 3$ | Hu and Bentler (1999), cited by Gaskin and Lim (2016) |
| Bentler Comparative Fit Index | IBM SPSS AMOS version 24, AMOS plugin "Model Fits Measures" by Gaskin and Lim (2016) | CFA GoF Approximate Fit Index | *CFI > 0.95* | Hu and Bentler (1999), cited by Gaskin and Lim (2016) |
| Standardised Root Mean Square Residual (SRMR) | IBM SPSS AMOS version 24, AMOS plugin "Model Fits Measures" by Gaskin and Lim (2016) | CFA GoF Approximate Fit Index | *SRMR < 0.08* | Hu and Bentler (1999), cited by Gaskin and Lim (2016) |
| Steiger–Lind Root Mean Square Error of Approximation (RMSEA) | IBM SPSS AMOS version 24, AMOS plugin "Model Fits Measures" | CFA GoF Approximate Fit Index | *RMSEA < 0.06* | Hu and Bentler (1999), cited by Gaskin and Lim (2016) |

| | | | | |
|---|---|---|---|---|
| | by Gaskin and Lim (2016) | | | |
| *p of close fit (PClosed)* | IBM SPSS AMOS version 24, AMOS plugin "Model Fits Measures" by Gaskin and Lim (2016) | CFA GoF Approximate Fit Index | A model assumed close fit when RMSEA <.06 and PClose not significant at *p*-value >.05 | Hu and Bentler (1999), cited by Gaskin and Lim (2016) |
| Moderating Variables Test | IBM SPSS AMOS version 24, AMOS plugin "Multigroup Analysis" | $\chi 2$ model differences test between different groups of a moderator. | Moderating effect assumed present if *p*-value for $\chi 2$ model is < .05 | Gaskin and Lim (2016) |
| Harman's Single-Factor Test | IBM SPSS version 23 | CMB | No factor with threshold at 50% or above 50%. | Chang, v. Witteloostuijn and Eden (2010); Podsakoff, MacKenzie, Lee, and Podsakoff (2003); Podsakoff et al. (2012). |
| Correlation Matrix Assessment | IBM SPSS version 23 | CMB | Correlation value between constructs < 0.9 | Bagozzi, Yi, and Phillips (1991) |
| Full Collinearity Assessment | IBM SPSS version 23 | CMB | Variance Inflation Factor (VIF) < 3.3 | Kock (2015) |

| | | | | |
|---|---|---|---|---|
| Covariance significant verification | IBM SPSS AMOS version 24 | Covariance verification | Critical ratio ≥ 1.96, *p*-value ≤ 0.05 and critical ratio ≥ 2.56, *p*-value ≤ 0.01. | Hair, Black, Babin and Anderson (2010); Tabachnick and Fidell, (2013) |
| Hypothesis significant verification | IBM SPSS AMOS version 24 | Hypotheses verification | Critical ratio ≥ 1.96, *p*-value ≤ 0.05 and critical ratio ≥ 2.56, *p*-value ≤ 0.01. | Hair, Black, Babin and Anderson (2010) |
| Hypothesis β path analysis verification | IBM SPSS AMOS version 24 | Determine the effect power of β path | Strong β effect if coefficient value ≥ 0.5, Moderate β effect if between 0.2 to 0.5 and Weak β effect if < 0.2 | Hair, Aderson, Tatham and Black (1998). |
| Conceptual Model $R^2$ | IBM SPSS AMOS version 24 | Determine the $R^2$ coefficient determinant of the conceptual model | $R^2 \geq 0.75$ (substantial), between 0.50 up to below 0.75 (moderate), and 0.25 or below (weak). | Hair, Hult, Ringle, and Sarstedt (2014) |

Table 3-6 Quantitative Data Analysis Interpretation Reference

Source: Compiled by this study as a reference for data analysis.

## 3.10 Ethical Considerations

The study emphasises the management of research data related to privacy and confidentiality and embraces an ethical compass throughout the research journey (Cooper and Schindler, 2014). This study does not collect any sensitive personal data, and the intention is described and reflected in the self-administered survey questionnaire. However, this study agrees that ethical data collection, administration and handling, is essential and aims to avoid any misrepresentation of research findings, outcome and adhere to non-disclosure agreements (if any).

At a national level, many countries have data protection laws, including Malaysia. This study aims to adhere to Malaysia data protection law at the national level when dealing with research data collection and administration (where applicable). In case of conflicts, the data protection laws take precedence over codes of conduct. At a personal level, ethical research practice starts with the researcher upholding and exhibit personal integrity across the entire research journey, and this study aims to uphold and stay true to ethical practices approved for this study.

Consistent with this study's research approach and process, the researcher practices objectivism and neutrality throughout the research study; the online self-administered survey questionnaire (measurement instrument) identified as the primary off-line conversation between the researcher and each participant. The ethical compliances require the researcher to devise a functional written survey questionnaire that can effectively deliver this study's intention and expectation in a written form. Since this study, data collection relies solely on each written question to ethically communicate and induce accurate participants' responses. The self-administered survey questions statement content designed to collect relevant and non-sensitive data, and it follows a written style that emphasises being polite, neutral, unambiguous and unbiased.

The self-administered survey questionnaire cover letter described the purpose of the study and articulated the study's purposes and the intention of the survey. The content of the cover letter introduces the researcher and the university, the purpose of the research, treatment of data protection and confidentiality, the estimated length of the survey, gratitude statement to thank and acknowledge the participant's generosity and effort to assist the research (Cooper and Schindler, 2014). Participants informed that online survey participation is voluntary, and participants can withdraw from the online survey anytime during the online survey. Participation consent requested from the participant before administering the survey; upon participant confirmation, online survey logic will guide the participant through the entire survey questionnaire content. Finally, the research data set collected stored securely according to the duration agreed between the researcher and the university for this study. Upon expiry of the agreement, the research data set ethically deleted or destroyed.

## 3.11 Chapter Summary

This chapter refers to the conceptual model and seven hypotheses developed in Chapter 2. The chapter consistent with Chapter 2 continues the works that focus on addressing both research objectives and research questions. In this chapter, the study presented the research methodology employed to operationalise the research study to collect primary data for empirical testing of the seven hypotheses, enable observation of the study model $R^2$ explanatory power and infer if this study has an adequate sample size to achieve a substantial power.

The study research philosophical worldview is post-positivist. The research paradigm is objectivism and adopted a quantitative inquiry as a research approach to address the research questions consistent with the theory to practice approach and deductive reasoning toward problem-solving proposed in Chapter 2. The research design selected by this study is nonexperimental. The data collection strategy is a cross-sectional survey. Consistent with the research philosophical worldview, paradigm, research design and data collection strategy, this study developed a self-administered survey questionnaire to induce, measure and collect primary data from Malaysia residents. The self-administered survey questionnaire's development emphasises adhering to ethics practices approved for this study, quantitative practices, reducing responses bias, verifying reliability via a pilot study and initial content validity by adapting similar questionnaire from past successful smartwatch adoption studies.

The study aims to achieve a confidence level of 95% with a margin of error of ±5%. The population is Malaysia resident, and the target population is preferably age 15 and above. The unit of analysis is an individual who has experience using either a smartwatch, a smart band or a smartphone with health applications. The study target sample size based on structural equation modelling is 200 valid samples; however, this study aims to attain larger valid samples to gain unbiased research findings. This study employed convenience and snowball sampling due to low smartwatch diffusion in Malaysia, time constraints, and challenges this study faced in identifying adequate participants to execute probabilistic sampling.

This chapter compiled a statistical analysis and interpretation reference to guide the study data analysis and interpretation of findings works in Chapter 4. In general, this study considered the parametric, non-parametric, strictly confirmatory analysis and structural equation modelling β path analysis to completed the research objectives and answered the research questions. A pilot study's outcome suggested that this study's self-administered survey questionnaire met Cronbach's α internal consistency assumption. The primary data collection was roll-out via the internet, distributed online to potential participants via social media applications such as WhatApps, FaceBook, LinkedIn, WeChat and email after the pilot study verification. The details of the pilot and primary data collection and analysis presented in the next chapter.

# CHAPTER 4: DATA ANALYSIS AND FINDINGS

## 4.0 Introduction

The three previous chapters presented the introduction, literature review, and research methodology. This chapter mainly focuses on data analysis and findings using the pilot data and primary data collected by this study. The majority of this chapter focuses on primary data analysis and findings. The software tools used for data analysis and findings are IBM SPSS version 23, IBM SPSS AMOS version 24, three AMOS plugins, "Model Fit Measures", "Master Validity Tool" and "Multigroup Analysis" by Gaskin and Lim (2016) for AMOS version 24 and G*Power Analysis version 3.1.9.7.

## 4.1 Pilot Test and Findings

An online pilot survey conducted via the Google platform from 20th June 2020 to 22nd June 2020, the pilot study's main intention was to gather responses to the online self-administered survey questionnaire to examine its measurement scale's reliability before conducting the primary survey study. Thirty (30) participants invited from the target sample population using convenient sampling; twenty-six (26) participants responded, which is representing approximately 6.8% of the intended sample size of three hundred and eighty-four (384). Participants encouraged to provide feedback if they face any challenges while accessing the online survey or having problem understanding any survey questionnaire.

No feedback received from any participants during the pilot study stage; all participants who participated were able to complete and submit their response during the pilot survey stage successfully. The demographic profile of the twenty-six (26) respondents compiled and shown in Table 4-1.

| Profile of Pilot Study Participants | | Count |
|---|---|---|
| Gender | Female | 8 |
| | Male | 18 |
| | Total | 26 |
| Age Group | 15 to 24 years old | 1 |
| | 25 to 54 years old | 20 |
| | 55 to 64 years old | 4 |
| | 65 years old and above | 1 |
| | Total | 26 |
| Education Level | Bachelor Degree | 17 |
| | Certificate/Diploma/ Advance Diploma | 2 |
| | Postgraduate Degree | 7 |
| | Total | 26 |
| Monthly Gross Income | Above RM10K | 14 |
| | Above RM5K - RM10K | 6 |
| | RM2K to RM5K | 4 |
| | No income | 2 |
| | Total | 26 |
| Employment Industry | Advertising | 1 |
| | Audit & Accounting | 1 |
| | Civil/Construction | 4 |
| | Education/Consulting | 1 |
| | Entrepreneur/ self-employed | 1 |
| | HR | 1 |
| | Information Technology | 7 |
| | Manufacturing | 4 |
| | Student | 1 |
| | Telecommunications/Broadcasting | 4 |
| | Unemployed / Retired | 1 |
| | Total | 26 |

Table 4-1 Demographic Profile of Pilot Study Participants

Source: Developed for this thesis

The pilot study ordinal questions examined for its reliability (internal consistency) based on Cronbach's α coefficient (Pallant, 2016), and the Cronbach's α coefficient values ranged from 0.729 to 0.938 is above the minimum threshold of 0.70 (refer to Table 4-2). All pilot study measured item satisfied Cronbach's α coefficient value is above 0.70, demonstrating sufficient internal consistency (Hair, Black, Babin and Anderson, 2010). The outcome implies that the survey measurement instrument is suitable for primary data collection deployment.

| Construct | Number of Items | Composite Cronbach's Alpha (α) |
| --- | --- | --- |
| PE, EE, SI, HM, PV, HT, DB, BI | 24 | 0.878 |
| Performance Expectancy (PE01, PE02, PE03) | 3 | 0.796 |
| Effort Expectancy (EE01, EE02, EE03) | 3 | 0.729 |
| Social Influence (SI01, SI02, SI03) | 3 | 0.732 |
| Hedonic Motivation (HM01, HM02, HM03) | 3 | 0.938 |
| Price Value (PV01, PV02, PV03) | 3 | 0.888 |
| Health Technology (HT01, HT02, HT03) | 3 | 0.729 |
| Design Benefit (DB01, DB02, DB03) | 3 | 0.761 |
| Behavioural Intention (BI01, BI02, BI03) | 3 | 0.853 |

Table 4-2 Pilot Test Internal Consistency – Cronbach's α Coefficient

Source: Developed for this thesis

## 4.2 Primary Data Collection

This study's primary data collection started on 23rd June 2020; the self-administered online survey electronic link distributed to one hundred and twenty (120) participants via What apps, LinkedIn, Facebook, which is popular and widely used social media applications for smartphones. Each participant is shown an introductory page with the researcher identity, the university identity, the study's purpose, and the estimated survey's duration of approximately 10 minutes. The introductory page also emphasised that participation in the survey is voluntary, and consent requested from each participant before the self-administered online questionnaire.

Although the researcher is aware of probability sampling merits, the researcher did not know adequate peoples in Malaysia who use smartwatch, smart band and smartphone with health apps to build a comprehensive list to perform probabilistic sampling. Therefore, under such circumstances, opted to employ non-probabilistic sampling to extend the online survey's distribution boundary toward a wider geographical area and reach more participants who have the intention to use a smartwatch technology or participants who have already use a smartwatch technology. The study employed convenience sampling and, through snowball sampling, requested assistance from each participant to solicit participation from personal networks.

After no further activity detected on the Google online platform, the study decided to close the primary data collection on 31st July 2020. The survey data downloaded from Google online platform for analysis using the International Business Machine (IBM) Statistical Packages for Social Science (SPSS) Version 23. A total of 446 responses registered by the self-administered online survey (refer to Table 4-3). Five (5) participants declined to participate, ten (10) indicate no interest in a smartwatch, and thirty-eight (38) suggested that they have no experience using either a smartwatch, smart band or smartphone apps. These participants (highlighted in yellow, refer to Table 4-3) were filtered by decision logic during the smartwatch online survey to prevent wasting the respondent time and avoid response bias. Three hundred ninety-three (393) registered their responses in the self-administered online survey; 131 smartwatch users, 96 smart band users and 166 smartphone users with health apps (highlighted in green, refer to Table 4-3).

| | | Participant |
|---|---|---|
| Classification by survey participant selection | Declined | 5 |
| | I am not interested in a smartwatch. | 10 |
| | I have no experience in using a smartwatch, smart band and physical activity tracking on a smartphone. | 38 |
| | I have experience using a smartwatch | 131 |
| | I have experience using a smart-band | 96 |
| | I have experience using smartphone apps for physical activity tracking but intent to use a smartwatch in the future | 166 |
| | Total | 446 |

Table 4-3 Main Survey Responses

Source: Developed for this thesis

## 4.3 Preliminary Data Screening

Most researchers tend to overlook the importance of verifying assumptions for proper multivariate data analysis (Schreiber, Nora, Stage, Barlow, and King, 2006). Thus, the study begins by assessing the primary dataset quality against missing values, unengaged responses, duplication, and outliers. Subsequently, the primary dataset verified for conformity to multivariate regression analysis assumptions such as normality, linearity, homoscedasticity and multicollinearity (Hair et al., 2010). This study's unengaged responses follow Gaskin (2016) recommendation that a standard deviation lower than 0.50 in a single case across all Likert scale questions is likely a candidate of unengaged responses where a respondent of the survey is likely to respond without reading the survey question.

### 4.3.1 Screening for Missing Values, Unengaged Responses and Duplicate

The primary dataset consisting of three hundred ninety-three (393) cases, examined for missing data, unengaged responses and duplicate using IBM SPSS version 23. No missing values, unengaged responses and missing data found; however, twenty-two (22) cases flagged as duplicate by IBM SPSS (refer to Table 4-4).

| | | Frequency |
|---|---|---|
| Valid | Duplicate Case | 22 |
| | Valid Case | 371 |
| | Total | 393 |
| Participant ID (Duplicate) | | 32, 58, 112, 173, 202, 203, 219, 242, 262, 265, 289, 295, 303, 310, 312, 316, 317, 319, 337, 342, 378, 382 |

Table 4-4 Duplicate Data by Participant ID

Source: Developed for this thesis

After manual review of duplicate cases, the decision is to remove the identical responses from the dataset. The balance of three hundred seventy-one (371) sample data brought forward to the next screening process, the outliers assessment.

### 4.3.2 Outlier Assessment - Mahalanobis Distance Ratio ($D^2/df$)

This study acknowledged that multivariate regression analysis is susceptible to outliers' influence; therefore, it is vital to examine the primary dataset for any outliers before performing multivariate regression analysis (Gaskin, 2016; Hair et al., 2010). When dealing with outliers, the remedy available is recoding the outlier cases into a less extreme value or removing the outlier data (Pallant, 2016). However, the recommended approach or remedy for multivariate regression analysis is to remove outlier data (Gaskin, 2016; Hair et al., 2010).

This study employed Mahalanobis distance ($D^2$) measured from the primary dataset divided by the number of predictive constructs involved in the model ($df$) to compute ($D^2/df$), which is mention as approximately equal to a distributed t-value, therefore has statistical properties for significance testing (Hair et al., 2010). The recommended threshold value for classifying a case as potential outliers are $D^2/df$ value above 2.5 for small, $D^2/df$ value above 3 for medium and $D^2/df$ value above 4 for large sample size (Hair et al., 2010). This study's sample size assumed as medium size; therefore, it adopted a $D^2/df$ value above 3 as outliers. Based on Mahalanobis distance and $D^2/df$ calculation, five (5) cases found having $D^2/df$ above 3 (refer to Table 4-5), therefore classified as outliers and removed from the primary dataset.

| Participant ID | Mahalanobis Distance | D2/df |
|---|---|---|
| 387 | 98.03294 | 4.08 |
| 162 | 81.25889 | 3.39 |
| 191 | 80.79880 | 3.37 |
| 231 | 80.10738 | 3.34 |
| 167 | 75.14400 | 3.13 |
| 250 | 69.48865 | 2.90 |

Table 4-5 Potential Outliers Based on D2/df

Source: Developed for this thesis

After removing five (5) outlier cases, this study's valid sample data is three hundred sixty-six (366) cases. The next section deals with the continuing examination of the primary dataset against multivariate regression analysis assumptions.

## 4.4 Preliminary Screening for Multivariate Regression Compliances

### 4.4.1 Normality Assessment

It is essential to check if this study's valid sample data of 366 cases fall within the envelope of a normality assumption before multivariate regression analysis. Skewness and kurtosis statistic for distribution enables a researcher to diagnose if the dataset profile statistically falls within the envelope of a normal distribution assumption (Hair et al., 2010). However, research scholars recommend several different skewness and kurtosis threshold limits. For example, skewness lower than ±3 and kurtosis lower than ±10 is acceptable (Kline, 2016), while skewness lower than ±2.58 and lower than ±1.96 is acceptable (Hair et al., 2010). The differing threshold recommendation adds a dilemma to this study on which standard to follow.

In this study, the self-administered online survey only consist of nominal (no specific order) and ordinal data using a Likert scale. Unlike interval or ratio data, nominal is controlled or restricted within choices provided, and ordinal data responses measure the order of preference within a predetermined scale. There is no real mean or actual standard deviation associated with nominal or ordinal data; these data are often skewed or multi-modal and does not comply with normal distribution assumption (Ghosh, Burns, Prager, Zhang, Hui., 2018). Based on this understanding, the study employed Kolmogorov-Smirnov (a non-parametric test) to conduct a normality assessment (Pallant, 2016). The Kolmogorov-Smirnov normality assessment indicated that this study's ordinal data does not comply with the normality assumption (refer to Table 4-6).

However, according to Byrne (2016) and Hair et al. (2010), multivariate regression analysis, which employed maximum likelihood estimation, is robust against normality assumption violations. The effect of non-compliance to normality assumption on multivariate regression analysis diminishes as the study sample size grow significantly above 200 samples (Hair et al., 2010). This study collected 366 valid sample cases and employed the maximum likelihood estimation algorithm using IBM SPSS AMOS version 24; the non-compliance to normality assumption, therefore, assumed to have a low impact.

**Hypothesis Test Summary**

| | Null Hypothesis | Test | Sig. | Decision |
|---|---|---|---|---|
| 1 | The distribution of PE01 is normal with mean 4.1 and standard deviation 0.885. | One-Sample Kolmogorov-Smirnov Test | .000[1] | Reject the null hypothesis. |
| 2 | The distribution of PE02 is normal with mean 3.9 and standard deviation 0.914. | One-Sample Kolmogorov-Smirnov Test | .000[1] | Reject the null hypothesis. |
| 3 | The distribution of PE03 is normal with mean 3.7 and standard deviation 0.969. | One-Sample Kolmogorov-Smirnov Test | .000[1] | Reject the null hypothesis. |
| 4 | The distribution of EE01 is normal with mean 4.3 and standard deviation 0.746. | One-Sample Kolmogorov-Smirnov Test | .000[1] | Reject the null hypothesis. |
| 5 | The distribution of EE02 is normal with mean 4.1 and standard deviation 0.837. | One-Sample Kolmogorov-Smirnov Test | .000[1] | Reject the null hypothesis. |
| 6 | The distribution of EE03 is normal with mean 4.1 and standard deviation 0.789. | One-Sample Kolmogorov-Smirnov Test | .000[1] | Reject the null hypothesis. |
| 7 | The distribution of SI01 is normal with mean 3.4 and standard deviation 1.024. | One-Sample Kolmogorov-Smirnov Test | .000[1] | Reject the null hypothesis. |
| 8 | The distribution of SI02 is normal with mean 3.4 and standard deviation 1.029. | One-Sample Kolmogorov-Smirnov Test | .000[1] | Reject the null hypothesis. |
| 9 | The distribution of SI03 is normal with mean 3.6 and standard deviation 1.006. | One-Sample Kolmogorov-Smirnov Test | .000[1] | Reject the null hypothesis. |
| 10 | The distribution of HM01 is normal with mean 3.6 and standard deviation 0.896. | One-Sample Kolmogorov-Smirnov Test | .000[1] | Reject the null hypothesis. |
| 11 | The distribution of HM02 is normal with mean 3.5 and standard deviation 0.960. | One-Sample Kolmogorov-Smirnov Test | .000[1] | Reject the null hypothesis. |
| 12 | The distribution of HM03 is normal with mean 3.7 and standard deviation 0.911. | One-Sample Kolmogorov-Smirnov Test | .000[1] | Reject the null hypothesis. |
| 13 | The distribution of PV01 is normal with mean 3.3 and standard deviation 1.022. | One-Sample Kolmogorov-Smirnov Test | .000[1] | Reject the null hypothesis. |

Asymptotic significances are displayed. The significance level is .05.

[1]Lilliefors Corrected

**Hypothesis Test Summary**

| | Null Hypothesis | Test | Sig. | Decision |
|---|---|---|---|---|
| 14 | The distribution of PV02 is normal with mean 3.4 and standard deviation 0.942. | One-Sample Kolmogorov-Smirnov Test | .000[1] | Reject the null hypothesis. |
| 15 | The distribution of PV03 is normal with mean 3.3 and standard deviation 0.995. | One-Sample Kolmogorov-Smirnov Test | .000[1] | Reject the null hypothesis. |
| 16 | The distribution of HT01 is normal with mean 4.4 and standard deviation 0.755. | One-Sample Kolmogorov-Smirnov Test | .000[1] | Reject the null hypothesis. |
| 17 | The distribution of HT02 is normal with mean 4.3 and standard deviation 0.767. | One-Sample Kolmogorov-Smirnov Test | .000[1] | Reject the null hypothesis. |
| 18 | The distribution of HT03 is normal with mean 3.9 and standard deviation 0.946. | One-Sample Kolmogorov-Smirnov Test | .000[1] | Reject the null hypothesis. |
| 19 | The distribution of DB01 is normal with mean 3.9 and standard deviation 0.810. | One-Sample Kolmogorov-Smirnov Test | .000[1] | Reject the null hypothesis. |
| 20 | The distribution of DB02 is normal with mean 4.0 and standard deviation 0.847. | One-Sample Kolmogorov-Smirnov Test | .000[1] | Reject the null hypothesis. |
| 21 | The distribution of DB03 is normal with mean 4.2 and standard deviation 0.768. | One-Sample Kolmogorov-Smirnov Test | .000[1] | Reject the null hypothesis. |
| 22 | The distribution of BI01 is normal with mean 4.3 and standard deviation 0.864. | One-Sample Kolmogorov-Smirnov Test | .000[1] | Reject the null hypothesis. |
| 23 | The distribution of BI02 is normal with mean 4.4 and standard deviation 0.808. | One-Sample Kolmogorov-Smirnov Test | .000[1] | Reject the null hypothesis. |
| 24 | The distribution of BI03 is normal with mean 4.4 and standard deviation 0.835. | One-Sample Kolmogorov-Smirnov Test | .000[1] | Reject the null hypothesis. |

Asymptotic significances are displayed. The significance level is .05.

[1]Lilliefors Corrected

Table 4-6 Ordinal Data – Normality Assessment

Source: Developed for this thesis

### 4.4.2 Linearity Assessment

The primary dataset conformity to linearity assumption plotted using IBM SPSS version 23 linear regression analysis. The probability vs probability (P-P) plot (refer to Chart 4-1), based on visual observation, the primary dataset observed cumulative probability is approximately tracking the diagonal normality line (expected cumulative probability); therefore, assumed meeting linearity assumption (Pallant, 2016).

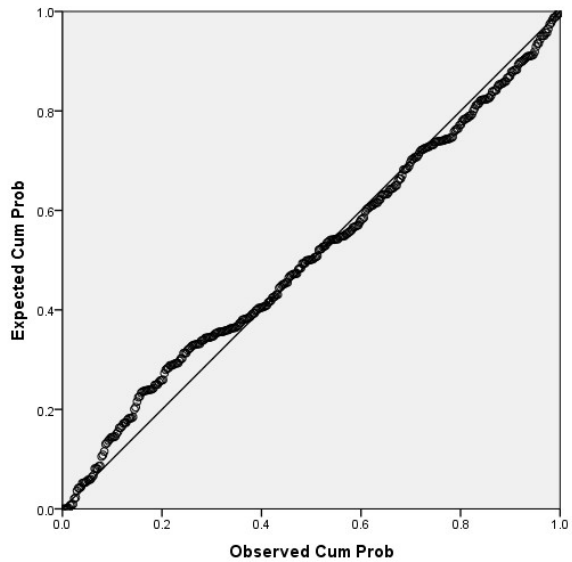



Chart 4-1 z residual Normal P-P Plot

Source: Developed for this thesis

### 4.4.3 Homoscedasticity Assessment

The primary dataset homoscedasticity plotted using IBM SPSS version 23. The z-residual (Y) vs z-predicted (X) scatter plot (refer to Chart 4-2) produced a random shotgun scatter pattern, and the z-residual (Y) value distributed close to zero value which indicates that a large majority of the primary data satisfy homoscedasticity assumption (Gaskin, 2016; Pallant, 2016).

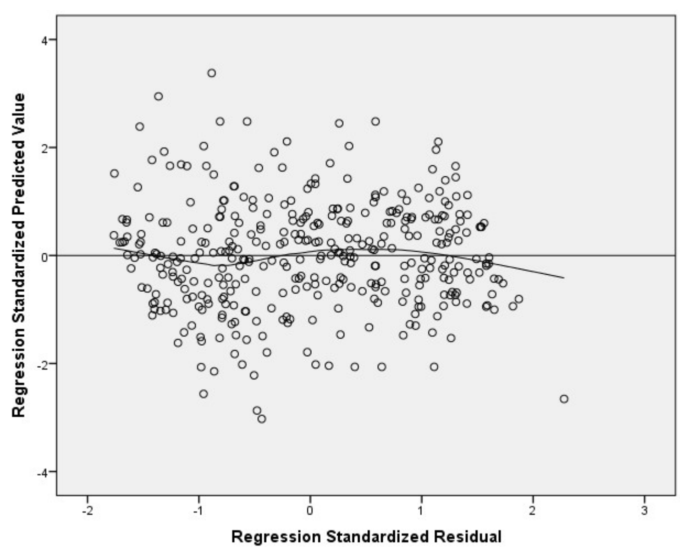



Chart 4-2 z residual vs z predicted Scatter Plot
Source: Developed for this thesis

## 4.5 Preliminary Common Method Bias Assessment

### 4.5.1 Multicollinearity Assessment

The primary dataset subjected to multicollinearity assessment before conducting any multivariate regression analysis. The presence of multicollinearity could lead to flawed regression analysis (Gaskin, 2016; Hair et al., 2010; Pallant, 2016). Multicollinearity problems are present when the Tolerance values of a construct in the model is below 0.10, or the VIF values of a construct in the model is above 10 (Hair et al., 2010; Miles, 2014). This primary dataset examined for the presence of multicollinearity problems. The collinearity diagnostics report generated using IBM SPSS version 23 showed that all Tolerance value above the threshold value of 0.10, and the VIF value is below the threshold of 10 (refer to Table 4-7). The collinearity diagnostic statistical diagnostic indicated that the primary dataset satisfied multicollinearity assumptions and implied that this study's survey measurement instrument is effective. This study will perform a comprehensive common method bias assessment in a later section of this chapter.

| Model | Collinearity Statistics | |
|---|---|---|
| | Tolerance | VIF |
| PE | .551 | 1.814 |
| EE | .657 | 1.521 |
| SI | .781 | 1.281 |
| HM | .573 | 1.746 |
| PV | .796 | 1.257 |
| HT | .612 | 1.634 |
| DB | .566 | 1.767 |

Table 4-7 Multicollinearity Diagnostic Results

Source: Developed for this thesis

## 4.6 Preliminary Reliability and Validity Assessment

### 4.6.1 Cronbach's α Internal Consistency

This study's primary dataset exhibited adequate reliability if its internal consistency among related measurement items shows a high correlation. Cronbach's α coefficient is widely employed to assess the internal consistency among measurement items where on a scale of 0 to 1, a higher score suggests better reliability. (Hair et al., 2010; Pallant, 2016). An acceptable internal consistency threshold value for Cronbach's α coefficients is 0.70 and above (Hair et al., 2010).

This study's primary dataset satisfied the reliability assumption; the Cronbach's α coefficients value is 0.929 for twenty-four (24) measurement items, and Cronbach's α coefficients value for each construct that measures different concept ranged between 0.818 (lowest) to 0.925 (highest) (refer to Table 4-8). The preliminary outcome implies that this study's survey measurement instrument is reliable. The primary dataset subjected to another type of reliability assessment known as composite reliability in the confirmatory factor analysis section of this chapter,

| Construct | Number of Items | Composite Cronbach's Alpha (α) |
|---|---|---|
| PE, EE, SI, HM, | 24 | 0.929 |
| PV, HT, DB, BI | | |
| Performance Expectancy | 3 | 0.865 |
| (PE01, PE02, PE03) | | |
| Effort Expectancy | 3 | 0.838 |
| (EE01, EE02, EE03) | | |
| Social Influence | 3 | 0.862 |
| (SI01, SI02, SI03) | | |
| Hedonic Motivation | 3 | 0.921 |
| (HM01, HM02, HM03) | | |
| Price Value | 3 | 0.919 |
| (PV01, PV02, PV03) | | |
| Health Technology | 3 | 0.818 |
| (HT01, HT02, HT03) | | |
| Design Benefit | 3 | 0.871 |
| (DB01, DB02, DB03) | | |
| Behavioural Intention | 3 | 0.925 |
| (BI01, BI02, BI03) | | |

Table 4-8 Conceptual Research Model Cronbach's α Coefficient

Source: Developed for this thesis.

### 4.6.2 Validity (Measurement Loading)

This study's primary dataset exhibited adequate validity if the factor loading value for each measurement item that measures the same concept within a construct is equal to or above 0.50 (Hair et al., 2010). The primary dataset unrotated factors cross-loading generated using IBM SPSS version 23 Principal Components Analysis (PCA). This study's primary dataset satisfied the validity assumption since all unrotated PCA factor loading value above the threshold value of 0.50 (refer to Table 4-9). The preliminary outcome implies that this study's survey measurement instrument is valid. This study will perform a more comprehensive validity assessment based on convergent validity and discriminant validity during confirmatory factor analysis at a later section in this chapter.

| Measurement Item | Loading | Measurement Item | Loading |
|---|---|---|---|
| PE01 | .740 | PV01 | .896 |
| PE02 | .732 | PV02 | .819 |
| PE03 | .736 | PV03 | .878 |
| EE01 | .754 | HT01 | .828 |
| EE02 | .735 | HT02 | .845 |
| EE03 | .785 | HT03 | .657 |
| SI01 | .872 | DB01 | .795 |
| SI02 | .859 | DB02 | .804 |
| SI03 | .627 | DB03 | .648 |
| HM01 | .806 | BI01 | .771 |
| HM02 | .882 | BI02 | .767 |
| HM03 | .819 | BI03 | .830 |

Table 4-9 Unrotated PCA Factor Loading

Source: Developed for this thesis

## 4.7 Descriptive Analysis of Survey Questionnaire

### 4.7.1 Survey Question #1

The purpose of survey question #1 was to identify participants by their device experience profile (smartwatch, smart band and smartphone with health apps) and filtered out nonexperience and disinterested survey participants. The purpose of filtering out the nonexperience and the disinterested participant is to prevent response bias. The finding after data screening operation consists of 32% smartwatch users, 25.1% smart band users and 42.9% smartphone users with health apps. The primary research dataset collected from online surveys consists of representation from smart wearable technology: smartwatch and smart band users at 57.1% and user of non-wearable smart technology (smartphone with health apps users) at 42.9% (refer to Table 4-10).

| | Frequency | Percentage |
|---|---|---|
| Smartwatch | 117 | 32.0% |
| Smart Band | 92 | 25.1% |
| Smartphone Apps | 157 | 42.9% |
| Total | 366 | 100% |

Table 4-10 Survey Responses to Question #1

Source: Developed for this thesis

4.7.2 Survey Question #2 - Smartwatch Brand

The purpose of question #2 was to collect a smartwatch user device brand for descriptive purposes. The participant who uses a smartwatch asked the following question – “What is the brand of your smartwatch?” and given predetermined standard choices and a manual option to enter the smartwatch brand if not available in the standard list. Approximately 88.9% of the smartwatch survey respondent indicates brand ownership of Apple, Garmin, Fitbit, Huawei, Samsung and Xiaomi (refer to Table 4-11). Thirteen participants that account for 11.1% of smartwatch respondents entered their smartwatch brand manually, consisting of low occurrence combinations of smartwatch brands such as Fossil, Kakafit, Amazfit, and Coros Tag Heuer, Asus Zenwatch, and Pebble. Participant also entered other types of remark such as cannot remember and kid-type smartwatch brand. All other remark was combined and classified into a single category known as other brands.

| | Frequency | Percentage |
|---|---|---|
| Apple | 26 | 22.2% |
| Fitbit | 20 | 17.1% |
| Garmin | 23 | 19.7% |
| Huawei | 16 | 13.7% |
| Samsung | 12 | 10.3% |
| Xiaomi | 7 | 6.0% |
| Other brand | 13 | 11.1% |
| Total | 117 | 100.0% |

Table 4-11 Survey Responses to Question #2 - Smartwatch Brand

Source: Developed for this thesis

4.7.3 Survey Question #3 – Device Usage Pattern

The purpose of question #3 was to collect participant device usage pattern for descriptive purposes. The participant asked about their device usage pattern, where daily = every day, frequent = use 5 to 6 days a week, moderate = a few days a week, seldom = a few days in a month and stop use (refer to Table 4-12). The overall sample population profile by usage patterns (refer to Chart 4-3) reveals that 65.6% use their respective device (smartwatch, smart band and smartphone apps) daily, 20.2% frequently, and the balance of 14.2%, which consist of 6.8% is moderate, 6.6% seldom and 0.8% stop use. When daily and frequent use combined, the findings suggested that 85.8% of the sample population are considered active users.

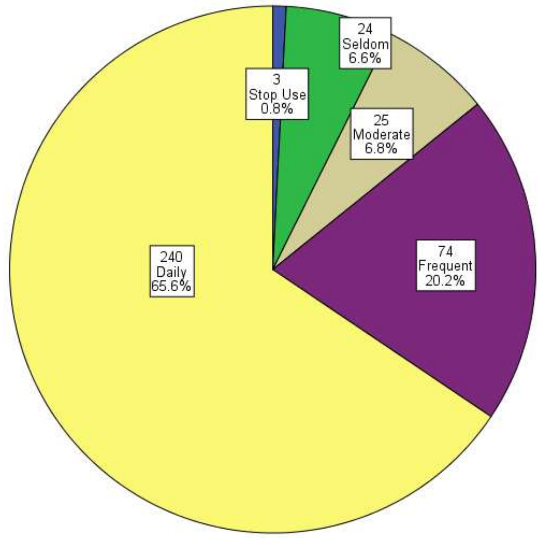



Chart 4-3 Survey Responses to Question #3 (Usage Patterns)
Source: Developed for this thesis

The finding also reveals that the smartwatch daily usage pattern in term of percentage is highest at 76.9%, followed by smartphone apps at 61.1%, and the smart band is the lowest at 58.7%. In term of active usage (when daily and frequent is combined), smartwatch lead at 93.1%, followed by the smart band at 85.9% and smartphone apps at 80.2%.

| | | Experience | | | | | |
|---|---|---|---|---|---|---|---|
| | | Smartwatch | | Smart Band | | Smartphone Apps | |
| | | Count | Column N % | Count | Column N % | Count | Column N % |
| Usage Pattern | Daily | 90 | 76.9% | 54 | 58.7% | 96 | 61.1% |
| | Frequent | 19 | 16.2% | 25 | 27.2% | 30 | 19.1% |
| | Moderate | 7 | 6.0% | 3 | 3.3% | 15 | 9.6% |
| | Seldom | 0 | 0.0% | 10 | 10.9% | 14 | 8.9% |
| | Stop Use | 1 | 0.9% | 0 | 0.0% | 2 | 1.3% |
| | Total | 117 | 100.0% | 92 | 100.0% | 157 | 100.0% |

Table 4-12 User Device Experience Versus Usage Pattern
Source: Developed for this thesis

### 4.7.4 Performance Expectancy Construct Measurement Question #4, #5 and #6

The purpose of measurement question #4, #5 and #6 are to collect participant opinion for H1 hypothesis testing, which is necessary to achieve RO1 and address RQ1. The three measurement questions aim to measure participant opinion about Performance Expectancy's influence on Behavioural Intention to use a consumer smartwatch. The measurement guided by UTAUT2 theory, which underpins the conceptual smartwatch adoption model and hypothesis H1. The three (3) measurement question formed the observable variables that measure the unobserved latent variable Performance Expectancy based on a reflective measurement theory. The questions are:

- Question #4 (Performance Expectancy 01) - I find that smartwatch is useful in my daily life compared to an ordinary watch.
- Question #5 (Performance Expectancy 02) - I find that using smartwatch can helps me accomplish my daily goals more efficiently compared to an ordinary watch.
- Question #6 (Performance Expectancy 03) - I find that using smartwatch can increase my productivity compared to an ordinary watch.

| | | Count | Mean | Median | Mode | Standard Deviation |
|---|---|---|---|---|---|---|
| PE01 | Strongly Disagree | 3 | | | | |
| | Disagree | 18 | | | | |
| | Neutral | 70 | | | | |
| | Agree | 146 | | | | |
| | Strongly Agree | 129 | | | | |
| | Total | 366 | 4.0 | 4.0 | 4.0 | .9 |
| PE02 | Strongly Disagree | 5 | | | | |
| | Disagree | 20 | | | | |
| | Neutral | 77 | | | | |
| | Agree | 157 | | | | |
| | Strongly Agree | 107 | | | | |
| | Total | 366 | 3.9 | 4.0 | 4.0 | .9 |
| PE03 | Strongly Disagree | 8 | | | | |
| | Disagree | 23 | | | | |
| | Neutral | 119 | | | | |
| | Agree | 127 | | | | |
| | Strongly Agree | 89 | | | | |
| | Total | 366 | 3.7 | 4.0 | 4.0 | 1.0 |

Table 4-13 Survey Responses to Question #4, #5 and #6
Source: Developed for this thesis

The numeric scale 1.0 (Strongly Disagree) to 5.0 (Strongly Agree) implemented for ordinal measurement. The median and mode for question #4, #5 and #6 are at scale 4.0, which is “Agree”, and the mean value for question #4 is 4.0, question #5 is 3.9 and question #6 is 3.7. The standard deviation distribution for the three questions is approximately similar between 0.9 and 1.0 (refer to Table 4-13). The respondents’ mean opinion toward Performance Expectancy for the three measurement question calculated using IBM SPSS version 23 is 3.89.

### 4.7.5 Effort Expectancy Construct Measurement Question #7, #8 and #9

The purpose of measurement question #7, #8 and #9 are to collect participant opinion for H2 hypothesis testing, which is necessary to achieve RO2 and address RQ2. The three measurement questions aim to measure participant opinion about Effort Expectancy's influence on Behavioural Intention to use a consumer smartwatch. The measurement guided by UTAUT2 theory, which underpins the conceptual smartwatch adoption model and hypothesis H2. The three (3) measurement question formed the observable variables that measure the unobserved latent variable Effort Expectancy based on a reflective measurement theory. The questions are:

- Question #7 (Effort Expectancy 01) - I find that learning how to use smartwatch is easy for me.
- Question #8 (Effort Expectancy 02) - I find that the touch screen menu of a smartwatch is clear and understandable.
- Question #9 (Effort Expectancy 03) - I find that it is easy for me to become skilful at using a smartwatch.

| | | Count | Mean | Median | Mode | Standard Deviation |
|---|---|---|---|---|---|---|
| EE01 | Strongly Disagree | 0 | | | | |
| | Disagree | 7 | | | | |
| | Neutral | 43 | | | | |
| | Agree | 154 | | | | |
| | Strongly Agree | 162 | | | | |
| | Total | 366 | 4.3 | 4.0 | 5.0 | .7 |
| EE02 | Strongly Disagree | 3 | | | | |
| | Disagree | 9 | | | | |
| | Neutral | 65 | | | | |
| | Agree | 156 | | | | |
| | Strongly Agree | 133 | | | | |
| | Total | 366 | 4.1 | 4.0 | 4.0 | .8 |
| EE03 | Strongly Disagree | 0 | | | | |
| | Disagree | 11 | | | | |
| | Neutral | 58 | | | | |
| | Agree | 164 | | | | |
| | Strongly Agree | 133 | | | | |
| | Total | 366 | 4.1 | 4.0 | 4.0 | .8 |

Table 4-14 Survey Responses to Question #7, #8 and #9
Source: Developed for this thesis

The numeric scale 1.0 (Strongly Disagree) to 5.0 (Strongly Agree) implemented for ordinal measurement. The standard deviation distribution for the three measurement questions is approximately similar at between 0.7 to 0.8. The median for measurement question #7 is 4.0, and mode is 5.0, the responses to question #7 recorded a higher mean value of 4.3 compared to two other questions, #8 and #9, which register median of 4.0 and mode of 4.0 and mean value of 4.1 (refer to Table 4-14). The respondents' mean opinion toward Effort Expectancy for the three measurement question calculated using IBM SPSS version 23 is 4.18.

#### 4.7.6 Social Influence Construct Measurement Question #10, #11 and #12

The purpose of measurement question #10, #11 and #12 is to collect participant opinion for H3 hypothesis testing, which is necessary to achieve RO3 and address RQ3. The three measurement questions aim to measure participant opinion about Social Influence's effect on Behavioural Intention to use a consumer smartwatch. The measurement guided by UTAUT2 theory, which underpins the conceptual smartwatch adoption model and hypothesis H3. The three (3) measurement question formed the observable variables that measure the unobserved latent variable Social Influence based on a reflective measurement theory. The questions are:

- Question #10 (Social Influence 01) - People in my social circle encourage the use of a smartwatch.
- Question #11 (Social Influence 02) - People whom I trust in my social circle encourage the use of smartwatch.
- Question #12 (Social Influence 03) - People around my social space (expert opinions, forum discussions and smartwatch advertisement) increase my awareness and consideration about using a smartwatch.

| | | Count | Mean | Median | Mode | Standard Deviation |
|---|---|---|---|---|---|---|
| SI01 | Strongly Disagree | 14 | | | | |
| | Disagree | 48 | | | | |
| | Neutral | 130 | | | | |
| | Agree | 118 | | | | |
| | Strongly Agree | 56 | | | | |
| | Total | 366 | 3.4 | 3.0 | 3.0 | 1.0 |
| SI02 | Strongly Disagree | 18 | | | | |
| | Disagree | 36 | | | | |
| | Neutral | 134 | | | | |
| | Agree | 121 | | | | |
| | Strongly Agree | 57 | | | | |
| | Total | 366 | 3.4 | 3.0 | 3.0 | 1.0 |
| SI03 | Strongly Disagree | 15 | | | | |
| | Disagree | 34 | | | | |
| | Neutral | 108 | | | | |
| | Agree | 148 | | | | |
| | Strongly Agree | 61 | | | | |
| | Total | 366 | 3.6 | 4.0 | 4.0 | 1.0 |

Table 4-15 Survey Responses to Question #10, #11 and #12

Source: Developed for this thesis

The numeric scale 1.0 (Strongly Disagree) to 5.0 (Strongly Agree) implemented for ordinal measurement. The median and mode for measurement question #10 and #11 are 3.0, which indicate a neutral tendency toward both questions. Question #12 registered median and mode value of 4.0 indicate opinion tendency toward “Agree”. The standard deviation distribution for the three measurement questions is similar at 1.0 for all question. The mean for question #10, #11 and #12 is 3.4, 3.4 and 3.6, respectively (refer to Table 4-15). The respondents’ mean opinion toward Social Influence for the three measurement question calculated using IBM SPSS version 23 is 3.48.

#### 4.7.7 Hedonic Motivation Construct Measurement Question #13, #14 and #15

The purpose of measurement question #13, #14 and #15 is to collect participant opinion for H4 hypothesis testing, which is necessary to achieve RO4 and address RQ4. The three measurement questions aim to measure participant opinion about Hedonic Motivation’s influence on Behavioural Intention to use a consumer smartwatch. The measurement guided by UTAUT2 theory, which underpins the conceptual smartwatch adoption model and hypothesis H4. The three (3) measurement question formed the observable variables that measure the unobserved latent variable Hedonic Motivation based on a reflective measurement theory. The questions are:

- Question #13 (Hedonic Motivation 01) - I find that interaction with a smartwatch is entertaining.
- Question #14 (Hedonic Motivation 02) - I find that interaction with a smartwatch can bring enjoyment.
- Question #15 (Hedonic Motivation 03) - I find that interaction with a smartwatch can bring satisfaction.

| | | Count | Mean | Median | Mode | Standard Deviation |
|---|---|---|---|---|---|---|
| HM01 | Strongly Disagree | 7 | | | | |
| | Disagree | 27 | | | | |
| | Neutral | 136 | | | | |
| | Agree | 142 | | | | |
| | Strongly Agree | 54 | | | | |
| | Total | 366 | 3.6 | 4.0 | 4.0 | .9 |
| HM02 | Strongly Disagree | 11 | | | | |
| | Disagree | 29 | | | | |
| | Neutral | 142 | | | | |
| | Agree | 124 | | | | |
| | Strongly Agree | 60 | | | | |
| | Total | 366 | 3.5 | 4.0 | 3.0 | 1.0 |
| HM03 | Strongly Disagree | 6 | | | | |
| | Disagree | 23 | | | | |
| | Neutral | 123 | | | | |
| | Agree | 144 | | | | |
| | Strongly Agree | 70 | | | | |
| | Total | 366 | 3.7 | 4.0 | 4.0 | .9 |

Table 4-16 Survey Responses to Question #13, #14 and #15

Source: Developed for this thesis

The numeric scale 1.0 (Strongly Disagree) to 5.0 (Strongly Agree) implemented for ordinal measurement. The median for measurement question #13, #14 and #15 is 4.0, mode for question #13 and #15 is 4.0 and question 14 is 3.0. The standard deviation distribution for the three measurement questions is between 0.9 and 1.0. The mean for question #13, #14 and #15 is 3.6, 3.5 and 3.7, respectively (refer to Table 4-16). The respondents' mean opinion toward Hedonic Motivation for the three measurement question calculated using IBM SPSS version 23 is 3.59.

4.7.8 <u>Price Value Construct Measurement Question #16, #17 and #18</u>

The purpose of measurement question #16, #17 and #18 is to collect participant opinion for H5 hypothesis testing, which is necessary to achieve RO5 and address RQ5. The three measurement questions aim to measure participant opinion about Price Value's influence on Behavioural Intention to use a consumer smartwatch. The measurement guided by UTAUT2 theory, which underpins the conceptual smartwatch adoption model and hypothesis H5. The three (3) measurement question formed the observable variables that measure the unobserved latent variable Price Value based on a reflective measurement theory. The questions are:

- Question #16 (Price Value 01) - At the current price, I find that smartwatch is reasonably priced.
- Question #17 (Price Value 02) - At the current price, I find that smartwatch offers good value relative to its cost.
- Question #18 (Price Value 03) - At the current price, I find that the smartwatch price is affordable.

| | | Count | Mean | Median | Mode | Standard Deviation |
|---|---|---|---|---|---|---|
| PV01 | Strongly Disagree | 16 | | | | |
| | Disagree | 61 | | | | |
| | Neutral | 140 | | | | |
| | Agree | 104 | | | | |
| | Strongly Agree | 45 | | | | |
| | Total | 366 | 3.3 | 3.0 | 3.0 | 1.0 |
| PV02 | Strongly Disagree | 8 | | | | |
| | Disagree | 47 | | | | |
| | Neutral | 144 | | | | |
| | Agree | 121 | | | | |
| | Strongly Agree | 46 | | | | |
| | Total | 366 | 3.4 | 3.0 | 3.0 | .9 |
| PV03 | Strongly Disagree | 16 | | | | |
| | Disagree | 58 | | | | |
| | Neutral | 141 | | | | |
| | Agree | 112 | | | | |
| | Strongly Agree | 39 | | | | |
| | Total | 366 | 3.3 | 3.0 | 3.0 | 1.0 |

Table 4-17 Survey Responses to Question #16, #17 and #18

Source: Developed for this thesis

The numeric scale 1.0 (Strongly Disagree) to 5.0 (Strongly Agree) implemented for ordinal measurement. The participant responses to Question #16, #17 and #18 median and mode for measurement items is 3.0. The standard deviation distribution for the three measurement questions is between 0.9 and 1.0. The mean for question #16, #17 and #18 is 3.3, 3.4 and 3.3, respectively (refer to Table 4-17). The respondents' mean opinion toward Price Value for the three measurement question calculated using IBM SPSS is 3.32.

4.7.9 Health Technology Construct Measurement Question #19, #20 and #21

The purpose of measurement question #19, #20 and #21 is to collect participant opinion for H6 hypothesis testing, which is necessary to achieve RO6 and address RQ6. The three measurement questions aim to measure participant opinion about Health Technology's influence on Behavioural Intention to use a consumer smartwatch. The measurement guided by UTAUT2 theory, which underpins the conceptual smartwatch adoption model and hypothesis H6. The three (3) measurement question formed the observable variables that measure the unobserved latent variable Health Technology based on a reflective measurement theory. The questions are:

- Question #19 (Health Technology 01) - I find that using smartwatch (by tracking my heartbeat patterns, sleep patterns, blood pressure patterns, etc.) can motivate a healthy lifestyle.
- Question #20 (Health Technology 02) - I find that using smartwatch (by tracking my physical movement goals: distance travelled, movement step, stair climb count) can motivate a physically active lifestyle.
- Question #21 (Health Technology 03) - I find that using smartwatch (by tracking my calories and water intake) can help the achievement of a balanced diet.

| | | Count | Mean | Median | Mode | Standard Deviation |
|---|---|---|---|---|---|---|
| HT01 | Strongly Disagree | 1 | | | | |
| | Disagree | 10 | | | | |
| | Neutral | 25 | | | | |
| | Agree | 147 | | | | |
| | Strongly Agree | 183 | | | | |
| | Total | 366 | 4.4 | 4.5 | 5.0 | .8 |
| HT02 | Strongly Disagree | 1 | | | | |
| | Disagree | 11 | | | | |
| | Neutral | 27 | | | | |
| | Agree | 150 | | | | |
| | Strongly Agree | 177 | | | | |
| | Total | 366 | 4.3 | 4.0 | 5.0 | .8 |
| HT03 | Strongly Disagree | 6 | | | | |
| | Disagree | 22 | | | | |
| | Neutral | 96 | | | | |
| | Agree | 138 | | | | |
| | Strongly Agree | 104 | | | | |
| | Total | 366 | 3.9 | 4.0 | 4.0 | 1.0 |

Table 4-18 Survey Responses to Question #19, #20 and #21
Source: Developed for this thesis

The numeric scale 1.0 (Strongly Disagree) to 5.0 (Strongly Agree) implemented for ordinal measurement. The standard deviation distribution for the three measurement questions is approximately similar at between 0.8 to 1.0. The median for measurement question #19, #20, and #21 are 4.5, 4.0 and 4.0; the mode is 5.0, 5.0 and 4.0, and the mean is 4.4, 4.3 and 3.9, respectively (refer to Table 4-18). The respondents' mean opinion toward Health Technology for the three measurement question calculated using IBM SPSS is 4.19.

#### 4.7.10 Design Benefit Construct Measurement Question #22, #23 and #24

The purpose of measurement question #22, #23 and #24 is to collect participant opinion for H7 hypothesis testing, which is necessary to achieve RO7 and address RQ7. The three measurement questions aim to measure participant opinion about Design Benefit's influence on Behavioural Intention to use a consumer smartwatch. The measurement guided by UTAUT2 theory, which underpins the conceptual smartwatch adoption model and hypothesis H7. The three (3) measurement question formed the observable variables that measure the unobserved latent variable Design Benefit based on a reflective measurement theory. The questions are:

- Question #22 (Design Benefit 01) - I find that the overall look and feel of a smartwatch is visually appealing.
- Question #23 (Design Benefit 02) - I find that smartwatch design attributes (size, weight, touch display, colour and materials) are attractive.
- Question #24 (Design Benefit 03) - I find that smartwatch design which securely strapped on the human wrist is light, convenient to carry, non-intrusive, easily accessible and less likely to be misplaced compared to a loosely held smartphone.

The numeric scale 1.0 (Strongly Disagree) to 5.0 (Strongly Agree) implemented for ordinal measurement. The standard deviation distribution for the three measurement questions is similar at 0.8. The median and mode for measurement question #22, #23 and #24 are 4.0, and the mean value is 4.0, 4.0 and 4.2, respectively (refer to Table 4-19). The respondents' mean opinion toward Design Benefit for the three measurement question calculated using IBM SPSS is 4.03.

| | | Count | Mean | Median | Mode | Standard Deviation |
|---|---|---|---|---|---|---|
| DB01 | Strongly Disagree | 3 | | | | |
| | Disagree | 12 | | | | |
| | Neutral | 75 | | | | |
| | Agree | 186 | | | | |
| | Strongly Agree | 90 | | | | |
| | Total | 366 | 4.0 | 4.0 | 4.0 | .8 |
| DB02 | Strongly Disagree | 4 | | | | |
| | Disagree | 11 | | | | |
| | Neutral | 79 | | | | |
| | Agree | 169 | | | | |
| | Strongly Agree | 103 | | | | |
| | Total | 366 | 4.0 | 4.0 | 4.0 | .8 |
| DB03 | Strongly Disagree | 2 | | | | |
| | Disagree | 9 | | | | |
| | Neutral | 46 | | | | |
| | Agree | 180 | | | | |
| | Strongly Agree | 129 | | | | |
| | Total | 366 | 4.2 | 4.0 | 4.0 | .8 |

Table 4-19 Survey Responses to Question #22, #23 and #24

Source: Developed for this thesis

### 4.7.11 Behavioural Intention Construct Measurement Question #25, #26, #27

The purpose of measurement question #25, #26 and #27 is to collect participant opinion for Behavioural Intention to use a consumer smartwatch. The three measurement questions aim to measure participant opinion about their Behavioural Intention to use a consumer smartwatch. The measurement guided by UTAUT2 theory, which underpins the conceptual smartwatch adoption model. The three (3) measurement questions formed the observable variables that measure the unobserved latent variable Behavioural Intention based on a reflective measurement theory. The questions are:

- Question #25 (Behavioral Intention 01) - I intend to consider using a smartwatch in the future.
- Question #26 (Behavioural Intention 02) - I would be willing to use a smartwatch if I possess one.
- Question #27 (Behavioral Intention 03) - I find smartwatch useful; I would be willing to use smartwatch frequently in my daily life.

| | | Count | Mean | Median | Mode | Standard Deviation |
|---|---|---|---|---|---|---|
| BI01 | Strongly Disagree | 5 | | | | |
| | Disagree | 11 | | | | |
| | Neutral | 34 | | | | |
| | Agree | 135 | | | | |
| | Strongly Agree | 181 | | | | |
| | Total | 366 | 4.3 | 4.0 | 5.0 | .9 |
| BI02 | Strongly Disagree | 4 | | | | |
| | Disagree | 8 | | | | |
| | Neutral | 27 | | | | |
| | Agree | 129 | | | | |
| | Strongly Agree | 198 | | | | |
| | Total | 366 | 4.4 | 5.0 | 5.0 | .8 |
| BI03 | Strongly Disagree | 5 | | | | |
| | Disagree | 8 | | | | |
| | Neutral | 31 | | | | |
| | Agree | 131 | | | | |
| | Strongly Agree | 191 | | | | |
| | Total | 366 | 4.4 | 5.0 | 5.0 | .8 |

Table 4-20 Survey Responses to Question #25, #26 and #27

Source: Developed for this thesis

The numeric scale 1.0 (Strongly Disagree) to 5.0 (Strongly Agree) implemented for ordinal measurement. The standard deviation distribution for the three measurement questions is approximately similar at 0.8 and 0.9. The mode for measurement question #25, #26 and #27 is 5.0, median at 4.0, 5.0 and 5.0 and mean value is 4.3, 4.4 and 4.4, respectively (refer to Table 4-20). The respondents' mean opinion toward Behavioural Intention for the three measurement question calculated using IBM SPSS is 4.35.

### 4.7.12 Survey Question #28 - Demographic Profile by Gender

The purpose of this question is to collect gender information of each participant for descriptive comparison against the Department of Statistic Malaysia (DoSM) and independent group testing against opinion collected from survey question #4 to #27. Reference to the Department of Statistics Malaysia (2019), the split between male and female gender for Malaysia population in 2019 is 107 males to 100 females; therefore, the gender data collected by online survey based on general population profile is not representative of Malaysia general population by gender.

The distribution split by gender shows that (refer to Table 4-21) two hundred fifty-five (255) or 69.7% of the participants were male, and one hundred fifteen (111) or 30.3% of the participants were female.

| Gender | Frequency | Percentage |
|---|---|---|
| Female | 111 | 30.3% |
| Male | 255 | 69.7% |
| Total | 366 | 100% |

Table 4-21 Sample Population Profile by Gender

Source: Developed for this thesis

However, upon analysing the gross monthly income information collected from the sample population, three hundred forty (335) participants or 91.5% receiving monthly income (refer to Table 4-22). The finding leads to the attempt to verify the sample population by gender against Malaysia labour population characteristics.

| | Frequency | Percentage |
|---|---|---|
| No Income | 31 | 8.5% |
| Receiving Income | 335 | 91.5% |
| Total | 366 | 100% |

Table 4-22 Sample Population Profile by Income/No Income

Source: Developed for this thesis

The male participation in the Malaysia labour population is 80.8%, versus female participation at 55.6%. The higher number of males participating in Malaysia's labour market vs female implies a higher probability of getting male participation than females because of a higher number of males in the Malaysia labour population. The labour population for Malaysia in 2019 is 15.6 million, and the split by gender is 9.5 million or 61% male and 6.1 million or 39% female (Department of Statistics Malaysia, 2019). Therefore, the gender ratio collected by this research shown in Table 4-21 tends to follow the Malaysia labour population gender ratio instead of the general population gender ratio.

4.7.13 Survey Question #29 - Demographic Profile by Citizenship Status

The purpose of this question is to collect the nationality status of each participant for descriptive comparison with the prevailing Malaysia resident profile published by the DoSM and independent group testing against opinion collected from survey question #4 to #27. The sample population distribution split by citizenship shows that (refer to Table 4-23) three hundred thirty-one (327) or 89.3% of the participants are Malaysia citizen/Malaysia permanent resident and thirty-nine (39) or 10.7% foreign citizen.

| | Frequency | Percentage |
|---|---|---|
| Malaysian / Malaysia Permanent Resident | 327 | 89.3% |
| Foreign Citizen | 39 | 10.7% |
| Total | 366 | 100% |

Table 4-23 Sample Population Profile by Citizenship

Source: Developed for this thesis

The population of Malaysia in 2019 based on statistic published by DoSM is 32.6 million. The Malaysia resident split between citizen and foreigner is 29.4 million (approximately 90.2%) Malaysian and 3.2 million (approximately 9.8%) foreign national (Department of Statistics Malaysia, 2019). The sample population profile by citizenship collect by online survey appears to be approximately in line with the DoSM statistic. Using $\chi 2$ Goodness of Fit test, the asymptote signal is > .05, which statistically confirm that the sample data collected is within the representative boundary of Malaysia resident profile based on the split between Malaysia citizen and foreigner (Pallant, 2016) (refer to Table 4-24).

| | Observed N | Expected N | Residual |
|---|---|---|---|
| Malaysian / Malaysia Permanent Resident | 327 | 330.1 | -3.1 |
| Foreign Citizen | 39 | 35.9 | 3.1 |
| Total | 366 | | |

| | Nationality |
|---|---|
| Chi-Square | .303[a] |
| df | 1 |
| Asymp. Sig. | 0.582 |

a. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 35.9.

Table 4-24 Sample Population Resident Profile $\chi 2$ Goodness of Fit Test

Source: Developed for this thesis

#### 4.7.14 Survey Question #30 - Demographic Profile by Age Group

The purpose of this question is to collect information related to each respondent age group for descriptive comparison against the prevailing DoSM age group and independent group testing against opinion collected from survey question #4 to #27. The sample population profile by age group shown that 81.69% is from 25 to 54 years old age group, followed by 55 to 64 years old age group at 13.93%, the remaining three age group (Below 15 years old, 15 to 24 years old and 65 years and above) making up the balance 4.38%. The findings show that the sample population's participants were mainly from 25 to 54 years old, followed by 55 to 64 years old age group (refer to Chart 4-4).

The Malaysia population split in 2019 by age group are 7.6 million or 23.5% for the age group from 0 to 14 years old, 22.7 million or 69.8% for age group 15 to 64 years old and 2.2 million or 6.7% for age group 65 years old, and above (Department of Statistics Malaysia, 2019). In comparison with Malaysia general population by age group, the sample population by age group is not representative of Malaysia general population by age group.

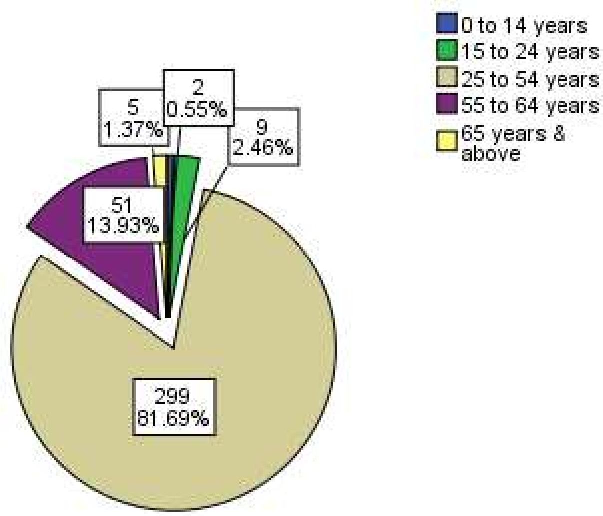



Chart 4-4 Sample Population Profile by Age Group
Source: Developed for this thesis

Reference to Table 4-22, three hundred and forty (335) or 91.5% of the sample population received monthly income. The findings indicated that most of the participants engaged in active employment, which probably explained why a high concentration seen in the 25 to 54 years old age group, followed by 55 to 64 years old age group as both are active age for employment or engaging in business activities.

4.7.15 Survey Question #31 - Demographic Profile by Education

The purpose of this question is to collect information related to each respondent education level for descriptive purposes and independent group testing against opinion collected from survey question #4 to #27. The sample population profile by education reveals that one hundred and ninety-seven (192) or 52.46% hold a bachelor degree or equivalent education, and one hundred and seven (104) or 28.42% hold a post-graduate degree. The balance of twenty-six (26) or 7.10% of the sample population attended formal schooling, and forty-four (44) or 12.02% hold a vocational qualification. The sample findings reveal that a high proportion of the sample population, two hundred and ninety-six (296) or 80.88% are university graduates (refer to Chart 4-5).

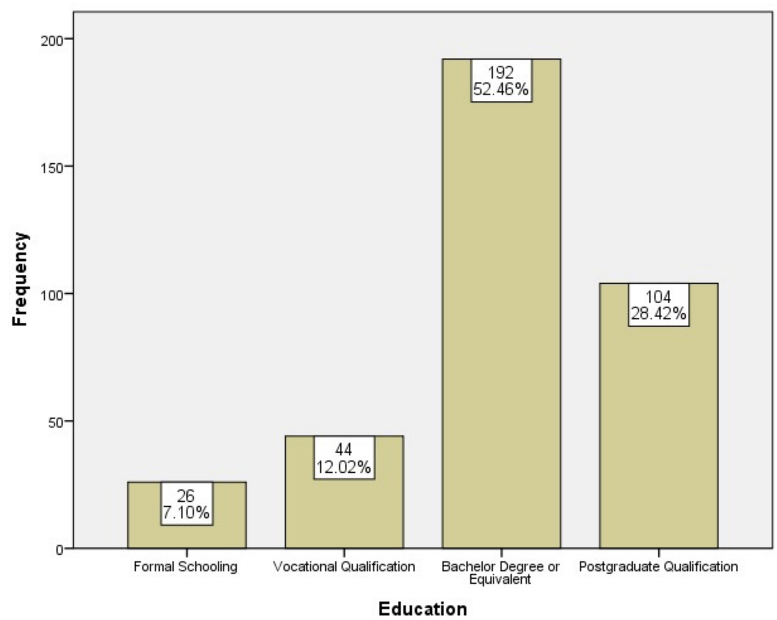



Chart 4-5 Sample Population Profile by Education Level
Source: Developed for this thesis

4.7.16 Survey Question #32 - Demographic Profile by Income Group

The purpose of this question is to collect information related to each respondent income group for descriptive purposes and independent group testing against opinion collected from survey question #4 to #27. The income profile of sample population reveals that thirty-one (31) or 8.3% of respondents have no income, six (6) or 1.6% earned below RM2,000 per month, fifty-nine (59) or 15.9% received above RM2,000 to RM5,000 per month, eighty-nine (89) or 23.9% made above RM5,000 to RM10,000 and one hundred eighty-seven (187) or 50.3% earned above RM10,000. The sample population's findings reveal that slightly more than half of the sample population received above RM10,000 monthly and approximately three-quarters of the sample population - two hundred eighty-eight (288) or 74.2% of the sample population earned above RM5,000 monthly (refer to Chart 4-6).

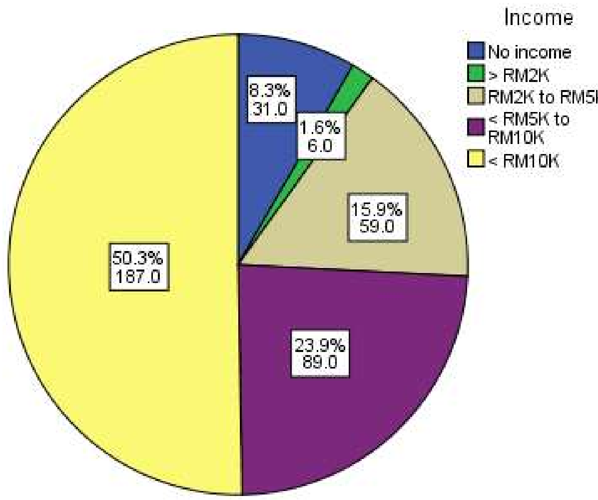



Chart 4-6 Sample Population Profile (n=366) by Income

Source: Developed for this thesis

4.7.17 Survey Question #33 - Demographic Profile by Industry

The purpose of this question is to collect information related to each respondent industry for descriptive purposes and independent group testing against opinion collected from survey question #4 to #27. The industry profile collected from the smartwatch study sample population organised according to industry classification provided by Dun and Bradstreet available at https://www.dnb.com/resources/sic-naics-industry-codes.html.

The sample population profile by industry showed respondents spread across multiple industries, and the majority distributed around four industries; services industry at 33.61%, followed by transportation and public utilities industry at 27.05%, manufacturing industry at 11.20%, finance, insurance and real estate industry at 8.47%. The top four industry account for 80.33% of the sample population. The outside employment market category, consisting of student, housewife, unemployed and retirees accounted for 9.56% of the sample population. The rest of the respondents are from construction, mining, retails, and other industry that make up the balance of 10.11% (refer to Chart 4-7).

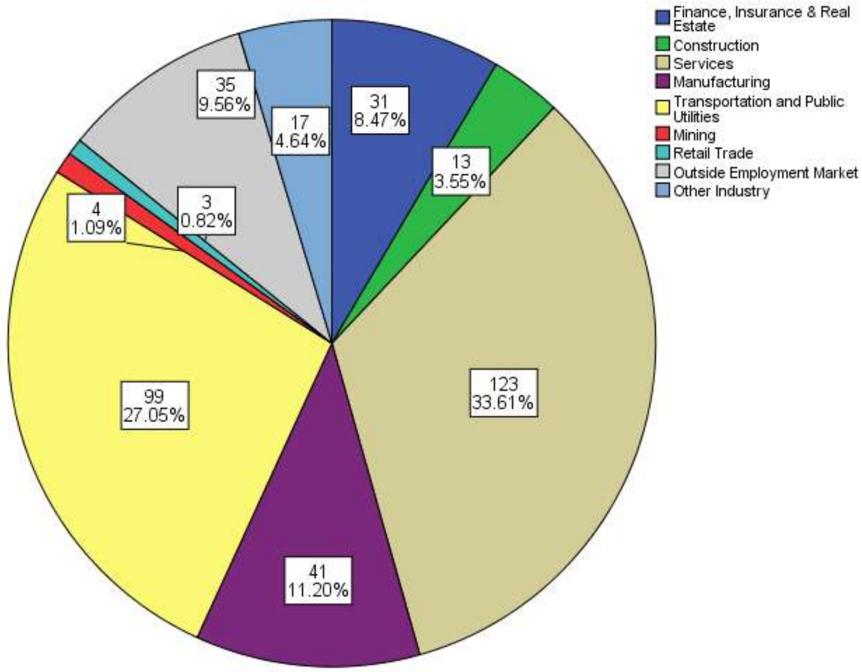



Chart 4-7 Sample Population Profile (n=366) by Industry
Source: Developed for this thesis

4.7.18 Summary of Sample Population Demographic Profile

The sample population profile found to be representative of Malaysia resident profile by nationality. The research dataset consists of three (3) distinct groups: a smartwatch, smart band and smartphone with health apps; most users in each category found engaging in daily and frequent usage pattern. The sample population demographic profile dominated by male, Malaysian, 25 to 54 years old age group, university graduate, the gross income of above RM10,000 monthly. The majority of the respondent came from services and transportation and public utilities (refer to Table 4-25).

| | | Experience | | | |
|---|---|---|---|---|---|
| | | Smartwatch | Smart Band | Smartphone Apps | Total |
| | | Count | Count | Count | Count |
| Gender | Female | 34 | 37 | 40 | 111 |
| | Male | 83 | 55 | 117 | 255 |
| | Total | 117 | 92 | 157 | 366 |
| Nationality | Malaysia Citizen | 103 | 75 | 141 | 319 |
| | Malaysia Permanent Resident | 2 | 4 | 2 | 8 |
| | Foreign Citizen | 12 | 13 | 14 | 39 |
| | Total | 117 | 92 | 157 | 366 |
| Age Group | 0 to 14 years | 1 | 1 | 0 | 2 |
| | 15 to 24 years | 3 | 3 | 3 | 9 |
| | 25 to 54 years | 98 | 78 | 123 | 299 |
| | 55 to 64 years | 13 | 8 | 30 | 51 |
| | 65 years & above | 2 | 2 | 1 | 5 |
| | Total | 117 | 92 | 157 | 366 |
| Education | Formal Schooling | 5 | 9 | 12 | 26 |
| | Vocational Qualification | 16 | 8 | 20 | 44 |
| | Bachelor Degree or Equivalent | 60 | 59 | 73 | 192 |
| | Postgraduate Qualification | 36 | 16 | 52 | 104 |
| | Total | 117 | 92 | 157 | 366 |
| Income | No income | 12 | 6 | 13 | 31 |
| | > RM2K | 0 | 2 | 4 | 6 |
| | RM2K to RM5k | 13 | 18 | 28 | 59 |
| | < RM5K to RM10K | 31 | 25 | 32 | 88 |
| | < RM10K | 61 | 41 | 80 | 182 |
| | Total | 117 | 92 | 157 | 366 |
| Industry | Finance, Insurance & Real Estate | 10 | 9 | 12 | 31 |
| | Construction | 3 | 5 | 5 | 13 |
| | Services | 37 | 26 | 60 | 123 |
| | Manufacturing | 10 | 14 | 17 | 41 |
| | Transportation and Public Utilities | 38 | 27 | 34 | 99 |
| | Mining | 2 | 0 | 2 | 4 |
| | Retail Trade | 0 | 0 | 3 | 3 |
| | Outside Employment Market | 13 | 6 | 16 | 35 |
| | Other Industry | 4 | 5 | 8 | 17 |
| | Total | 117 | 92 | 157 | 366 |
| Usage Pattern | Stop Use | 1 | 0 | 2 | 3 |
| | Seldom | 0 | 10 | 14 | 24 |
| | Moderate | 7 | 3 | 15 | 25 |
| | Frequent | 19 | 25 | 30 | 74 |
| | Daily | 90 | 54 | 96 | 240 |
| | Total | 117 | 92 | 157 | 366 |

Table 4-25 The Sample Population Profile (n = 366): Gender, Nationality, Age Group, Education Level, Income Group, Industry and Usage Pattern

Source: Developed for this thesis

## 4.8 Non-Parametric Independent Testing

Mann-Whitney U (alternative for parametric t-test) and Kruskal-Wallis (alternative to single-factor ANOVA) because data collected by this research does not conform to normality assumption (Pallant, 2016). Mann-Whitney U test the independent opinion between gender and Malaysian and foreigner for survey question #4 to #27. Kruskal-Wallis test the independent opinion between different age groups, education groups, different income groups, and industry groups for survey question #4 to #27.

### 4.8.1 Mann-Whitney U Test of Independent Between Gender

The sample size of 366 participants consists of 111 female and 255 males subjected to a Mann-Whitney U test. The outcome of the Mann-Whitney U test reveals that the *p*-value (two tails) for each construct is > .05; therefore, all null hypotheses are retained (refer to Table 4-26).

**Hypothesis Test Summary**

| | Null Hypothesis | Test | Sig. | Decision |
|---|---|---|---|---|
| 1 | The distribution of BI is the same across categories of Gender. | Independent-Samples Mann-Whitney U Test | .433 | Retain the null hypothesis. |
| 2 | The distribution of PE is the same across categories of Gender. | Independent-Samples Mann-Whitney U Test | .494 | Retain the null hypothesis. |
| 3 | The distribution of EE is the same across categories of Gender. | Independent-Samples Mann-Whitney U Test | .116 | Retain the null hypothesis. |
| 4 | The distribution of SI is the same across categories of Gender. | Independent-Samples Mann-Whitney U Test | .693 | Retain the null hypothesis. |
| 5 | The distribution of HM is the same across categories of Gender. | Independent-Samples Mann-Whitney U Test | .609 | Retain the null hypothesis. |
| 6 | The distribution of PV is the same across categories of Gender. | Independent-Samples Mann-Whitney U Test | .905 | Retain the null hypothesis. |
| 7 | The distribution of HT is the same across categories of Gender. | Independent-Samples Mann-Whitney U Test | .120 | Retain the null hypothesis. |
| 8 | The distribution of DB is the same across categories of Gender. | Independent-Samples Mann-Whitney U Test | .548 | Retain the null hypothesis. |

Asymptotic significances are displayed. The significance level is .05.

Table 4-26 Mann-Whitney U Test for Independent Between Gender

Source: Developed for this thesis

4.8.2 Mann-Whitney U Test of Independent Between Nationality

The sample size of 366 participants consists of 327 Malaysian/Malaysia Permanent Resident and 39 foreign nationals. A Mann-Whitney U test is employed to examine any difference between Malaysia/Malaysia permanent resident and foreign national opinions or responses. According to Table 4-27 compilation, the Mann-Whitney U test outcome reveals that the *p*-value (two tails) for each construct is > .05; therefore, all null hypotheses retained.

**Hypothesis Test Summary**

| | Null Hypothesis | Test | Sig. | Decision |
|---|---|---|---|---|
| 1 | The distribution of BI is the same across categories of Nationality. | Independent-Samples Mann-Whitney U Test | .706 | Retain the null hypothesis. |
| 2 | The distribution of PE is the same across categories of Nationality. | Independent-Samples Mann-Whitney U Test | .764 | Retain the null hypothesis. |
| 3 | The distribution of EE is the same across categories of Nationality. | Independent-Samples Mann-Whitney U Test | .407 | Retain the null hypothesis. |
| 4 | The distribution of SI is the same across categories of Nationality. | Independent-Samples Mann-Whitney U Test | .530 | Retain the null hypothesis. |
| 5 | The distribution of HM is the same across categories of Nationality. | Independent-Samples Mann-Whitney U Test | .705 | Retain the null hypothesis. |
| 6 | The distribution of PV is the same across categories of Nationality. | Independent-Samples Mann-Whitney U Test | .869 | Retain the null hypothesis. |
| 7 | The distribution of HT is the same across categories of Nationality. | Independent-Samples Mann-Whitney U Test | .444 | Retain the null hypothesis. |
| 8 | The distribution of DB is the same across categories of Nationality. | Independent-Samples Mann-Whitney U Test | .168 | Retain the null hypothesis. |

Asymptotic significances are displayed. The significance level is .05.

Table 4-27 Mann-Whitney U Test for Independent Between Nationality

Source: Developed for this thesis

4.8.3 Kruskal-Wallis Test of Independent Between Age Group

Based on the sample size of 366 participants, different age groups examined using the Kruskal-Wallis test to examine any differences in opinions or responses among the different age groups. According to Table 4-28 compilation, the Kruskal-Wallis test outcome reveals that the *p*-value (two tails) for each construct is > .05; therefore, all null hypotheses retained.

**Hypothesis Test Summary**

| | Null Hypothesis | Test | Sig. | Decision |
|---|---|---|---|---|
| 1 | The distribution of BI is the same across categories of Age Group. | Independent-Samples Kruskal-Wallis Test | .828 | Retain the null hypothesis. |
| 2 | The distribution of PE is the same across categories of Age Group. | Independent-Samples Kruskal-Wallis Test | .976 | Retain the null hypothesis. |
| 3 | The distribution of EE is the same across categories of Age Group. | Independent-Samples Kruskal-Wallis Test | .758 | Retain the null hypothesis. |
| 4 | The distribution of SI is the same across categories of Age Group. | Independent-Samples Kruskal-Wallis Test | .972 | Retain the null hypothesis. |
| 5 | The distribution of HM is the same across categories of Age Group. | Independent-Samples Kruskal-Wallis Test | .052 | Retain the null hypothesis. |
| 6 | The distribution of PV is the same across categories of Age Group. | Independent-Samples Kruskal-Wallis Test | .632 | Retain the null hypothesis. |
| 7 | The distribution of HT is the same across categories of Age Group. | Independent-Samples Kruskal-Wallis Test | .079 | Retain the null hypothesis. |
| 8 | The distribution of DB is the same across categories of Age Group. | Independent-Samples Kruskal-Wallis Test | .700 | Retain the null hypothesis. |

Asymptotic significances are displayed. The significance level is .05.

Table 4-28 Kruskal-Wallis Test for Independent Between Age Group

Source: Developed for this thesis

### 4.8.4 Kruskal-Wallis Test of Independent Between Education Group

Based on the sample size of 366 participants, different education groups examine using the Kruskal-Wallis test to examine any differences in opinions or responses among different education groups. According to Table 4-29 compilation, the Kruskal-Wallis test outcome reveals that the *p*-value (two tails) for each construct is > .05; therefore, all null hypotheses retained.

**Hypothesis Test Summary**

| | Null Hypothesis | Test | Sig. | Decision |
|---|---|---|---|---|
| 1 | The distribution of BI is the same across categories of Education. | Independent-Samples Kruskal-Wallis Test | .658 | Retain the null hypothesis. |
| 2 | The distribution of PE is the same across categories of Education. | Independent-Samples Kruskal-Wallis Test | .308 | Retain the null hypothesis. |
| 3 | The distribution of EE is the same across categories of Education. | Independent-Samples Kruskal-Wallis Test | .864 | Retain the null hypothesis. |
| 4 | The distribution of SI is the same across categories of Education. | Independent-Samples Kruskal-Wallis Test | .993 | Retain the null hypothesis. |
| 5 | The distribution of HM is the same across categories of Education. | Independent-Samples Kruskal-Wallis Test | .478 | Retain the null hypothesis. |
| 6 | The distribution of PV is the same across categories of Education. | Independent-Samples Kruskal-Wallis Test | .850 | Retain the null hypothesis. |
| 7 | The distribution of HT is the same across categories of Education. | Independent-Samples Kruskal-Wallis Test | .936 | Retain the null hypothesis. |
| 8 | The distribution of DB is the same across categories of Education. | Independent-Samples Kruskal-Wallis Test | .415 | Retain the null hypothesis. |

Asymptotic significances are displayed. The significance level is .05.

Table 4-29 Kruskal-Wallis Test for Independent Between Education Group
Source: Developed for this thesis

### 4.8.5 Kruskal-Wallis Test of Independent Between Income Group

Based on the sample size of 366 participants, different income groups examined using the Kruskal-Wallis test to examine any differences in opinions or responses among different income groups. According to Table 4-30 compilation, the Kruskal-Wallis test outcome reveals that the *p*-value (two tails) is > .05 for seven out of eight constructs; therefore, the seven null hypotheses retained. Only a single construct, HM *p*-value (two tails) is < .001; therefore, the alternative hypothesis accepted for HM.

**Hypothesis Test Summary**

| | Null Hypothesis | Test | Sig. | Decision |
|---|---|---|---|---|
| 1 | The distribution of BI is the same across categories of Income. | Independent-Samples Kruskal-Wallis Test | .538 | Retain the null hypothesis. |
| 2 | The distribution of PE is the same across categories of Income. | Independent-Samples Kruskal-Wallis Test | .710 | Retain the null hypothesis. |
| 3 | The distribution of EE is the same across categories of Income. | Independent-Samples Kruskal-Wallis Test | .567 | Retain the null hypothesis. |
| 4 | The distribution of SI is the same across categories of Income. | Independent-Samples Kruskal-Wallis Test | .571 | Retain the null hypothesis. |
| 5 | The distribution of HM is the same across categories of Income. | Independent-Samples Kruskal-Wallis Test | .000 | Reject the null hypothesis. |
| 6 | The distribution of PV is the same across categories of Income. | Independent-Samples Kruskal-Wallis Test | .666 | Retain the null hypothesis. |
| 7 | The distribution of HT is the same across categories of Income. | Independent-Samples Kruskal-Wallis Test | .737 | Retain the null hypothesis. |
| 8 | The distribution of DB is the same across categories of Income. | Independent-Samples Kruskal-Wallis Test | .499 | Retain the null hypothesis. |

Asymptotic significances are displayed. The significance level is .05.

Table 4-30 Kruskal-Wallis Test for Independent Between Income Group

Source: Developed for this thesis

### 4.8.6 Kruskal-Wallis Test of Independent Between Industry Group

Based on the sample size of 366 participants, various industry groups examined using the Kruskal-Wallis test to examine any differences in opinions or responses among various industry groups. According to Table 4-31 compilation, the Kruskal-Wallis test outcome reveals that the *p*-value (two tails) for each construct is > .05; therefore, all null hypotheses retained.

Hypothesis Test Summary

| | Null Hypothesis | Test | Sig. | Decision |
|---|---|---|---|---|
| 1 | The distribution of BI is the same across categories of Industry. | Independent-Samples Kruskal-Wallis Test | .666 | Retain the null hypothesis. |
| 2 | The distribution of PE is the same across categories of Industry. | Independent-Samples Kruskal-Wallis Test | .154 | Retain the null hypothesis. |
| 3 | The distribution of EE is the same across categories of Industry. | Independent-Samples Kruskal-Wallis Test | .442 | Retain the null hypothesis. |
| 4 | The distribution of SI is the same across categories of Industry. | Independent-Samples Kruskal-Wallis Test | .337 | Retain the null hypothesis. |
| 5 | The distribution of HM is the same across categories of Industry. | Independent-Samples Kruskal-Wallis Test | .283 | Retain the null hypothesis. |
| 6 | The distribution of PV is the same across categories of Industry. | Independent-Samples Kruskal-Wallis Test | .519 | Retain the null hypothesis. |
| 7 | The distribution of HT is the same across categories of Industry. | Independent-Samples Kruskal-Wallis Test | .660 | Retain the null hypothesis. |
| 8 | The distribution of DB is the same across categories of Industry. | Independent-Samples Kruskal-Wallis Test | .698 | Retain the null hypothesis. |

Asymptotic significances are displayed. The significance level is .05.

Table 4-31 Kruskal-Wallis Test for Independent Between Industry Group

Source: Developed for this thesis

### 4.8.7 Summary – Non-Parametric Assessment Findings

Based on non-parametric statistical testing, all null hypotheses retained except for the income group where seven null hypotheses retained except only the HM construct in the income group where the alternative hypothesis accepted. The non-parametric statistical inference findings suggested that gender, nationality, age groups, education groups, and industry groups may not moderate hypotheses (H1 to H7). Seven of eight predictive constructs of the income group may not moderate hypotheses H1 to H7.

## 4.9 Common Method Bias (CMB) Assessment

This study uses a survey strategy for primary data collection, which is susceptible to CMB influences. A survey measurement instrument susceptible to systematic measurement error (Podsakoff et al., 2012) and respondents' sociability desirability factor (Chang et al., 2010). This study understood that it is imperative to clear CMB influence doubt to demonstrate the survey measurement instrument credibility (Chang et al., 2010; Podsakoff et al., 2012). In section 4.5.1 earlier, the primary dataset satisfied the multicollinearity assessment. In this section, the primary dataset subjected to three additional CMB assessment; (1) Harman's single factor test (Chang et al., 2010), (2) Correlation matrix assessment (Bagozzi, Yi, and Phillips, 1991) and (3) Full collinearity assessment (Kock 2015).

### 4.9.1 Harman's Single Factor Test

The presence of any single factor that accounted for equal to 50% or more than 50% of the total variance explained violated Harman's Single Factor Test assumption and indicated CMB influence is present in this study (Chang et al., 2010; Podsakoff et al., 2003). The Harman's Single-Factor Test performed using IBM SPSS version 23, where unrotated principal component analysis (PCA) generated using the primary dataset. The cumulative variance for the largest single factor is approximately 39.6%; the primary dataset not influenced by CMB because no single factor breaches the threshold of 50% (refer to Table 4-32).

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 9.498 | 39.573 | 39.573 | 9.498 | 39.573 | 39.573 |
| 2 | 2.424 | 10.098 | 49.671 | 2.424 | 10.098 | 49.671 |
| 3 | 1.826 | 7.610 | 57.281 | 1.826 | 7.610 | 57.281 |
| 4 | 1.537 | 6.405 | 63.686 | 1.537 | 6.405 | 63.686 |
| 5 | 1.371 | 5.714 | 69.401 | 1.371 | 5.714 | 69.401 |
| 6 | 1.142 | 4.759 | 74.159 | 1.142 | 4.759 | 74.159 |
| 7 | 1.087 | 4.528 | 78.687 | 1.087 | 4.528 | 78.687 |
| 8 | .752 | 3.135 | 81.822 | | | |
| 24 | .109 | .455 | 100.000 | | | |

Extraction Method: Principal Component Analysis.

Table 4-32 Harman Single Factor Test Using SPSS

Source: Developed for this thesis

### 4.9.2 Correlation Matrix Assessment

CMB influences are present in the primary dataset if the correlation value between constructs is above 0.9 (Bagozzi et al., 1991). The correlation table generated based on this study's primary dataset using Gaskin, and Lim (2016) "Master Validity Tool" (refer to Table 4-33) show that all correlation value between constructs is lower than 0.9 (ranged between 0.209 to 0.785) with statistical significance at $p< 0.001$, suggested that this study's primary dataset not influenced by CMB.

| | BI | PV | HM | SI | EE | HT | DB | PE |
|---|---|---|---|---|---|---|---|---|
| **BI** | **1** | | | | | | | |
| **PV** | 0.209*** | **1** | | | | | | |
| **HM** | 0.456*** | 0.346*** | **1** | | | | | |
| **SI** | 0.438*** | 0.227*** | 0.336*** | **1** | | | | |
| **EE** | 0.517*** | 0.384*** | 0.503*** | 0.299*** | **1** | | | |
| **HT** | 0.595*** | 0.209*** | 0.469*** | 0.285*** | 0.457*** | **1** | | |
| **DB** | 0.577*** | 0.369*** | 0.596*** | 0.301*** | 0.478*** | 0.535*** | **1** | |
| **PE** | 0.785*** | 0.254*** | 0.541*** | 0.456*** | 0.610*** | 0.570*** | 0.531*** | **1** |

Table 4-33 Correlation Matrix Between Constructs

Source: Developed for this thesis

4.9.3 Full Collinearity Assessment

This study's primary dataset assumed not influenced by CMB if its Variance Inflation Factor (VIF) value based on a full collinearity assessment is lower than 3.3 (Kock, 2015). A full collinearity diagnostic generated using IBM SPSS version 23; all VIF value for predictive constructs ranged from 1.257 to 1.814, suggested that the primary dataset not influenced by CMB (refer to Table 4-34).

| Model | Collinearity Statistics | |
|---|---|---|
| | Tolerance | VIF |
| PE | .551 | 1.814 |
| EE | .657 | 1.521 |
| SI | .781 | 1.281 |
| HM | .573 | 1.746 |
| PV | .796 | 1.257 |
| HT | .612 | 1.634 |
| DB | .566 | 1.767 |

Table 4-34 Full Collinearity Assessment

Source: Developed for this thesis

4.9.4 CMB Assessment - Summary

The outcome of three different types of CMB assessment methods (Harman Single-Factor Test, Correlation Matrix Assessment and Full Collinearity Assessment) suggested that primary data not influenced by systematic measurement error and respondents' sociability desirability factor (Chang et al., 2010; Podsakoff et al., 2003; Podsakoff et al., 2012). It also implied that this study's survey measurement instrument meets its development goal of minimising bias.

## 4.10 Confirmatory Factor Analysis (CFA)

The IBM SPSS software version 23 employed to examine the primary dataset for compliances to factorial analysis assumption using Kaiser-Meyer-Olkin (KMO) Sampling Adequacy and Bartlett's Sphericity test (Hair et al., 2010; Pallant, 2016). This study employed a strictly confirmatory strategy; hence it is essential to confirm that the study's measurement model validity before the structural equation model path analysis (Hair et al., 2010). IBM SPSS AMOS software version 24 with two AMOS version 24 plugins, "Model Fit Measures" and "Master Validity Tool" by Gaskin and Lim (2016), employed to automate the CFA steps.

### 4.10.1 Kaiser-Meyer-Olkin Sampling Adequacy and Bartlett's Sphericity

The minimum pre-requisite for satisfying factor analysis assumption is a Kaiser-Meyer-Olkin (KMO) value above 0.6 and Bartlett's test of sphericity significant at *p*-value < 0.05 (Hair et al., 2010). The primary dataset was analysed using IBM SPSS version 23; the KMO sampling adequacy is 0.890, and Bartlett's test of sphericity was significant at *p*-value < .001 (refer to Table 4-35), suggesting that this study's primary dataset satisfied the assumption for factorial analysis.

| | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | .890 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 6512.484 |
| | df | 276 |
| | Sig. | .000 |

Table 4-35 KMO and Bartlett's Test

Source: Developed for this thesis

### 4.10.2 The Study Conceptual Measurement Model For CFA

This study's reflective measurement model constructed to facilitate CFA evaluation activities (refer to Diagram 4-1).

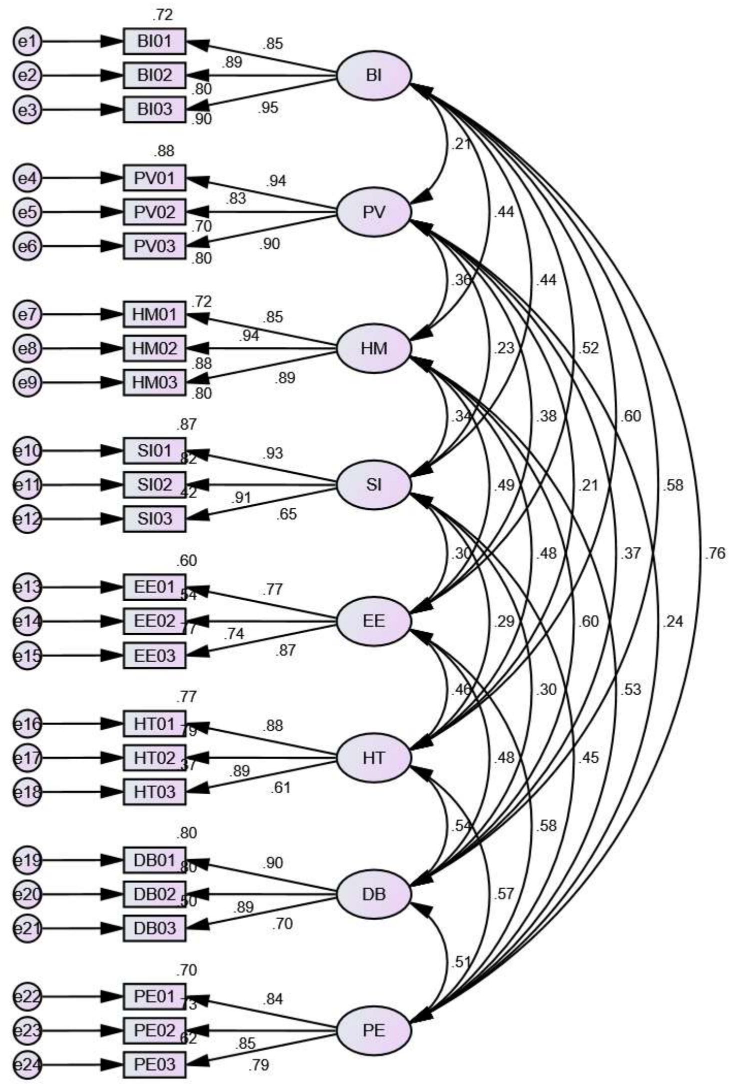



Diagram 4-1 Study Measurement Model For CFA

Source: Developed for this thesis

### 4.10.3 Composite Reliability

Earlier in section 4.6.1 above, this study's primary dataset satisfied Cronbach's α Internal Consistency. In this section, composite reliability (which is often regarded as an appropriate criterion to establish internal consistency reliability than Cronbach's alpha) employed to appraise the study's measurement model using the primary dataset (Hair et al., 2010). The composite reliability measures internal consistency in a scale similar to Cronbach's α internal consistency assessment, where the composite reliability of any construct should be ≥ 0.7 (Hair et al., 2010). This study employed the AMOS plugin "Master Validity Tool" by Gaskin and Lim (2016) to generate composite reliability (CR), all construct composite reliability value is above 0.7, indicating that this study's measurement model satisfied composite reliability (refer to Table 4-36).

| | Composite Reliability (CR) |
|---|---|
| **BI** | 0.926 |
| **PV** | 0.920 |
| **HM** | 0.939 |
| **SI** | 0.873 |
| **EE** | 0.839 |
| **HT** | 0.840 |
| **DB** | 0.873 |
| **PE** | 0.842 |

Table 4-36 CFA - Composite Reliability

Source: Developed for this thesis

### 4.10.4 Convergent Validity

Earlier in section 4.6.2 above, this study's primary dataset satisfied validity based on unrotated PCA factor loading, and all measurement item satisfied factor loading threshold > 0.50. In this section, convergent validity assessment consists of satisfying three types of assessment; composite reliability, factor loadings of each measurement items, and average variance extracted (AVE) employed to appraise the study's measurement model using the primary dataset (Hair et al., 2010).

This study's measurement model had earlier satisfied composite reliability (refer to section 4.10.3), where all construct composite reliability > 0.7 (refer to Table 4-36). The second type of assessment requires factor loadings value of all measurement item within a related construct ≥ 0.50 (Hair et al., 2010); all factor loading for measurement item within each related construct extracted from the IBM SPSS AMOS version 24 report is larger than the threshold of 0.50 (refer to Table 4-37).

| | | | Estimate | | | | Estimate |
|---|---|---|---|---|---|---|---|
| BI01 | <--- | BI | **0.848** | EE01 | <--- | EE | **0.774** |
| BI02 | <--- | BI | **0.893** | EE02 | <--- | EE | **0.736** |
| BI03 | <--- | BI | **0.951** | EE03 | <--- | EE | **0.875** |
| PV01 | <--- | PV | **0.939** | HT01 | <--- | HT | **0.879** |
| PV02 | <--- | PV | **0.835** | HT02 | <--- | HT | **0.888** |
| PV03 | <--- | PV | **0.895** | HT03 | <--- | HT | **0.607** |
| HM01 | <--- | HM | **0.851** | DB01 | <--- | DB | **0.896** |
| HM02 | <--- | HM | **0.937** | DB02 | <--- | DB | **0.892** |
| HM03 | <--- | HM | **0.894** | DB03 | <--- | DB | **0.704** |
| SI01 | <--- | SI | **0.932** | PE01 | <--- | PE | **0.835** |
| SI02 | <--- | SI | **0.907** | PE02 | <--- | PE | **0.852** |
| SI03 | <--- | SI | **0.645** | PE03 | <--- | PE | **0.787** |

Table 4-37 Measurement Item Factor Loading

Source: Developed for this thesis

Finally, the third assessment requires all construct AVE threshold value must be ≥ 0.50 (Hair et al., 2010). The AVE value for all constructs generated by AMOS plugin "Master Validity Tool" by Gaskin and Lim (2016) reported that all construct AVE value is above 0.50 (refer to Table 4-38).

| | **Average Variance Extracted (AVE)** |
|---|---|
| **BI** | 0.807 |
| **PV** | 0.793 |
| **HM** | 0.836 |
| **SI** | 0.702 |
| **EE** | 0.635 |
| **HT** | 0.643 |
| **DB** | 0.698 |
| **PE** | 0.641 |

Table 4-38 AVE - Measurement Constructs

Source: Developed for this thesis

In summary, the outcome of three types of convergent validity assessment indicated that this study's measurement model satisfied convergent validity.

#### 4.10.5 Discriminant Validity (Fornell and Larcker Method)

Discriminant validity determines if each construct that measures different concepts is sufficiently distinct from each other. The discriminant validity for each construct satisfied if the construct AVE's square root value is greater than the correlation value with other constructs (Fornell and Larcker, 1981). The AMOS plugin "Master Validity Tool" by Gaskin and Lim (2016) employed to assess this study's primary dataset and report discriminant validity based on Fornell and Larcker (1981) method. The outcome (refer to Table 4-39) suggested that this study's measurement model satisfied discriminant validity because all constructs' correlation value is significant with *p*-value < .001, and construct AVE's square root value is more significant than other constructs correlation value.

| | **BI** | **PV** | **HM** | **SI** | **EE** | **HT** | **DB** | **PE** |
|---|---|---|---|---|---|---|---|---|
| **BI** | **0.898** | | | | | | | |
| **PV** | 0.209*** | **0.891** | | | | | | |
| **HM** | 0.456*** | 0.346*** | **0.914** | | | | | |
| **SI** | 0.438*** | 0.227*** | 0.336*** | **0.838** | | | | |
| **EE** | 0.517*** | 0.384*** | 0.503*** | 0.299*** | **0.797** | | | |
| **HT** | 0.595*** | 0.209*** | 0.469*** | 0.285*** | 0.457*** | **0.802** | | |
| **DB** | 0.577*** | 0.369*** | 0.596*** | 0.301*** | 0.478*** | 0.535*** | **0.836** | |
| **PE** | 0.785*** | 0.254*** | 0.541*** | 0.456*** | 0.610*** | 0.570*** | 0.531*** | **0.801** |

Table 4-39 Discriminant Validity (Fornell and Larcker Method)

Source: Developed for this thesis

4.10.6 Discriminant Validity (Heterotrait-Monotrait Ratio of Correlations)

In this section, this study's measurement model subjected to discriminant validity assessment using the Heterotrait-Monotrait ratio of correlations (HTMT) (Henseler, Ringle and Sarstedt, 2015). The HTMT is a recent discriminant validity method that assesses the ratio of between-trait correlations to within-trait correlations to verify discriminant validity (Henseler et al., 2015). The AMOS plugin "Master Validity Tool" by Gaskin and Lim (2016) employed to report the discriminant validity report based on the Henseler et al. (2015) HTMT method. This study's measurement model satisfied discriminant validity because all HTMT value is below a threshold value of 0.9 (Henseler, Ringle and Sarstedt, 2015) (refer to Table 4-40).

| | BI | PV | HM | SI | EE | HT | DB | PE |
|---|---|---|---|---|---|---|---|---|
| **BI** | | | | | | | | |
| **PV** | **0.226** | | | | | | | |
| **HM** | **0.454** | **0.386** | | | | | | |
| **SI** | **0.487** | **0.261** | **0.389** | | | | | |
| **EE** | **0.503** | **0.402** | **0.509** | **0.328** | | | | |
| **HT** | **0.607** | **0.232** | **0.533** | **0.373** | **0.449** | | | |
| **DB** | **0.622** | **0.411** | **0.618** | **0.360** | **0.513** | **0.607** | | |
| **PE** | **0.746** | **0.266** | **0.544** | **0.491** | **0.576** | **0.621** | **0.540** | |

Table 4-40 Discriminant Validity (HTMT Method)

Source: Developed for this thesis

### 4.10.7 CFA – Goodness of Fit (GoF) Assessment

In this section, this study plan to evaluates the degree of fit between the primary dataset and the study's pre-defined measurement model based on approximate GoF indices threshold (Kline, 2016). A study by Jackson, Gillaspy and Purc-Stephenson (2009) found that the most frequently reported GoF indices across 194 research publication are model $\chi 2$ (89.2%), CFI (78.4%) and RMSEA (64.9%). Kline (2016) suggested reporting at least four GoF indices; Model $\chi 2$ with its degrees of freedom, Bentler Comparative Fit Index (CFI), Standardised Root Mean Square Residual (SRMR) and Steiger–Lind Root Mean Square Error of Approximation (RMSEA). However, the $\chi 2$ statistic is sensitive to sample size and tend to reject measurement model with a large sample (Bentler and Bonnet, 1980; Jöreskog and Sörbom, 1993, cited in Hooper, Coughlan and Mullen, 2008). Wheaton, Muthen, Alwin and Summers suggested measuring the relative/normed chi-square ($\chi 2/df$) instead of the model chi-square $\chi 2$ statistic (1977, cited in Hooper et al., 2008).

This study employed the AMOS plugin "Model Fit Measures" by Gaskin and Lim (2016) because it is consistent with other scholars' recommendations discussed in this section. The Gaskin and Lim (2016) tool report approximate GoF indices such CMIN/DF ($\chi 2$/df), CFI, SRMR, RMSEA and *p* of close fit (PClosed) as hypothesis test indicator on how close a model fits together based on RMSEA and followed Hu and Bentler (1999) recommendation on approximate GoF indices cut-off threshold value (refer to Table 4-41).

| Measure | Terrible | Acceptable | Excellent |
|---|---|---|---|
| CMIN/DF | > 5 | > 3 | > 1 |
| CFI | <0.90 | <0.95 | >0.95 |
| SRMR | >0.10 | >0.08 | <0.08 |
| RMSEA | >0.08 | >0.06 | <0.06 |
| PClose | <0.01 | <0.05 | >0.05 |

Table 4-41 Recommended GoF Threshold

Source: Gaskin and Lim (2016)

Based on the information extracted from IBM SPSS AMOS version 24, this study's measurement model classified as an over-identified model which suited the AMOS maximum likelihood algorithm (Bryne, 2016) with 366 sample size, 300 distinct sample moments with 76 distinct parameters for estimation, yielding 224 degrees of freedom. The GoF approximate indices report indicated that the study's measurement model met GoF indices assumptions (refer to Table 4-42); since the measurement model already satisfied the construct validity assumption in an earlier section, the GoF findings strengthen that this study's measurement model satisfied CFA validity indicator (Hair et al., 2010).

| Measure | Estimate | Threshold | Interpretation |
|---|---|---|---|
| CMIN | 466.39 | -- | -- |
| DF | 224 | -- | -- |
| CMIN/DF | 2.082 | Between 1 and 3 | Excellent |
| CFI | 0.962 | >0.95 | Excellent |
| SRMR | 0.056 | <0.08 | Excellent |
| RMSEA | 0.054 | <0.06 | Excellent |
| PClose | 0.143 | >0.05 | Excellent |

Table 4-42 CFA GoF Indices

Source: Developed for this thesis

4.10.8 Standardised Residuals Diagnostic

Any standardised residuals value lower than 2.5 is considered acceptable. Any standardised residuals value that falls between ±2.5 and ±4.0 requires attention only if other assessment such as composite reliability and construct validity failed threshold assessment, indicating potential problems with the survey measurement items. Standardised residuals value exceeds ±4.0 indicates severe problems with survey measurement items (Hair et al., 2010; Tabachnick and Fidell, 2013).

The standardised residual diagnostic report extracted from IBM SPSS AMOS version 24 report has 276 standardised residuals value. Since the table is large and violation above ±2.5 concentrated in a single area, for simplicity, the relevant portion of the big table extracted, the violation highlighted in red colour and shown in Table 4-43 (The full standardised diagnostic residuals table attached in Appendix B: Standardised Residuals Diagnostic).

| | PE03 | PE02 | PE01 | DB03 | DB02 | DB01 | HT03 | HT02 | HT01 |
|---|---|---|---|---|---|---|---|---|---|
| PE03 | 0 | | | | | | | | |
| PE02 | 0.681 | 0 | | | | | | | |
| PE01 | -0.288 | -0.313 | 0 | | | | | | |
| DB03 | 1.056 | 1.905 | 2.331 | 0 | | | | | |
| DB02 | -0.996 | -0.178 | 0.707 | -0.196 | 0 | | | | |
| DB01 | -1.104 | -0.795 | 0.367 | -0.333 | 0.154 | 0 | | | |
| HT03 | **2.784** | **3.168** | 1.362 | 1.771 | 0.302 | 1.107 | 0 | | |
| HT02 | -0.954 | 0.309 | -0.137 | **2.948** | -0.586 | -0.638 | -0.112 | 0 | |
| HT01 | -1.07 | -0.066 | -0.256 | **2.514** | -0.304 | -0.572 | -0.357 | 0.098 | 0 |
| EE03 | -0.316 | -0.147 | 0.685 | 1.624 | -0.832 | -0.047 | -0.273 | -0.360 | 0.512 |
| EE02 | -0.806 | -1.007 | 1.006 | 1.075 | -0.207 | 0.083 | -0.491 | -1.089 | -0.974 |
| EE01 | -1.044 | -0.202 | 1.042 | 1.768 | -0.553 | 0.515 | -0.676 | 0.671 | 1.201 |
| SI03 | 2.043 | 1.717 | 1.354 | **2.976** | 1.073 | 1.351 | 2.491 | 1.986 | 1.241 |
| SI02 | -0.552 | -0.05 | -0.114 | 1.220 | -0.394 | -0.315 | **2.939** | -0.878 | -0.547 |
| SI01 | -0.667 | 0.24 | -0.083 | 0.713 | -0.166 | -0.330 | 2.227 | -0.588 | 0.033 |
| HM03 | 1.073 | 1.035 | 0.563 | 0.919 | 0.358 | 0.550 | 2.463 | 0.168 | 0.793 |
| HM02 | -0.029 | -0.598 | -0.993 | -0.785 | -0.683 | 0.013 | **2.609** | -0.637 | -0.548 |
| HM01 | 0.552 | -0.443 | 0.682 | 0.261 | -0.060 | 0.497 | 1.803 | -0.645 | -0.465 |

Source: Developed for this thesis

Table 4-43 Standardised Residuals Diagnostic

Of the total 276 standardised residuals, none exceed the threshold of ±4.0. Seven standardised residuals value exceed ±2.5 threshold; the four most significant violation is 3.168 (PE02 and HT03), 2.976 (SI03 and DB03), 2.948 (HT02 and DB03) and 2.939 (SI02 and HT03). The remaining three violation is marginal, with a value ranging from 2.514 to 2.784. Of the 276 standardised residuals examined, 269 standardised residuals of the model fit within expected tolerance; the remaining seven standardised residuals violations indicated that the measured items and conceptual model did not match the expectation in term of predictive relationship (Hair et al., 2010; Tabachnick and Fidell, 2013).

In conclusion, the study's measurement model satisfied standardised residuals diagnostic because no standardised residuals violation above ±3.0 and the standardised residuals violation above ±2.5 is minimal (Hair et al., 2010; Tabachnick and Fidell, 2013).

Since the measurement model already satisfied the construct validity and GoF approximate indices assumption in an earlier section, the standardised residuals diagnostic is another CFA validity indicator that confirmed this study's measurement model validity (Hair et al., 2010).

#### 4.10.9 CFA - Summary

The composite reliability, convergent validity and discriminant validity assessment outcome confirmed that this study's measurement model is reliable (exhibiting internal and composite consistency) and valid (measuring the concepts it designed to measure). The standardised residuals diagnostic, together with composite reliability, convergent validity, discriminant validity, and the GoF indices outcome, provide an overall reassurance that this study's measurement model satisfied essential CFA quality and validity indicators (Hair et al., 2010). The findings also implied that this study's survey measurement instrument meets its development goal of achieving good reliability and validity.

### 4.11 Structural Equation Modelling (SEM)

The SEM facilitates the assessment of hypotheses β path analysis and estimates the relationship direction and strength between exogenous and endogenous constructs (Hair et al., 2010). This study's seven hypotheses, H1 to H7, are represented in Diagram 4-2, and the description of hypotheses are:

- H1 – Performance Expectancy (PE) has a significant and positive influence on Malaysia residents' behavioural intention to use a smartwatch.
- H2 – Effort Expectancy (EE) has a significant and positive influence on Malaysia residents' behavioural intention to use a smartwatch.
- H3 – Social Influence (SI) has a significant and positive influence on Malaysia residents' behavioural intention to use a smartwatch.
- H4 – Hedonic Motivation (HM) has a significant and positive influence on Malaysia residents' behavioural intention to use a smartwatch.
- H5 – Price Value (PV) has a significant and positive influence on Malaysia residents' behavioural intention to use a smartwatch.
- H6 – Health Technology (HT) has a significant and positive influence on Malaysia residents' behavioural intention to use a smartwatch.
- H7 – Design Benefit (DB) has a significant and positive influence on Malaysia residents' behavioural intention to use a smartwatch.

The study's measurement model had satisfied reliability and validity indicators during CFA. In this section, the measurement model is re-aligned to construct an SEM that linked exogenous constructs with an endogenous construct according to a pre-defined conceptual model of this study (refer to Diagram 4-2).

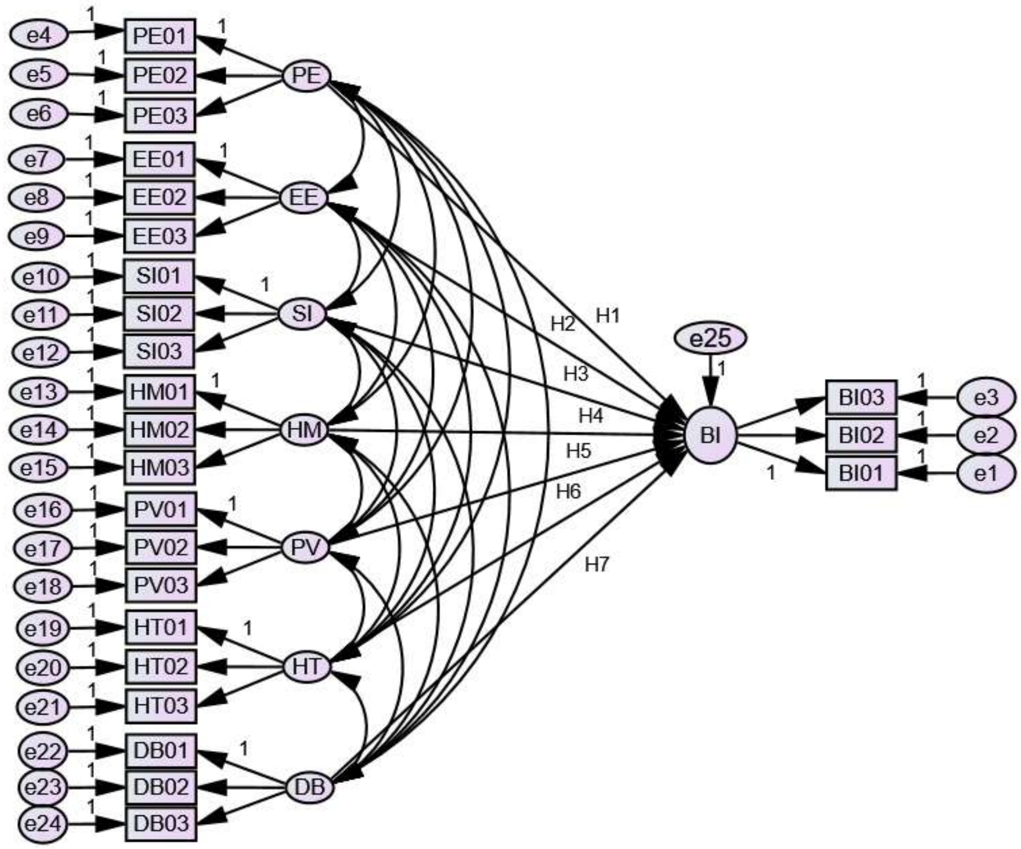



Diagram 4-2 Conceptual Model SEM Path Diagram

Source: Developed for this thesis

### 4.11.1 Study Model GoF Assessment

This study's SEM model (refer to Diagram 4-2) subjected to GoF indices verification before SEM β path analysis; the GoF approximate indices report (refer to Table 4-44) indicated that model validity remained intact after conversion from the measurement model into an SEM path model (Gaskin, 2016).

| Measure | Estimate | Threshold | Interpretation |
|---|---|---|---|
| CMIN | 466.39 | -- | -- |
| DF | 224 | -- | -- |
| CMIN/DF | 2.082 | Between 1 and 3 | Excellent |
| CFI | 0.962 | >0.95 | Excellent |
| SRMR | 0.056 | <0.08 | Excellent |
| RMSEA | 0.054 | <0.06 | Excellent |
| PClose | 0.143 | >0.05 | Excellent |

Table 4-44 SEM GoF Indices

Source: Developed for this thesis

### 4.11.2 Study Model Covariances

The critical ratio for covariance relationship in AMOS is the covariances estimated value divided by its standard measurement error. The critical ratio mimics a z-statistic test's function to confirm that covariance relationship is statistically different from zero (Byrne, 2016). The covariance relationship between constructs is statistically significant at *p-value* < 0.05 if the critical ratio value is above 1.96 and significant at *p-value* < .001 if the critical ratio value is above 2.56 (Hair et al., 2010; Tabachnick and Fidell, 2013). The covariances relationship between constructs represented by the double-headed arrow in Diagram 4-2 extracted from the IBM SPSS AMOS version 24 report indicated that all covariances between predictive variables critical ratio value above 2.56 and significant at *p-value* < .001 (refer to Table 4-45).

| | | | Correlations Estimate | Covariances Estimate | S.E. | C.R. | P | Interpretation |
|---|---|---|---|---|---|---|---|---|
| PE | <--> | EE | 0.583 | 0.254 | 0.033 | 7.787 | *** | Significant |
| PE | <--> | SI | 0.453 | 0.325 | 0.047 | 6.937 | *** | Significant |
| PE | <--> | HM | 0.527 | 0.303 | 0.039 | 7.700 | *** | Significant |
| PE | <--> | PV | 0.243 | 0.176 | 0.044 | 4.033 | *** | Significant |
| PE | <--> | HT | 0.567 | 0.283 | 0.035 | 8.016 | *** | Significant |
| PE | <--> | DB | 0.507 | 0.277 | 0.037 | 7.472 | *** | Significant |
| EE | <--> | SI | 0.299 | 0.164 | 0.034 | 4.776 | *** | Significant |
| EE | <--> | HM | 0.490 | 0.216 | 0.030 | 7.081 | *** | Significant |
| EE | <--> | PV | 0.384 | 0.213 | 0.036 | 5.953 | *** | Significant |
| EE | <--> | HT | 0.457 | 0.175 | 0.026 | 6.629 | *** | Significant |
| EE | <--> | DB | 0.477 | 0.200 | 0.029 | 6.927 | *** | Significant |
| SI | <--> | HM | 0.345 | 0.250 | 0.044 | 5.690 | *** | Significant |
| SI | <--> | PV | 0.227 | 0.207 | 0.053 | 3.916 | *** | Significant |
| SI | <--> | HT | 0.285 | 0.180 | 0.038 | 4.709 | *** | Significant |
| SI | <--> | DB | 0.301 | 0.208 | 0.042 | 4.997 | *** | Significant |
| HM | <--> | PV | 0.360 | 0.264 | 0.044 | 5.948 | *** | Significant |
| HM | <--> | HT | 0.478 | 0.242 | 0.033 | 7.261 | *** | Significant |
| HM | <--> | DB | 0.602 | 0.333 | 0.038 | 8.688 | *** | Significant |
| PV | <--> | HT | 0.209 | 0.133 | 0.038 | 3.539 | *** | Significant |
| PV | <--> | DB | 0.369 | 0.257 | 0.043 | 6.027 | *** | Significant |
| HT | <--> | DB | 0.535 | 0.257 | 0.033 | 7.893 | *** | Significant |

Table 4-45 SEM Correlations and Covariances between Constructs

Source: Developed for this thesis

### 4.11.3 SEM Hypotheses Testing

The SEM hypotheses (H1 to H7) testing using the primary dataset analysed in the IBM SPSS AMOS version 24. The report extracted from IBM SPSS AMOS version 24 provides the hypothesis β path estimate value of the relationship strength and direction, critical ratio value and *p-value*. In this study, the α error probability limit is 0.05; a hypothesis accepted as significant if β path single-tailed *p-value* ≤ 0.05. The result and interpretation of hypotheses testing based on estimated β path value of the relationship strength and direction (see standard estimate heading in Table 4-46), critical ratio and *p-value.* The hypotheses H1, H3, H4, H6 and H7 (in green colour) were supported, and H2 and H5 (in red colour) were not supported (refer to Table 4-46). The outcome of hypotheses testing represented graphically in Diagram 4-3 between exogenous constructs and endogenous construct, where the green colour is supported, and the red colour is not supported; the discussion on the study model hypotheses provided in the next chapter.

| Path Relationship | | | Standard Estimate | Estimate | C.R. | P | Hypothesis | Interpretation |
|---|---|---|---|---|---|---|---|---|
| BI | <--- | PE | 0.518 | 0.501 | 7.750 | *** | H1 | Supported |
| BI | <--- | EE | 0.058 | 0.073 | 1.048 | 0.295 | H2 | Not Supported |
| BI | <--- | SI | 0.112 | 0.086 | 2.576 | 0.010 | H3 | Supported |
| BI | <--- | HM | -0.108 | -0.104 | -2.039 | 0.041 | H4 | Supported |
| BI | <--- | PV | -0.051 | -0.039 | -1.200 | 0.230 | H5 | Not Supported |
| BI | <--- | HT | 0.176 | 0.194 | 3.312 | *** | H6 | Supported |
| BI | <--- | DB | 0.242 | 0.243 | 4.305 | *** | H7 | Supported |

Table 4-46 SEM Hypotheses β Path Analysis Result

Source: Developed for this thesis

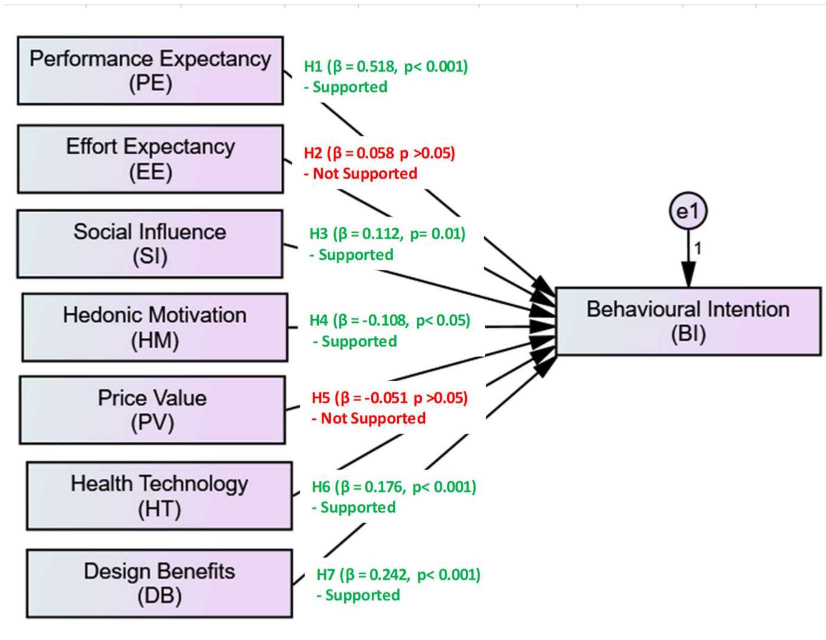



Diagram 4-3 SEM β Path Diagram - Hypotheses Testing Outcome

Source: Developed for this thesis

### 4.11.4 Study Model Hypotheses Test Findings

The β path coefficient value of above 0.5 classified as a strong effect, between 0.2 to 0.5 as moderate effect and below 0.2 as a weak effect (Hair, Aderson, Tatham and Black, 1998). The findings of each hypothesis (β path coefficient value and statistical significance) linked to the related research question and presented in ascending order:

- H1 Performance Expectancy was supported and statistically found to exhibit a strong positive significant relationship ($\beta = 0.518$, *p-value* <

0.001) toward Malaysia residents' Behavioural Intention to use a smartwatch. The finding link to RQ1 and the details discussed in the next chapter.

- H2 Effort Expectancy was not supported and statistically found to exhibit a weak non-significant effect ($\beta = 0.058$, *p-value* > 0.05) toward Malaysia residents' Behavioural Intention to use a smartwatch. Therefore, Effort Expectancy is not an essential factor influencing Malaysia residents' Behavioural Intention to use a smartwatch. The finding link to RQ2 and the details discussed in the next chapter.

- H3 Social Influence was supported and statistically found to exhibit a weak positive significant relationship ($\beta = 0.112$, *p-value* = 0.01) toward Malaysia residents' Behavioural Intention to use a smartwatch. The finding link to RQ3 and the details discussed in the next chapter.

- H4 Hedonic Motivation was supported and statistically found to exhibit a weak negative significant relationship ($\beta = -0.108$, *p-value* < 0.05) toward Malaysia residents' Behavioural Intention to use a smartwatch. The finding link to RQ4 and the details discussed in the next chapter.

- H5 Price Value was not supported and statistically found to exhibit a weak non-significant effect ($\beta = -0.051$, *p-value* > 0.05) toward Malaysia residents' Behavioural Intention to use a smartwatch. Therefore, Price Value is not an essential factor influencing Malaysia residents' Behavioural Intention to use a smartwatch. The finding link to RQ5 and the details discussed in the next chapter.

- H6 Health Technology was supported and statistically found to exhibit a weak positive significant relationship ($\beta = 0.176$, *p-value* < 0.001) toward Malaysia residents' Behavioural Intention to use a smartwatch. The finding link to RQ6 and the details discussed in the next chapter.

- H7 Design Benefit was supported and statistically found to exhibit a moderate positive significant relationship ($\beta = 0.242$, *p-value* < 0.001) toward Malaysia residents' Behavioural Intention to use a smartwatch. The finding link to RQ7 and the details discussed in the next chapter.

### 4.11.5 Study Model $R^2$ and Adjusted $R^2$

The $R^2$ coefficient of determination value represents the total variance accounted for from a group of exogenous variables that predict the endogenous variable (Pituch and Stevens, 2016). The $R^2$ value for endogenous latent variables of 0.75 has a substantial effect, 0.50 has a moderate effect, and 0.25 has a weak effect (Hair, Hult, Ringle, and Sarstedt, 2014).

The $R^2$ value observed at the Malaysia residents Behavioural Intention to use a smartwatch extracted from the IBM SPSS AMOS version 24 report is 0.655. Since two constructs, EE and PV, were not a determinant of Malaysia residents' Behavioural Intention to use a smartwatch, this study decided to re-evaluate the study model with five statistically significant constructs: PE, SI, HM HT and DB) and the adjusted $R^2$ value after study model re-evaluation is 0.650. Both $R^2$ and adjusted $R^2$ value classified as having a moderate explanatory effect (Hair et al., 2014). The study model $R^2$ and adjusted $R^2$ finding link to RQ8 and the discussion provided in the next chapter.

### 4.11.6 Effect of Moderation Variable: Gender

In this section, the effect of moderating variable gender on the study's conceptual model was analysed using the AMOS plugin "Multigroup Analysis" developed by Gaskin and Lim (2016). The study's conceptual model $\chi 2$ difference test p-value for both unconstrained and constrained models for male and female was found significant. The conceptual model $\chi 2$ difference test statistical outcome at the model level suggested that gender moderate the relationship between IVs and DV (refer to Table 4-47).

| Model | $X^2$ | DF |
|---|---|---|
| Unconstrained | 769.573 | 448 |
| Constrained | 788.753 | 455 |
| Difference | 19.18 | 7 |
| P-Value | 0.008 | |

Table 4-47 Model $\chi 2$ Difference Test for Gender

Source: Developed for this thesis

The comparative differences between gender β path strength and corresponding moderating effect interpretations between gender generated from Gaskin and Lim (2016) AMOS plugin "Multigroup Analysis" are shown in Table 4-48 below.

| Path Name | Male Beta | Female Beta | Difference in Betas | P-Value for Difference | Interpretation |
|---|---|---|---|---|---|
| PE → BI. | 0.658*** | 0.245* | 0.413 | 0.025 | The positive relationship between BI and PE is stronger for Male. |
| EE → BI. | -0.008 | 0.151 | -0.159 | 0.203 | There is no difference |
| SI → BI. | 0.143** | 0.032 | 0.111 | 0.185 | The positive relationship between BI and SI is only significant for Male. |
| HM → BI. | -0.104 | -0.192 | 0.089 | 0.525 | There is no difference. |
| PV → BI. | -0.012 | -0.132 | 0.12 | 0.207 | There is no difference |
| HT → BI. | 0.065 | 0.485*** | -0.421 | 0.002 | The positive relationship between BI and HT is stronger for Female. |
| DB → BI. | 0.231*** | 0.246* | -0.015 | 1 | There is no difference. |

Table 4-48 Gender β Path Comparison and Moderation Effect

Source: Developed for this thesis

#### 4.11.7 Effect of Moderation Variable: Age Group

In this section, the effect of moderating variable age groups on the study's conceptual model was analysed using the AMOS plugin "Multigroup Analysis" developed by Gaskin and Lim (2016). This study data collected five age groups, the initial computation using IBM SPSS AMOS version 24 showed that three age groups (Up to 14 years old: 2 cases, 15 years to 24 years: 9 cases and 65 years and above: 5 cases) do not have enough sample for multi-group analysis. The approach adopted by this study was to combine two age groups (Up to 14 years old: 2 cases and 15 years to 24 years: 9 cases) with 25 years to 54 years old group, creating a new group of up to 54 years old with a combined total of 310 cases. The 65 years and above with 5 cases combined with 55 years to 64 years group, creating a consolidated group of 55 years and above with 56 cases.

The two groups; up to 55 years old with 310 cases and 55 years and above with 56 cases analysed using the AMOS plugin "Multigroup Analysis" by Gaskin and Lim (2016). The study's conceptual model $\chi 2$ difference test p-value for both unconstrained and constrained models for two consolidated age groups (Up to 54 years: 310 cases and 55 years and above: 56 cases) was found not significant (refer to Table 4-49).

| Model | $X^2$ | DF |
|---|---|---|
| Unconstrained | 806.84 | 448 |
| Constrained | 810.73 | 455 |
| Difference | 3.89 | 7 |
| P-Value | 0.792 | |

Table 4-49 Model χ2 Difference Test for Age Group

Source: Developed for this thesis

The model χ2 difference statistical analysis using Gaskin and Lim (2016) AMOS plugin "Multigroup Analysis" p-value is not significant for both unconstrained and constrained models for two consolidated age groups. The conceptual model χ2 difference test statistical outcome at the model level suggested that the two age groups do not moderate the relationship between IVs and DV. Hence, the presentation of any comparative interpretation for both age groups β path strength and moderating effect is not meaningful in this case (Gaskin and Lim, 2016).

4.12 Study Model Posthoc Statistical Power Evaluation

This study model subjected to posthoc assessment using G*Power analysis software version 3.1.9.7 downloaded from Heinrich-Heine-Universität, Düsseldorf, Germany website. An F-tests selected, consistent with this study characteristics, is multiple linear regression, $R^2$ deviation from zero. A posthoc statistical power analysis based on α error probability, study sample size and effect size, $f^2$ (Faul, Erdfelder, Buchner, and Lang, 2007; Faul, Erdfelder, Buchner, and Lang, 2009) employed to comprehend the study's model ability to achieve substantial statistical power.

This study model's posthoc parameters entered into the G*Power analysis software version 3.1.9.7 are effect size, $f^2 = 1.8985507$, α err probability = 0.05, sample size = 366 and number of predictors = 7. The posthoc power analysis test indicated that 20 valid samples required to achieve 95% statistical power and 35 valid samples required to achieve 100% statistical power (refer to Chart 4-8); this study with 366 valid samples has adequate samples to achieve substantial statistical power.

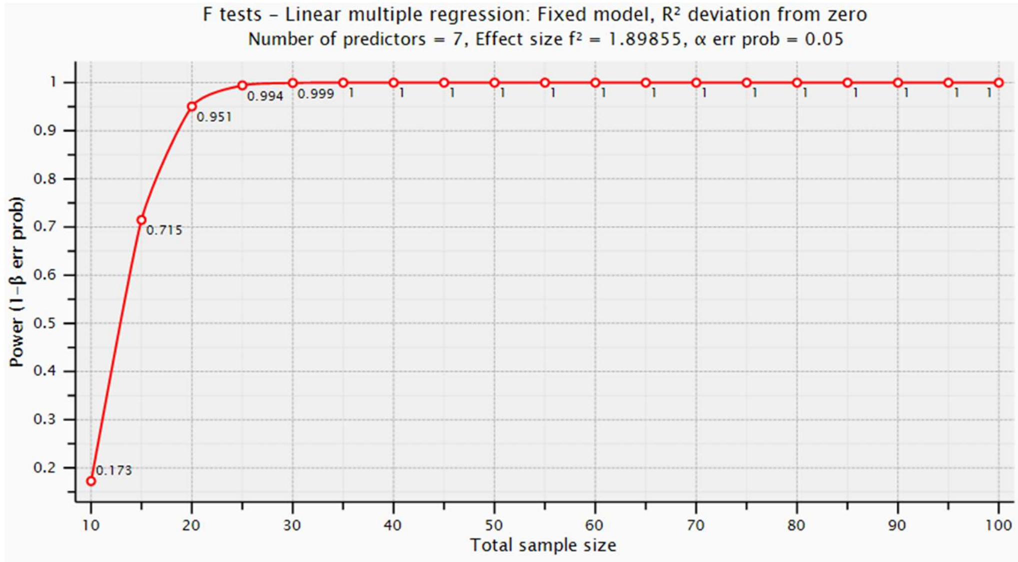



Chart 4-8 Study Model Post-Hoc Statistical Power Analysis

Source: Developed for this thesis

## 4.13 Chapter Summary

In this chapter, IBM SPSS version 23, IBM SPSS AMOS version 24, two AMOS version 24 plugins developed by Gaskin and Lim (2016) and G*Power Analysis version 3.1.9.7 employed to automate data analysis. The chapter presents the pilot study's outcome descriptive statistics and reliability (Cronbach's α internal consistency) assessment. This study primary data collection collected 393 sample data, and after data verification for missing, duplicate, unengaged responses, and outlier assessment, twenty-two suspected duplicate data and five outliers removed. The remaining 366 valid samples subjected to preliminary assessment against multivariate regression assumptions and justified as satisfying normality, linearity, homoscedasticity and multicollinearity. The primary dataset also satisfied the preliminary reliability assumption based on Cronbach's α internal consistency and preliminary validity assumption based on communalities.

A descriptive analysis of responses to each survey question and statistical summary of sample population characteristics presented. Non-parametric inferential analysis Mann-Whitney U test (alternative for parametric t-test) infer that there no perception or opinions differences between two independent groups (gender and nationality). Non-parametric inferential analysis Kruskal-Wallis test (alternative to single-factor ANOVA) infer that there no perception or opinions of multiple independent groups (age, education, income, and industry).

The outcome of multiple CMB assessments based on Harman's single factor test, correlational matrix, and full collinearity indicated that this study's primary dataset not influenced by common method bias. The primary dataset subjected to KMO sampling adequacy and Bartlett's sphericity assessment before the CFA step and satisfied the pre-requisite for factor analysis. This study seeks to understand the phenomenon under study by employing two-stage SEM. The first stage is a confirmatory approach to examine the study's measurement model reliability and validity before the second stage, where study hypotheses tested using SEM.

The study's measurement model satisfied the CFA composite reliability, convergence validity and discriminant validity (Fornell and Larcker method) and discriminant validity (HTMT method) assumptions, therefore, verified as reliable and valid. The GoF approximate indices and the standardised residual diagnostic assumptions compliances confirm that the study's measurement model is valid. The CFA quality indicators assessment's overall outcome suggested the study's measurement model is reliable and valid at both the operational and theoretical levels (Hair et al., 2010).

The SEM β path analysis performed using IBM SPSS AMOS version 24, five hypotheses (H1, H3, H4, H6 and H7) statistically significant and therefore supported. Hypotheses H1 PE exhibit a strong positive relationship ($\beta = 0.518$, *p-value* < 0.001), H3 SI weak positive relationship ($\beta = 0.112$, *p-value* = 0.01), H4 HM exhibit weak negative relationship ($\beta = -0.108$, *p-value* < 0.05), H6 HT exhibit weak positive relationship ($\beta = 0.176$, *p-value* < 0.001) and H7 DB exhibit moderate positive relationship ($\beta = 0.242$, *p-value* < 0.001). Two hypotheses H2 EE and H5 PV were statistically not significant, therefore, not supported. The $R^2$ coefficient determinant value observed at the Malaysia residents Behavioural Intention to use a smartwatch is 0.655, and the adjusted $R^2$ value with the five statistically significant constructs, PE, SI, HM, HT and DB, is 0.65. Both $R^2$ and adjusted $R^2$ value classified as having a moderate explanatory effect (Hair et al., 2014). This study with 366 valid samples has adequate samples to achieve substantial statistical power based on posthoc statistical power analysis (refer to section 4.12). The findings summarised in this paragraph link to RQ1 to RQ8, and details discussed provided in the next chapter.

# CHAPTER 5: DISCUSSION AND CONCLUSION

## 5.0 Introduction

The previous chapter provides the data analysis and findings of this thesis. This chapter summarises significant findings from the previous chapter before discussing each hypothesis finding, research questions, and research objectives. Other essential findings such as generalisation, inferential analysis between two and multiple groups, and descriptive observation of usage patterns were briefly discussed before discussing the study's academic and managerial implications. Finally, a section concluding the works presented in this thesis is presented.

## 5.1 Summary of this Study

The local smartwatch adoption research just started recently in 2016 and there are only six pieces of research literature published to date, making this field of study still in its infancy. The six pieces of local literature focus on understanding motivators that influence Malaysia residents' intention to use a consumer smartwatch. The most popular underpinning theory is TAM (three literature out of six literature, all analysing empirical data collected from university students), TAM and Net Valance framework (one literature, analysing empirical data collected from the population of Penang state), UTAUT2 theory (one literature purely applying the existing framework, analysing empirical data collected from the population of Penang state) and combination of the UTAUT2 and VAM (analysing empirical data collected from university students, however, the study stopped at CFA analysis). These studies examine behavioural intentions, adoption intentions and inspiration to use as dependent variables while independent factors are basic factors of TAM extended with cost, privacy, health risk, technology and fashion product, design aesthetic, hedonic, symbolic and independent factors of the UTAUT2 theory. In comparison to worldwide consumer smartwatch adoption literature, the findings from six pieces of local consumer smartwatch adoption research literature are quite limited and present room for further research opportunities. The low Malaysia smartwatch diffusion and the declining trend could be due to the scarcity of knowledge available for local practitioners to advance local smartwatch usage.

The observed phenomenon and research gaps prompted the development of a conceptual model underpinned by the UTAUT2 theory extended with Health Technology and Design Benefits constructs. The Health Technology construct was an important consumer smartwatch adoption motivator found empirically significant in other global smartwatch adoption research studies but was not tested in Malaysia smartwatch adoption research studies. The Design Benefits construct which was conceptualised from the combination of fashion, design aesthetic, design convenience and accessibility is a new concept. Its underlying factors such as fashion, design aesthetic, design convenience and accessibility were found as important as smartwatch adoption motivators in global smartwatch adoption research studies. In the context of Malaysia research studies, only fashion and design aesthetics were tested in Malaysia research studies and found significant as smartwatch adoption motivators, while design convenience and accessibility factors are untested factors. The works related to the conceptual model and hypotheses development were presented in Chapter 2 and the research and data collection process outline in Chapter 3. The next few sections summarise the findings that were presented in Chapter 4.

### 5.1.1 Summary of Preliminary Measurement Model Assessment

This study aims to achieve a confidence level of 95% with a margin of error of ±5%. This study's minimum recommended sample size based on Hair et al. (2010) for structural equation modelling is 200 valid cases; however, this study collected 393 responses from an individual residing in Malaysia using a self-administered questionnaire via an internet survey and upon data screening, removing duplicate (22 cases) and outlier cases (5 cases). The remaining 366 valid samples gauged for normality, linearity, homoscedasticity and found satisfying multivariate regression assumptions. A preliminary assessment indicated that the primary dataset satisfied reliability based on Cronbach's α internal consistency, validity based on communalities assessment and not influenced by common method bias based on multicollinearity assessment.

### 5.1.2 Summary of CFA and SEM Assessment

This study measurement model is a priori model based on the UTAUT2 theory as anchor theory and extended with smartwatch specific constructs from smartwatch adoption literature. In the initial stage of the study, the researcher assumed that the study model likely inherited the reliability, validity and parsimony properties of the UTAUT2 theory and smartwatch specific concept adopted from smartwatch adoption literature at a conceptual level.

This study's measurement model satisfied Harman's single factor test, correlation matrix assessment, full collinearity assessment assumption; therefore, not influenced by common method bias. The study measurement model satisfied KMO sampling adequacy, Bartlett's sphericity assessment, composite reliability, convergence validity, discriminant assumptions. The GoF indices and standardized residual diagnostic outcomes suggested that the measurement model is valid (Hair et al., 2010). The study's measurement model converted into an SEM path relationship diagram in IBM SPSS AMOS version 24 and evaluated. The SEM model converted from this study's measurement model evaluated and found satisfying GoF indices assumptions. The study model posthoc statistical power analysis suggested that this study with 366 valid samples has adequate samples to achieve substantial statistical power. Next, this chapter will discuss each hypothesis behaviour (PE, EE, SI, HM, PV, HT and DB), the $R^2$ and adjusted $R^2$ coefficient determinant from the following section onward. The next few sections discussed the findings of this study.

## 5.2 Discussion of H1 Performance Expectancy Factor

### 5.2.1 Current Practices – Performance Expectancy

This study noted that in the current consumer smartwatch functionalities can be categorised into health and fitness technologies, infotainment and communications, assisted living and safety, and lifestyle and fashion (Cheng and Mitomo, 2017; Choi and Kim, 2016; Chuah, Rauschnabel, Krey, Nguyen, Ramayah and Lade, 2016; Dehghani, 2018; Peake, Kerr and Sullivan, 2018; Tehrani and Andrew, 2014). These consumer smartwatch technology functionalities are perceived as utilitarian and influenced individuals' intention to use the technology (Canhoto and Arp, 2016).

Venkatesh et al. (2012) introduced the Performance Expectancy concept by combining five different factors from various technology acceptance theories: perceived usefulness from TAM, extrinsic motivation from MM, job-fit from MPCU, relative advantage from IDT, and outcome expectation from SCT. The Performance Expectancy of the UTAUT2 theory has been linked to assessing the degree of individual belief that using technology help the individual to improve overall performance.

Currently, only a single local consumer smartwatch adoption research study found empirically examine the Malaysia smartwatch technology acceptance based on the UTAUT2 theory. Beh et al. (2019) found that the Performance Expectancy construct is the strongest predictor of Malaysians' propensity to adopt a smartwatch (Beh et al., 2019). Because a single consumer smartwatch adoption study observation on the influence of Performance Expectancy in Malaysia is regarded as limited, this study opted to re-examine the Performance Expectancy construct to validate its effect on Malaysia individuals' behavioural intention to use a consumer smartwatch. The findings of this study are discussed in the next section.

### 5.2.2 Study Findings – Performance Expectancy

- The study RQ1 - What is the significance of Performance Expectancy on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context?

- The study RO1 examine the Performance Expectancy's influence on Malaysia residents' Behavioural Intention to use a smartwatch and test the significance of Performance Expectancy on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context.

- The study H1 predicts that Performance Expectancy has a significant and positive influence on Malaysia residents' Behavioural Intention to use a smartwatch.

H1 Performance Expectancy hypothesis result reported in the previous chapter was a supported hypothesis and statistically found to exhibit a strong positive significant relationship ($\beta = 0.518$, *p-value* < 0.001) toward Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context. Among all the seven proposed constructs in the conceptual smartwatch adoption model, Performance Expectancy is the most robust determinant of Malaysia residents' behavioural intention to use a smartwatch in a consumer context. This study's findings on Performance Expectancy are in line with Beh et al. (2019), who found that the Performance Expectancy construct is the strongest predictor of Malaysia residents' desire to use a consumer smartwatch. The findings of the study on the Performance Expectancy construct's behaviour were in line with global non-Malaysia smartwatch adoption research, for example, Gao et al. (2015), Kranthi and Ahmed (2018), Talukder et al. (2019) and Yuan et al. (2015).

In summary, the hypothesis H1 Performance Expectancy is the most robust hypothesis among all hypotheses in the conceptual smartwatch adoption model. At $\beta = 0.518$, *p-value* < 0.001 exhibited a strong positive relationship toward Malaysia residents'

Behavioural Intention to use a smartwatch in a consumer context. The discussion in this section, together with H1 SEM findings in the previous chapter, demonstrated the accomplishment of RO1 and adequately answered RQ1.

#### 5.2.3 Recommendations – Performance Expectancy

The review of the ongoing practice and the findings of the Performance Expectancy variable discussed in the preceding section indicated that current consumer smartwatch functions are perceived as utilitarian functions where it positively influenced Malaysia residents' and global individuals' behavioural intentions to use a consumer smartwatch technology. The findings of Performance Expectancy are likely to be universally applicable because Performance Expectancy is a strong determining factor in Malaysia and also a determining variable for global study.

This study recommended that consumer smartwatch manufacturers' product management and marketing organisations continue to get a deeper knowledge by measuring customer satisfaction with current performance functions and regularly survey current users' expectations for additional performance capabilities and non-users interests and views. The market intelligence together with a competitive analysis of other smartwatch manufacturers' offerings can provide cues for optimising resources on innovation that matches market expectations, therefore, boosting the odds of retaining the existing consumer base and attracting interest from new consumers.

## 5.3 Discussion of H2 Effort Expectancy Factor

#### 5.3.1 Current Practices – Effort Expectancy

Venkatesh et al. (2012) introduced the Effort Expectancy concept by combining three different factors from various technology acceptance theories: perceived ease of use from TAM, complexity from MPCU and complexity from IDT. The Effort Expectancy of the UTAUT2 theory has been linked to assessing the degree of individual believes that it is easy to learn or use innovative technology. In the current market, the consumer smartwatch user interface design, navigation and eco-system have a close resemblance to smartphone user interface design, navigation and eco-system.

Currently, only a single local consumer smartwatch adoption research study found empirically examine the Malaysia smartwatch technology acceptance based on the UTAUT2 theory. Beh et al. (2019) found that the Effort Expectancy construct is a predictor of Malaysians' propensity to adopt a smartwatch (Beh et al., 2019). Because a single consumer smartwatch adoption study observation on the influence of Effort

Expectancy in Malaysia is regarded as limited, this study opted to re-examine the Effort Expectancy construct to validate its effect on Malaysia individuals' behavioural intention to use a consumer smartwatch. The findings of this study are discussed in the next section.

5.3.2 Study Findings – Effort Expectancy

- The study RQ2 - What is the significance of Effort Expectancy on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context?

- The study RO2 examine the Effort Expectancy's influence on Malaysia residents' Behavioural Intention to use a smartwatch and test the significance of Effort Expectancy on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context.

- The study H2 predicts that Effort Expectancy has a significant and positive influence on Malaysia residents' Behavioural Intention to use a smartwatch.

The H2 Effort Expectancy hypothesis result reported in the previous chapter was not supported and exhibited a weak non-significant effect ($\beta = 0.058$, p-value $> 0.05$) toward Malaysia residents' behavioural intention to use a smartwatch in a consumer context. The study Effort Expectancy behaviour was found not consistent with the original UTAUT2 theory and findings of Beh et al. (2019). In contrast, two research studies applying the UTAUT2 also discover that Effort Expectancy is not a determinant of Behavioural Intention to use a smartwatch (Kranthi and Ahmed, 2018; Yuan et al., 2015), and a meta-study by Niknejad et al. (2020) tabulated that Perceived Ease of Use and Effort Expectancy was a non-influencing factor twice out of four previous smartwatch adoption studies. These studies suggested that individual experience with smartphone and literacy levels is likely to influence Effort Expectancy factor behavioural deviation.

The statistical analysis of three observable questions that measure the Effort Expectancy construct shows a high mean value of 4.18 and small variance; the statistic suggested that the Malaysia residents perceived that smartwatch is easy to learn and not an obstacle that influences behavioural intention (refer to Chapter 4, Section 4.7.5). The education demographic profile indicated that 92.9% holds academic education beyond secondary school, with 80.88% university graduate (refer to Chapter 4, Section 4.7.15) suggesting that learning a new technology may not be an obstacle for the Malaysia residents. The study finding implies that Malaysia residents believe that learning how to use a consumer smartwatch is not challenging. The consumer smartwatch employed a similar human-computer interface technology similar to a smartphone human-computer interface touch-screen, touch-screen items look and feels and third-party application ecosystem. Due to the high penetration of smartphones in Malaysia, individuals are likely to have prior experience with smartphone user design, navigation and eco-system, therefore, potentially reducing individual's consumer smartwatch product learning curve. Thus, Malaysia residents' previous experience using smartphone technology and education literacy are likely source that influences Effort Expectancy factor deviation. This study's observation is consistent with other researchers' observations and explanation for Effort Expectancy factor deviation discussed in the previous paragraph.

In summary, the hypothesis H2 Effort Expectancy found statistically not supported at $\beta = 0.058$, p-value $> 0.05$, therefore did not influence Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context. The discussion in this section, together with H2 SEM findings in the previous chapter, demonstrated the accomplishment of RO2 and adequately answered RQ2.

### 5.3.3 Recommendations – Effort Expectancy

The review of the ongoing practice found that influence of Effort Expectancy on individuals' intention to use a consumer smartwatch by some of global smartwatch adoption studies and this study is inconsistent with the UTAUT2 theory. Various global consumer smartwatch adoption research studies explained that familiarity with smartphones usage and ICT literacy are the main reasons for such deviations. Due to high smartwatch penetration and good ICT literacy in Malaysia, this study found that Effort Expectancy is not a predictor of Malaysia individuals' behavioural intentions to use a consumer smartwatch.

This study agreed that consumer smartwatch producers' current strategy of making consumer smartwatch user interface design, navigation and eco-system similar to a smartphone is a good approach, where it could reduce individuals learning time and effort. This study, therefore, recommended that consumer smartwatch producers continue to leverage individuals' familiarity with smartphone user interface design, navigation and eco-system. Existing customers will benefit from the continuation of the same strategy because their intuition and user experience will be minimally disrupted. Due to the high penetration of smartphones in Malaysia, individuals who have never used a consumer smartwatch are likely to have used a smartphone before, and they may find the user interface, navigation and eco-system of a consumer smartwatch familiar and intuitive.

Thus, easy to learn and intuitive human-to-machine interfaces improved the probability of retaining the current customer base and attracting interest from new customers.

## 5.4 Discussion of H3 Social Influence Factor

### 5.4.1 Current Practices – Social Influence

Venkatesh et al. (2012) introduced the Social Influence concept by combining three different factors from five various technology acceptance theories: subjective norm from TRA, TPB, C-TAM-TPB, the social concept from MPCU and image from IDT. The Social Influence of the UTAUT2 theory has been linked to assessing the degree of individual belief that behavioural intention to use innovative technology is influenced or encouraged by society. This study noted that consumer smartwatch manufacturers leverage a variety of social media platforms and advertising channels to educate and raise awareness about their products. These initiatives are part of a direct corporate marketing plan to promote consumer smartwatch products, either through well-known influencers or through direct education videos or information about the benefits of smartwatch technology. This study also observed indirect and voluntary actions by individuals sharing their experience and achievement using consumer smartwatch technology in their daily life on various social medial platforms. The effect of such voluntary actions may also spread and influence their friends and family intention to explore and understand consumer smartwatch technology.

Currently, only a single local consumer smartwatch adoption research study empirically examines the Malaysia smartwatch technology acceptance based on the UTAUT2 theory. Beh et al. (2019) found that the Social Influence variable is not a predictor of Malaysians' propensity to adopt a smartwatch, the discovery is not consistent with the UTAUT2 theory. Because a single consumer smartwatch adoption study observation on the influence of Social Influence is regarded as limited, this study opted to re-examine the Social Influence variable of the UTAUT2 theory. The findings of this study are discussed in the next section.

### 5.4.2 Study Findings – Social Influence

- The study RQ3 - What is the significance of Social Influence on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context?

- The study RO3 examine the Social Influence's effect on Malaysia residents' Behavioural Intention to use a smartwatch and test the significance of

Social Influence on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context.

- The study H3 predicts that Social Influence has a significant and positive influence on Malaysia residents' Behavioural Intention to use a smartwatch.

The H3 Social Influence hypothesis result reported in the previous chapter was supported and statistically found to exhibit a weak positive significant relationship ($\beta$ = 0.112, *p-value* = 0.01) toward Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context. This study finding on the Social Influence construct's behaviour was consistent with past smartwatch adoption literature insights, for example, Gao et al. (2015), Kranthi and Ahmed (2018) and Talukder et al. (2019). Among all the seven proposed constructs in the conceptual smartwatch adoption model, Social Influence is rank fourth in term of the strength of predicting Malaysia residents' behavioural intention to use a smartwatch in a consumer context.

The study finding suggested that Malaysia residents influenced by the social circle (friends and family) and social media (expert, influencing figures and credible news). Although Social influence is the fourth in terms of positive influencing strength, the key message is that Malaysia residents follow the social norm consistent with various other researchers finding referred to by this study. The finding implies that social influencers and expert opinions via social networks continue to play a relevant role in promoting consumer smartwatch adoption in Malaysia. Therefore, consumer smartwatch producers could employ network influencers and experts to advertise, promote and educate the benefits of using consumer smartwatch via popular social media channels to increase their product adoption.

In summary, the hypothesis H3 Social Influence ranks fourth in terms of relationship strength among all hypotheses in the conceptual smartwatch adoption model, supported at $\beta$ = 0.112 with *p-value* = 0.01, exhibited a weak positive relationship toward Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context. The discussion in this section, together with H3 SEM findings in the previous chapter, demonstrated the accomplishment of RO3 and adequately answered RQ3.

### 5.4.3 Recommendations – Social Influence

The review of the ongoing practice found that effect of Social Influence on individuals' intention to use a consumer smartwatch by most global smartwatch adoption studies and this study is consistent with the UTAUT2 theory. A meta-study compiled by Niknejad et al. (2020) tabulated that Social Influence shows resiliency as a predictor of behavioural intention, where 8 studies found Social Influence empirically affect behavioural intention out of a total of 10 smartwatch and smart wearables studies. These studies practically suggest that social events around us from social media and paid advertising influence individuals interests and intention to use a consumer smartwatch technology. The finding suggested that Malaysia residents are influenced by the social circle (friends and family) and social media (expert, influencing figures and credible news).

This study recommended that consumer smartwatch producers continue with the current practices as its strategy is to educate and create awareness of consumer smartwatch products through social media platforms and advertising channels remain effective. social influencers and expert opinions via social networks continue to play a relevant role in promoting consumer smartwatch adoption in Malaysia. Consumer smartwatch producers could employ network influencers and experts in advertising, promote and educate the benefits of using consumer smartwatches via popular social media channels to increase their product awareness and adoption interest. To encourage more voluntary actions from individuals to promote consumer smartwatch products, consumer smartwatch producers should make it easy, seamless and intuitive for individuals to share their multitude of personal or group achievements directly via a consumer smartwatch. This indirect and voluntary channel could complement the official advertising channel and generate a multipliers effect in terms of increasing the probability of reaching a wider social coverage.

## 5.5 Discussion of H4 Hedonic Motivation Factor

### 5.5.1 Current Practices – Hedonic Motivation

This study noted that in the current consumer smartwatch functionalities can be categorised into health and fitness technologies, infotainment and communications, assisted living and safety, and lifestyle and fashion (Cheng and Mitomo, 2017; Choi and Kim, 2016; Chuah, Rauschnabel, Krey, Nguyen, Ramayah and Lade, 2016; Dehghani, 2018; Peake, Kerr and Sullivan, 2018; Tehrani and Andrew, 2014). These consumer smartwatch technology functionalities other than being perceived as utilitarian, are also perceived as hedonic where both factors are found influencing individuals' intention to use the technology (Canhoto and Arp, 2016). In practice, this study also observed usage of these consumer smartwatch functions could generate performance expectancy and hedonic motivation.

Venkatesh et al. (2012) introduced the Hedonic Motivation concept using the perceived enjoyment variable and intrinsic motivation variable from MM. The Hedonic Motivation of the UTAUT2 theory has been linked to assessing the degree of individual enjoyment derived from using a consumer smartwatch technology and it plays an important role in predicting technology acceptance and use.

Currently, only a single local consumer smartwatch adoption research study found empirically examine the Malaysia smartwatch technology acceptance based on the UTAUT2 theory. Beh et al. (2019) found that the Hedonic Motivation construct is a predictor of Malaysians' intention to adopt a consumer smartwatch (Beh et al., 2019). Because a single consumer smartwatch adoption study observation on the influence of Hedonic Motivation in Malaysia is regarded as limited, this study opted to re-examine the Hedonic Motivation construct to validate its effect on Malaysia individuals' behavioural intention to use a consumer smartwatch. The findings of this study are discussed in the next section.

5.5.2 Study Findings – Hedonic Motivation

- The study RQ4 - What is the significance of Hedonic Motivation on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context?

- The study RO4 examine the Hedonic Motivation's influence on Malaysia residents' Behavioural Intention to use a smartwatch and test the significance of Hedonic Motivation on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context.

- The study H4 predicts that Hedonic Motivation has a significant and positive influence on Malaysia residents' Behavioural Intention to use a smartwatch.

The H4 Hedonic Motivation hypothesis result reported in the previous chapter was supported and statistically found to exhibit a weak negative significant relationship ($\beta = -0.108$, *p-value* $< 0.05$) toward Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context. However, hypothesis H4 outcome indicated that Malaysia residents' relationship direction toward Behavioural Intention is negatively influenced instead of positively influence predicted by this study. Hence, hypothesis H4 misclassified by this study. Among all the seven proposed constructs in the conceptual smartwatch adoption model, Hedonic Motivation is rank fifth in term strength of predicting Malaysia residents' behavioural intention to use a smartwatch in a consumer context.

In a meta-study compiled by Niknejad et al. (2020), the perceived enjoyment variable which is similar to Hedonic Motivation found 7 times out of 9 studies to positively influence behavioural intention to use a smart band or smartwatch. These studies suggested that the perceived enjoyment variable associated with fun and entertainment positively affect individuals' adoption process of a consumer smartwatch. The study finding on Hedonic Motivation construct's behaviour was consistent with past smartwatch adoption studies, such as Beh et al. (2019), Kranthi and Ahmed (2018) and Yuan et al. (2015) in terms of the significance of relationship but not in term of directional relationship. This study finding found the Hedonic Motivation variable has a weak negative influence on Malaysia residents' intention to use a consumer smartwatch adoption.

In summary, the hypothesis H4 Hedonic Motivation ranks fifth in terms of relationship strength among all hypotheses in the conceptual smartwatch adoption model, supported at $\beta = -0.108$, *p-value* $< 0.05$ and exhibited a weak negative relationship toward Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context. The discussion in this section, together with H4 SEM findings in the previous chapter, demonstrated the accomplishment of RO4 and adequately answered RQ4.

### 5.5.3 Recommendations – Hedonic Motivation

This study finding on the Hedonic Motivation variable discussed in the preceding section indicated it is the weakest predictor and directionally inconsistent with Beh et al. (2019), other past global smartwatch adoption studies and the UTAUT2 theory. The directional contradiction implies that more empirical research in Malaysia is required to confirm the effect of Hedonic Motivation on the Malaysia individuals' behavioural intention. Since Malaysia smartwatch adoption study is still in an infancy stage, this study encourages the Malaysia research community to perform more studies on the Hedonic Motivation variable, to acquire a better understanding of the behaviour of Hedonic Motivation.

In this study, the Hedonic Motivation variable was found to influence Malaysia individuals' intention to use a consumer smartwatch. However, this study acknowledges that the directional influence of the Hedonic Motivation construct found by this study is a weak negative, which differs from Beh et al. (2019) and other global smartwatch adoption studies. Considering the contradictory circumstances, this study does not have enough conviction to offer any concrete recommendation to consumer smartwatch producers.

## 5.6 Discussion of H5 Price Value Factor

### 5.6.1 Current Practices – Price Value

Venkatesh et al. (2012) argued that in an organisational context, technology is paid by the organisation; therefore, there is no sensitive impact on any individual in any corporation when considering technology acceptance and use. At a personal level, an individual paying for the technology is sensitive to price and value; hence the price and value composition mix influences consumer decision when considering technology adoption (Venkatesh et al. 2012). The Price Value of the UTAUT2 theory has been linked to assessing the degree of individual decision represents a personal intellectual trade-off evaluation comparing the product technology benefits versus the cost of owning and using the innovation. This study noted that consumer smartwatches available on e-commerce websites such as Alibaba.com, Lazada.com, Shoppee.com and Amazon.com showed that there are a variety of consumer smartwatches brands with differing offerings associated with their price. In short, consumer smartwatches market segments ranging from the luxury segment, mid-range, and entry-level have matching prices and value that could satisfy consumer expectations.

Currently, only a single local consumer smartwatch adoption research study empirically examines the Malaysia smartwatch technology acceptance based on the UTAUT2 theory. Beh et al. (2019) found that the Price Value variable is not a predictor of Malaysians' tendency to adopt a smartwatch, the discovery is not consistent with the UTAUT2 theory. Because a single consumer smartwatch adoption study observation on the influence of Price Value is regarded as limited, this study opted to re-examine the Price Value variable of the UTAUT2 theory. The findings of this study are discussed in the next section.

### 5.6.2 Study Findings – Price Value

- The study RQ5 - What is the significance of Price Value on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context?

- The study RO5 examine the Price Value's influence on Malaysia residents' Behavioural Intention to use a smartwatch and test the significance of Price

Value on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context.

- The study H5 predicts that Price Value has a significant and positive influence on Malaysia residents' Behavioural Intention to use a smartwatch.

The hypothesis H5 Price Value reported in the previous chapter was not supported and exhibit a weak non-significant effect ($\beta$ = -0.051, *p-value* > 0.05) toward Malaysia residents' behavioural intention to use a smartwatch in a consumer context. Although other smartwatch adoption, for example, Kranthi and Ahmed (2018) and Yuan et al. (2015), have found Price Value influencing Behavioural Intention, this study's Price Value behaviour was not consistent with the original UTAUT2 theory. The finding is consistent with Beh et al. (2019) study, which reported the Price Value factor as a non-significant predictor of Behavioural Intention to use a smartwatch in Malaysia. Beh et al. (2019) explained plenty of consumer smartwatch choices available in Malaysia market, individual select consumer smartwatch product that fits their price value perception; hence, Price Value is not a critical individual concerned (Beh et al., 2019).

Based on the income profile of survey participants, 50.3% earned more than RM10k per month, 23.9% earned between RM5k to RM10k and 15.9% earned between RM2k and RM5k. The median and mode for the Price Value variable were 3.0 which suggest that most participants perception is neutral. The statistical analysis of three observable survey questions that measure the Price Value construct of this study shows a mean value of 3.32 with a small variance; the statistic indicated that participants when considering a consumer smartwatch, on average, is almost neutral on smartwatch cost or smartwatch price versus value (refer to Chapter 4, Section 4.7.8). The other observation by this study browsing two popular e-commerce websites available in Malaysia, such as Lazada.com and Shopee.com, shows plenty of consumer smartwatch brands marketed at varying prices ranging from affordable to premium pricing. Both observation of this study consistent with Beh et al. (2019) observation and explanation for Price Value factor deviation.

In summary, the hypothesis H5 Price Value is statistically not supported at $\beta$ = -0.051, *p-value* > 0.05, therefore did not influence Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context. The discussion in this section, together with H5 SEM findings in the previous chapter, demonstrated the accomplishment of RO5 and adequately answered RQ5.

### 5.6.3 Recommendations – Price Value

This study found that the Price Value variable does not influence Malaysia individuals' intention to use a consumer smartwatch, the finding is consistent with Beh et al. (2019) but inconsistent with the UTAUT2 theory. The finding of this study supported Beh et al. (2019) finding that Malaysia residents are likely not influenced by the Price Value variable when considering the use of a consumer smartwatch. The study participants income profile and Price Value variable perception and findings imply that Malaysia residents were likely less concerned with price and value when considering the adoption of a consumer smartwatch. It also likely implies that Malaysia residents have adequate purchasing power and are likely to be able to find and select smartwatch products that satisfy their target price and value expectation since there are plenty of different consumer smartwatches targeting different market segments. Hence, this study suggested that consumer smartwatch producers continue with their existing market offering and segmentation strategy or adjust their offering strategy if they want to increase or reduce their market segment coverage.

## 5.7 Discussion of H6 Health Technology Factor

### 5.7.1 Current Practices – Health Technology

The review of smart wearable device patents by Dehghani and Dangelico (2017) suggested that the consumer smartwatch is strategically positioned for use within the medical and health care industry. Hsiao and Chen (2018) argued that a consumer smartwatch worn around a human wrist enables the device to continuously be in contact with the human body is perceived as why the consumer smartwatch is extensively adopted in the fields of health care and athletic activities. A qualitative research study by Adapa et al. (2018) postulates that health and fitness application is a deciding factor for individual intention to use a consumer smartwatch while quantitative study by Dehgani et al. (2018) hypothesised that the health technology factor is an essential predictor of personal behavioural intention to use a consumer smartwatch.

Numerous practitioner survey report also indicated that the main reason for adopting a smartwatch is to manage personal health and fitness tracking (Richter, 2017; PWC, 2015; PWC, 2016). This study also observed that locally there are individuals who use consumer smartwatches to support health and fitness tracking and sports activities. However, currently, no local consumer smartwatch adoption research study found empirically examines the Malaysia smartwatch technology acceptance based on the

UTAUT2 theory extended with health technology variable. Hence, this study proposes examining the Health Technology variable to understand its effect on Malaysia individuals' behavioural intention to use a consumer smartwatch. The findings of this study are discussed in the next section.

#### 5.7.2 Study Findings – Health Technology

- The study RQ6 - What is the significance of Health Technology on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context?

- The study RO6 examine the Health Technology's influence on Malaysia residents' Behavioural Intention to use a smartwatch and test the significance of Health Technology on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context.

- The study H6 predicts that Health Technology has a significant and positive influence on Malaysia residents' Behavioural Intention to use a smartwatch.

The H6 Health Technology hypothesis result reported in the previous chapter was supported and statistically found to exhibit a weak positive significant relationship ($\beta = 0.176$, *p-value* < 0.001) toward Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context. Among all the seven proposed constructs in the conceptual smartwatch adoption model, Health Technology ranks third in term of the strength of predicting Malaysia residents' behavioural intention to use a smartwatch in a consumer context.

This study's finding on the Health Technology construct's behaviour was consistent with past smartwatch adoption literature insights. Dehghani et al. (2018) found that health technology is a significant predictor of behavioural intention to use a smartwatch. Numerous practitioner surveys reported that personal health and fitness tracking are among the top reasons' individuals adopt a consumer smartwatch (Richter, 2017; PWC, 2015; PWC, 2016). Besides, numerous research literature associates the interest in consumer smartwatch use with quantified self-tracking movement, where individual use consumer smartwatch to collect, track, monitor, and deliver personal physical activity and health information (Hänsel et al., 2015; Jung et al., 2016; Lentferink et al., 2017).

Although Health Technology predictive strength is third in the pecking order among all the seven constructs, the study finding suggested that Malaysia residents believe that Health Technology boosts their performance and life well-being. This study suggests appraising it as a sub-division from the overall Performance Expectancy factor because Malaysia resident believes using consumer smartwatch Health Technology as a pathway to improve personal performance and attain life well-being. The finding implies that consumer smartwatch producers can increase consumer smartwatch adoption in Malaysia by delivering health and fitness technology performance expectations. It also implies that consumer smartwatch producers who can innovate and differentiate their consumer smartwatch health and fitness features would likely stay ahead of the Malaysia consumer smartwatch market competition.

In summary, the hypothesis H6 Health Technology ranks third in terms of relationship strength among all hypotheses in the conceptual smartwatch adoption model, supported at $\beta = 0.176$, *p-value* < 0.001, exhibited a weak positive relationship toward Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context. The discussion in this section, together with H6 SEM findings in the previous chapter, demonstrated the accomplishment of RO6 and adequately answered RQ6.

### 5.7.3 Recommendations – Health Technology

The findings of the Health Technology variable suggested that Health Technology positively influenced Malaysia residents' behavioural intentions to use a consumer smartwatch and is consistent with findings of other global smartwatch adoption studies. The findings of Health Technology are likely to be universally applicable because Health Technology is both determining factor in Malaysia and global study. The finding suggests Health Technology is an essential utilitarian function and positively influenced Malaysia residents' intention to use a consumer smartwatch.

This study recommended that consumer smartwatch manufacturers' product management and marketing organisations focus on developing rich and accurate health technology offerings in their consumer smartwatch products as consumers rely on consumer smartwatch products to measure and inform their health, fitness and sports training. At the same time, consumer smartwatch producers should continue to get a deeper knowledge by measuring customer satisfaction with current health technology functions and regularly surveying current users' expectations for additional health technology capabilities and non-users interests and views. The market intelligence together with a competitive analysis of other smartwatch manufacturers' offerings can provide cues for optimising resources on innovation that matches market expectations, therefore, boosting the odds of retaining the existing consumer base and attracting interest from new consumers.

## 5.8 Discussion of H7 Design Benefit Factor

### 5.8.1 Current Practices – Design Benefit

Dehgani et al. (2018) and Dehgani and Kim (2019) empirically confirmed that the aesthetic appeal variable affects both consumer smartwatch users and non-users toward continuance intention and usage behaviour. Dehgani and Kim (2019) study also empirically confirmed that the need for uniqueness variable affects non-smartwatch users' behavioural intention to use a consumer smartwatch. Hsiao (2017) empirically confirmed that design aesthetic affects individuals' intention to accept a consumer smartwatch and Hsiao and Chen (2018) empirically confirmed that design aesthetic affects individuals' attitude to accept a consumer smartwatch. In the same study, Hsiao and Chen (2018) also empirically confirmed that the design aesthetic with social value (social image of having a smartwatch) variable influences individuals' intention to use a consumer smartwatch. This finding is consistent with Dehgani and Kim (2019) study, which empirically confirmed that the need for uniqueness affects individuals' intention to adopt a consumer smartwatch. Both Hsiao and Chen (2018) and Dehghani and Kim (2019) also postulated that smartwatches size, shape, and uniqueness are determinants of consumer smartwatch purchase intention and continuance intention. These studies provide insights that consumer smartwatch aesthetic design variables influence individuals' intention to use or continue to use a consumer smartwatch.

Jung et al. (2016) based on polling perception and thought of 123 South Korean individuals revealed that 51.6% of participants choose design aesthetic (display size and shape) variable when prospecting for a consumer smartwatch, which suggested that slightly more than half of the participants considered the aesthetic design variable as vital. 20.1% of participants indicated a preference for a consumer smartwatch with smartphone capabilities (not a companion device to a smartphone). Consumer smartwatch portability (lightweight, securely attached to the human wrist, convenience and accessibility) is an essential adoption consideration (Canhoto and Arp, 2016; Cecchinato et al., 2015; Kalantari, 2017). This observation suggested that 20.1% are interested in having a standalone consumer smartwatch, slightly more than a fifth of participants express a preference for standalone consumer smartwatches that can potentially replace the need to carry loosely held smartphones (Jeong et al., 2016). Local studies based on Chuah et al. (2016) and Krey et al. (2019) suggested that Malaysia university students are influenced by perceived visibility and perceived symbolism variables when considering the adoption of a consumer smartwatch. Both studies suggested that Malaysia students' perception of consumer smartwatches consist of dual dimensions; a smart technology gadget and a smart fashion gadget.

In this study, these variables; aesthetic design, portability, visibility and symbolism are collectively represented as the design benefit construct. This study postulated that design benefit could influence Malaysia individuals' intention to use a consumer smartwatch when considering practical needs and activities in their daily life. However, currently, there is no local consumer smartwatch adoption research study found empirically examining the Malaysia smartwatch technology acceptance based on the UTAUT2 theory extended with design benefit variable. Hence, this study proposes examining the Design Benefit construct to understand its effect on Malaysia individuals' behavioural intention to use a consumer smartwatch. The findings of this study are discussed in the next section.

5.8.2 Study Findings – Design Benefit

- The study RQ7 - What is the significance of Design Benefit on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context?

- The study RO7 examine the Design Benefit's influence on Malaysia residents' Behavioural Intention to use a smartwatch and test the significance of Design Benefit on Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context.

- The study H7 predicts that Design Benefit has a significant and positive influence on Malaysia residents' Behavioural Intention to use a smartwatch.

The H7 Design Benefit hypothesis result reported in the previous chapter was supported and statistically found to exhibit a moderate positive significant relationship ($\beta = 0.242$, p-value < 0.001) toward Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context. Among all the seven proposed constructs in the conceptual smartwatch adoption model, H7 Design Benefit ranks second in terms of strength of predicting Malaysia residents' behavioural intention to use a smartwatch in a consumer context. The Design Benefit factor in this study conceived from past studies that the aesthetic design of a consumer smartwatch and its advantages as a wearable influence individual Behavioural Intention to use a smartwatch. This study's findings on the Design Benefit construct's behaviour were consistent with numerous research studies that found aesthetic design characteristics such as smartwatches size, shape, and uniqueness are determinants of smartwatch use, purchase and continuance intention (Hsiao, 2017; Hsiao and Chen, 2018; Dehghani and Kim, 2019; Jung et al., 2016) and portability (Canhoto and Arp, 2016; Cecchinato et al., 2015; Kalantari, 2017).

Krey et al. (2019) found that Malaysia student perceived consumer smartwatch as both information technology and fashion technology. The Malaysia residents perceived consumer smartwatch as having dual dimensionality, a fashion product in this case and an information technology product, as explained in the previous Performance Expectancy and Health Technology factor. The overall observation of this study is consistent with Krey et al. (2019). The finding implies that, in addition to delivering general performance and health technology features, consumer smartwatch producers can increase consumer smartwatch adoption in Malaysia by packaging the intelligent wearable computer into aesthetic looking packaging that offers variation in terms of colour, appearance and material. Besides, the Malaysia residents favour the convenience of a consumer smartwatch as wearable in their daily lives than a loosely held smartphone indicated that they favour using a smartwatch compared to a smartphone with health application (refer to Chapter 4, section 4.7.10).

In summary, the hypothesis H7 Design Benefit ranks second in terms of relationship strength among all hypotheses in the conceptual smartwatch adoption model, supported at $\beta = 0.176$, *p-value* $< 0.001$ exhibited a moderate positive relationship toward Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context. The discussion in this section, together with H7 SEM findings in the previous chapter, demonstrated the accomplishment of RO7 and adequately answered RQ7.

### 5.8.3 Recommendations – Design Benefit

The discussion and findings of the Design Benefit variable in the preceding section suggested that Design Benefit positively influenced Malaysia residents' behavioural intentions to use a consumer smartwatch. The Design Benefit variable is the second strongest factor in this study after the Performance Expectancy construct. This implies that Malaysia residents are positively influenced by consumer smartwatch design propositions that can satisfy their expectations. This study's overall observation is consistent with Krey et al. (2019) that suggested that Malaysia students perceived consumer smartwatches as having dual dimensionality, information technology and a fashion product, where the overall consumer smartwatch design attractiveness and portability are essential considerations to satisfy consumers need for aesthetic, visibility, symbolism and practical usage.

The study Design Benefit finding indicated that Malaysia residents are influenced by aesthetic design (with variation in terms of colour, appearance and material), portability and design convenience (securely strap on a human wrist as wearable) offered by consumer smartwatch, in contrast with a loosely held smartphone (refer to Chapter 4, section 4.7.10). The understanding can provide cues for optimising resources on innovation that matches market expectations, therefore, boosting the odds of retaining the existing consumer base and attracting interest from new consumers. This study recommended that consumer smartwatch manufacturers' product management and marketing organisations development of rich technology functions, design packages that meet consumers need is equally essential. Consumer smartwatch producers should continue to understand consumers expectations by regularly surveying consumers expectations and assessing them together with a competitive analysis of other smartwatch manufacturers' offerings.

## 5.9 Discussion on Study Model $R^2$ and Adjusted $R^2$ Coefficient of Determinant

- The study RQ8 - What is the total variance explained by the conceptual smartwatch adoption model observed at Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context?

- The study RO8 examine the conceptual smartwatch adoption model and report the total variance explained by the conceptual smartwatch adoption model for Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context.

The study model $R^2$ value observed at the Malaysia residents Behavioural Intention to use a smartwatch with seven determinants (PE, EE, SI, HM, PV, HT and DB) is 0.655. The study model adjusted $R^2$ value observed at the Malaysia residents Behavioural Intention to use a smartwatch with five statistically significant determinants (PE, SI, HM, HT and DB) is 0.65. The adjusted $R^2$ value of 0.65 classified as having moderate explanatory power (Hair et al., 2014) and could explain 65% of Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context.

Myers (1990), cited in Pituch and Steven (2016), opines that a researcher who conducts a quantitative non-physical science study should feel fortunate if the observed $R^2$

value reached 0.70; therefore, the adjusted $R^2$ value of 0.65 observed by this study's model assumed adequately met expectation of non-physical science research. This study acknowledged the balance of adjusted $R^2 = 0.35$ that explain Malaysia residents' behavioural intention to use a smartwatch was not accounted for and not captured by this study. The posthoc power analysis test indicated that 20 valid samples required to achieve 95% statistical power and 35 valid samples required to achieve 100% statistical power (refer to Chart 4-8); this study with 366 valid samples has adequate samples to achieve substantial statistical power (refer to section 4.12). The discussion in this section, together with SEM model $R^2$ value, adjusted $R^2$ value and model statistical power analysis findings in the previous chapter, demonstrated the accomplishment of RO8 and adequately answered RQ8.

## 5.10 Discussion of Other Findings

### 5.10.1 Generalisation Finding

This study could not perform probabilistic sampling due to circumstances and constraints explained in Chapter 3. However, this study acknowledges that applying probabilistic sampling could help avoid generalisation problems faced by this study. Based on the Department of Statistic Malaysia 2019 statistical data, the study's demographic profile by gender and demographic profile by age group distribution not generalisable to the Malaysia population.

However, based on applying the $\chi 2$ Goodness of Fit statistical inference, the study observed that the split between Malaysia citizen and foreigner fall within the Department of Statistic Malaysia statistical data boundary; therefore, this study assumed generalisable to Malaysia residents based on split by citizen and foreigner (refer to Chapter 4, Section 4.7.13). Since this study employed non-probabilistic sampling, this study believes that generalisation happens by chance.

### 5.10.2 Discussion on Independent of Perception Between Group(s)

Mann-Whitney U test employed to infer the independence between gender using empirical data from responses to survey question #4 to #27 (which measures H1 to H7 hypotheses). The statistical inference suggested that perceptions or opinions among gender generally fall within similar statistical distribution boundary (refer to Chapter 4, Section 4.8.1). Mann-Whitney U test also employed to infer the independence between nationality. The statistical inference suggested that perceptions or opinions among local (Malaysia/Malaysia PR) and foreigner generally fall within similar statistical distribution boundary (refer to Chapter 4, Section 4.8.2). The preliminary findings suggested that gender and nationality may not moderate the relationship between constructs in this study's model.

Kruskal-Wallis test employed to infer the independent between age group, education group, income group and industry group using empirical data from responses to survey question #4 to #27 (which measures H1 to H7 hypotheses). The statistical inference suggested that perceptions or opinions among diverse age group (refer to Chapter 4, Section 4.8.3), education group (refer to Chapter 4, Section 4.8.4), income group (refer to Chapter 4, Section 4.8.5) and industry group (refer to Chapter 4, Section 4.8.6) generally fall within a similar statistical boundary. The preliminary findings suggested that age group, education group, income group and industry group may not influence the relationship between constructs in the study's model.

### 5.10.3 Discussion on Descriptive Study of Usage Pattern

In the current study, Malaysia residents asked about their existing smart device usage pattern based on the following definition: daily = every day, frequent = use 5 to 6 days a week, moderate = a few days a week, seldom = a few days in a month, and stop use. Based on analysing responses collected, 76.9% (90 of 117 users) of smartwatch users, 61.1% (96 of 157 users) of the smartphone with health and fitness application users, and 58.7% (54 of 92 users) of the smart band users confirm using their device every day. The descriptive observation indicated that a user of a smartwatch highly likely to use their device daily.

When combined daily and frequent (5 to 6 day a week) usage pattern categories, 93.1% (107 of 117 users) of smartwatch users, 85.9% (79 of 92 users) of smart band users, and 80.2% (126 of 157 users) of smartphones with health and fitness applications identified as exhibiting an active usage pattern. The descriptive observation indicated that a smartwatch user is highly likely to use their device actively. In comparison, those who use smart wearables such as smart band also tend to stay more active than those who use loosely held device such as a smartphone with health application.

In contrast on the other extreme, 1.3% (2 of 157 users) of the smartphone with health and fitness application users, 0.9% (1 of 117 users) of smartwatch users and 0% (0 of 92) of the smart band users reported that they stop using their device. When combining stop use and seldom (a few days in a month) usage pattern categories, 10.9% (10 of 92 users) of smart band users, 10.2% (16 of 157 users) of smartphones with health and fitness applications, and 0.9% (1 of 117 users) of smartwatch users identified as exhibiting an inactive usage pattern.

Based on these preliminary findings, the study infers that a user who adopts a smartwatch is likely to adopt daily usage behaviour and less likely to exhibit passive usage behaviour. However, this study acknowledges that the observation based on simple descriptive data is at best preliminary, lacks in-depth understanding but a good topic for future research.

## 5.11 The Implications of this Study

The discussion in this section is divided into two tracks: theoretical implications and managerial implications. The contributions of this study provide a richer understanding of what motivates Malaysia residents to adopt a consumer smartwatch product when compared to current local smartwatch adoption literature. In addition to the findings on the UTAUT2 theory factors, the role of health technology and design benefits were confirmed as motivators for Malaysia residents' behavioural intention to use a consumer smartwatch. This study's findings provide several important theoretical contributions and have practical implications for the research and the professional community.

### 5.11.1 Theoretical Implications

This study adapted and tested the UTAUT2 behavioural intention in the context of consumer smartwatches demonstrated that of five independent constructs (PE, EE, SI, HM and PV) from the original UTAUT2 theory, three constructs exhibit statistically significant influences (PE, SI, HM). EE and PV were statistically insignificant likely influence by the context of the study. The study also extended the UTAUT2 theory with HT and DB, and both found exhibit statistically significant predictor of Malaysia residents. This study's model satisfied CFA reliability and validity quality indicators, not influenced by CMB and demonstrated adequate explanatory power to predict Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context. This study's model findings address the research gap identified in Malaysia consumer smartwatch adoption and contribute new insights to the Malaysia consumer smartwatch adoption body of knowledge. This study's outcome could become a preliminary reference to researchers and businesses interested in advancing Malaysia consumer smartwatch adoption. The managerial implications from the findings are:

- The findings of the Performance Expectancy variable indicated that current consumer smartwatch functions are perceived as utilitarian functions where it positively influenced Malaysia residents' and global individuals' behavioural intentions to use a consumer smartwatch technology. The finding of Performance Expectancy is consistent with the UTAUT2 theory and are likely to be universally applicable because Performance Expectancy is a strong determining factor in Malaysia and also a determining variable for global study.

- The influence of Effort Expectancy on individuals' intention to use a consumer smartwatch found by some of global smartwatch adoption studies and this study is inconsistent with the UTAUT2 theory. Various global consumer smartwatch adoption research studies explained that familiarity with smartphones usage and ICT literacy are the main reasons for such deviations. Due to high smartwatch penetration and good ICT literacy in Malaysia, this study found that Effort Expectancy is not a predictor of Malaysia individuals' behavioural intentions to use a consumer smartwatch.

- The effect of Social Influence on individuals' intention to use a consumer smartwatch found by most global smartwatch adoption studies and this study is consistent with the UTAUT2 theory. A meta-study compiled by Niknejad et al. (2020) tabulated that Social Influence shows resiliency as a predictor of behavioural intention, where 8 studies found Social Influence empirically affect behavioural intention out of a total of 10 smartwatch and smart wearables studies. These studies practically suggest that social events around us from social media and paid advertising influence individuals interests and intention to use a consumer smartwatch technology. The finding suggested that Malaysia residents are influenced by the social circle (friends and family) and social media (expert, influencing figures and credible news).

- This study finding on the Hedonic Motivation variable discussed in the preceding section indicated it is the weakest predictor and directionally inconsistent with Beh et al. (2019), other past global smartwatch adoption studies and the UTAUT2 theory. The directional contradiction implies that more empirical research in Malaysia is required to confirm the effect of Hedonic Motivation on the Malaysia individuals' behavioural intention.

Since Malaysia smartwatch adoption study is still in an infancy stage, this study encourages the Malaysia research community to perform more studies on the Hedonic Motivation variable, to acquire a better understanding of the behaviour of Hedonic Motivation.

- This study found that the Price Value variable does not influence Malaysia individuals' intention to use a consumer smartwatch, the finding is consistent with Beh et al. (2019) but inconsistent with the UTAUT2 theory. The finding of this study supported Beh et al. (2019) finding that Malaysia residents are likely not influenced by the Price Value variable when considering the use of a consumer smartwatch.

- The findings of the Health Technology variable suggested that Health Technology positively influenced Malaysia residents' behavioural intentions to use a consumer smartwatch and is consistent with findings of other global smartwatch adoption studies. The findings of Health Technology are likely to be universally applicable because Health Technology is both determining factor in Malaysia and global study. The finding suggests Health Technology is an essential utilitarian function and positively influenced Malaysia residents' intention to use a consumer smartwatch.

- The findings of the Design Benefit variable suggested that Design Benefit positively influenced Malaysia residents' behavioural intentions to use a consumer smartwatch. The Design Benefit variable is the second strongest factor in this study after the Performance Expectancy construct. This implies that Malaysia residents are positively influenced by consumer smartwatch design propositions that can satisfy their expectations. This study's overall observation is consistent with Krey et al. (2019) that suggested that Malaysia students perceived consumer smartwatches as having dual dimensionality, information technology and a fashion product, where the overall consumer smartwatch design attractiveness and portability are essential considerations to satisfy consumers need for aesthetic, visibility, symbolism and practical usage.

### 5.11.2 Managerial Implications

In this study, the statistical analysis of the study's model suggested that Performance Expectancy, Social Influence, Hedonic Motivation, Health Technology, and Design Benefit factors influenced Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context. The empirical findings consist of practical insights that could help managers formulate attractive proposition and strategies to advance smartwatches adoption. It also serves as a preliminary reference for public health administrators interested in using smartwatch technology to reduce excessive sedentary behaviour. The managerial implications from the findings are:

- Performance Expectancy - This study recommended that consumer smartwatch manufacturers' product management and marketing organisations continue to get a deeper knowledge by measuring customer satisfaction with current performance functions and regularly survey current users' expectations for additional performance capabilities and non-users interests and views. The market intelligence together with a competitive analysis of other smartwatch manufacturers' offerings can provide cues for optimising resources on innovation that matches market expectations, therefore, boosting the odds of retaining the existing consumer base and attracting interest from new consumers.

- Effort Expectancy - This study acknowledges that consumer smartwatch producers' current strategy of making consumer smartwatch user interface design, navigation and eco-system similar to a smartphone is a good approach, where it could reduce individuals learning time and effort. This study, therefore, recommended that consumer smartwatch producers continue to leverage individuals' familiarity with smartphone user interface design, navigation and eco-system. Existing customers will benefit from the continuation of the same strategy because their intuition and user experience will be minimally disrupted. Due to the high penetration of smartphones in Malaysia, individuals who have never used a consumer smartwatch are likely to have used a smartphone before, and they may find the user interface, navigation and eco-system of a consumer smartwatch familiar and intuitive. Thus, easy to learn and intuitive human-to-machine interfaces improved the probability of retaining the current customer base and attracting interest from new customers.

- Social Influence - This study recommended that consumer smartwatch producers continue with the current practices as its strategy is to educate and create awareness of consumer smartwatch products through social media platforms and advertising channels remain effective. social influencers and expert opinions via social networks continue to play a relevant role in promoting consumer smartwatch adoption in Malaysia. Consumer smartwatch producers could employ network influencers and experts in advertising, promote and educate the benefits of using consumer smartwatches via popular social media channels to increase their product awareness and adoption interest. To encourage more voluntary actions from individuals to promote consumer smartwatch products, consumer smartwatch producers should make it easy, seamless and intuitive for individuals to share their multitude of personal or group achievements directly via a consumer smartwatch. This indirect and voluntary channel could complement the official advertising channel and generate a multipliers effect in terms of increasing the probability of reaching a wider social coverage.

- Hedonic Motivation - In this study, the Hedonic Motivation variable was found to influence Malaysia individuals' intention to use a consumer smartwatch. However, this study acknowledges that the directional influence of the Hedonic Motivation construct found by this study is a weak negative, which differs from Beh et al. (2019) and other global smartwatch adoption studies. Considering the contradictory circumstances, this study does not have enough conviction to offer any concrete recommendation to consumer smartwatch producers.

- Price Value - The study participants income profile and Price Value variable perception and findings imply that Malaysia residents were likely less concerned with price and value when considering the adoption of a consumer smartwatch. It also likely implies that Malaysia residents have adequate purchasing power and are likely to be able to find and select smartwatch products that satisfy their target price and value expectation since there are plenty of different consumer smartwatches targeting different market segments. Hence, this study suggested that consumer smartwatch producers continue with their existing market offering and segmentation strategy or adjust their offering strategy if they want to increase or reduce their market segment coverage.

- Health Technology - This study recommended that consumer smartwatch manufacturers' product management and marketing organisations focus on developing rich and accurate health technology offerings in their consumer smartwatch products as consumers rely on consumer smartwatch products to measure and inform their health, fitness and sports training. At the same time, consumer smartwatch producers should continue to get a deeper knowledge by measuring customer satisfaction with current health technology functions and regularly surveying current users' expectations for additional health technology capabilities and non-users interests and views. The market intelligence together with a competitive analysis of other smartwatch manufacturers' offerings can provide cues for optimising resources on innovation that matches market expectations, therefore, boosting the odds of retaining the existing consumer base and attracting interest from new consumers.

- Design Benefit - The study Design Benefit finding indicated that Malaysia residents are influenced by aesthetic design (with variation in terms of colour, appearance and material), portability and design convenience (securely strap on a human wrist as wearable) offered by consumer smartwatch, in contrast with a loosely held smartphone (refer to Chapter 4, section 4.7.10). The understanding can provide cues for optimising resources on innovation that matches market expectations, therefore, boosting the odds of retaining the existing consumer base and attracting interest from new consumers. This study recommended that consumer smartwatch manufacturers' product management and marketing organisations development of rich technology functions, design packages that meet consumers need is equally essential. Consumer smartwatch producers should continue to understand consumers expectations by regularly surveying consumers expectations and assessing them together with a competitive analysis of other smartwatch manufacturers' offerings.

## 5.12 Limitation of the Study

This study conceived to improve the Malaysia smartwatch adoption knowledge gap and contribute new insights into the Malaysia smartwatch adoption body of knowledge. While the effort and the research journey to increase the understanding of factors that influence Malaysia residents' behavioural intention to use a smartwatch in a consumer context were worthwhile, it was not without its limitations.

The first limitation is that smartwatch penetration in Malaysia is low, and the researcher did not know adequate Malaysia residents' that use a smartwatch to enable the execution of systematic sampling. Outsource option to external market research company was also explored; this study did not proceed due to the management fees and a cash gift of RM10 per participant for a minimum of 384 participants. This study is self-finance with a limited budget and completion time.

The second limitation is that this study acknowledges that it is possible to receive duplicate survey responses or multi-responses because this study opts to use the free of charges Google Form platform instead of the paid Survey Monkey platform, which leverage annual subscription fees and fees per survey response in the United States of America dollar. This study is self-financed and has a limited budget. The study understood the decision's implication, and there was no way to ensure that all respondents answered the survey once. The study believes that since no monetary incentive provided to encourage survey participation, repeating participation is unlikely. To deal with the likelihood of repeated participation, in the event it happened, the study screening the data and promptly remove any doubtful entry that exhibited a similar demographic profile and Likert scale response. During the primary data screening, twenty-two cases that exhibit similarity promptly removed.

The third limitation is that the Malaysia consumer smartwatch adoption study, due to time, resources, and budget constraints, prepared a survey questionnaire in English and assumed the target population is proficient in English. In reality, Malaysia consists of a multi-ethnic society; the study reflects that using a single language survey questionnaire in English may limit participation from those who are not proficient in English. The study's respondents' profile which biases toward employment age group, high income, and university graduate indicated that a survey questionnaire with multiple languages might help capture respondents from other age groups, income groups, and education groups.

The fourth limitation is that the researcher selects a non-experimental cross-sectional study because the thesis must complete for examination within a finite time limit. While the study collected 366 valid sample data (which is well above the minimum of 200 valid sample cases), employed CFA and SEM hypotheses analysis, a cross-sectional study is still considered weak in determining causality. A common criticism is that any form of cross-sectional nonexperimental study cannot conclusively confirm any causality but likely suggested plausibility (Hair et al., 2010). This study reflects that perhaps a longitudinal study repeated over different time cycle and participants could improve and yield a more conclusive outcome.

This study perceived the four research limitations identified and discussed in this section, similar to the end of a project debrief or reflection at the end of a research study. The discussion and reflection do not negate or minimize the study work's outcome and significance; the limitation identified in this section provides the basis and sets the agenda for future research recommendations.

## 5.13 Future Research Recommendations

The study limitations discussed and presented in the previous section is meant for reflection at the end of this study. The reflection facilitates the honest identification of issues and lesson learned to improve future research study. Next, the study proposed two future research recommendations: methodological/theoretical improvement and scope expansion.

### 5.13.1 Methodological and Theoretical Improvement

From a methodological improvement perspective, assuming that no constraint on budget, resources and time, the following theoretical and methodological improvement recommended as future research opportunity:

- The study conceptual smartwatch adoption model adjusted $R^2$ total variance explained is 65%; this suggests that 35% variance explained by other factors not captured in this study's conceptual smartwatch adoption model. The reflection at the end of the study suggests that future study should employ a mixed-method inquiry method. The mixed-method inquiry is comprehensive, covering the practice to theory (inductive) and theory to practice (deductive) process likely to improve the comprehensiveness of the conceptual smartwatch adoption model.

- The study conducts descriptive and non-parametric inferential analysis on the effect of gender, nationality, age, income, education and industry. Future research may consider gender, age, income and education as moderating variables in the conceptual smartwatch adoption model.
- Future research should employ probabilistic sampling so that the study outcome attains external validity and generalizable to the Malaysia population.
- Future study should prepare survey questionnaires in four languages (English, Malay, Mandarin and Tamil) since Malaysia is a multi-ethnic nation. The diverse set of questionnaires empowers broader coverage and participation, especially from those who are not proficient in English. The English questionnaire for Malaysian who is comfortable with the language and foreigner who reside in Malaysia. The other languages extend survey coverage to Malaysia residents who comfortable with the national language, Mandarin Chinese and Tamil.
- The current study employed a five-point Likert scale; a future study could employ a seven-point or a nine-point Likert scale to magnify the opinions or perceptions differences by expanding the measurement scale's granularity.
- A longitudinal study that collected over different time cycle and participants improve and yield a more conclusive outcome. The longitudinal study's research outcome repeated over different probabilistic sampling frames is likely to be more representative and conclusive.

#### 5.13.2 Expanding the Study Scope

In the current study, Malaysia residents asked about their existing smart device usage pattern based on the following definition: daily = every day, frequent = use 5 to 6 days a week, moderate = a few days a week, seldom = a few days in a month, and stop use. Based on analysing responses collected, 76.9% (90 of 117 users) of smartwatch users, 61.1% (96 of 157 users) of the smartphone with health and fitness application users, and 58.7% (54 of 92 users) of the smart band users confirm using their device every day. The descriptive observation indicated that a user of a smartwatch highly likely to use their device daily.

When combined daily and frequent (5 to 6 day a week) usage pattern categories, 93.1% (107 of 117 users) of smartwatch users, 85.9% (79 of 92 users) of smart band users, and 80.2% (126 of 157 users) of smartphones with health and fitness applications identified as exhibiting an active usage pattern. The descriptive observation indicated that a smartwatch user is highly likely to use their device actively. In comparison, those who use smart wearables such as smart band also tend to stay more active than those who use loosely held device such as a smartphone with health application.

In contrast on the other extreme, 1.3% (2 of 157 users) of the smartphone with health and fitness application users, 0.9% (1 of 117 users) of smartwatch users and 0% (0 of 92) of the smart band users reported that they stop using their device. When combining stop use and seldom (a few days in a month) usage pattern categories, 10.9% (10 of 92 users) of smart band users, 10.2% (16 of 157 users) of smartphones with health and fitness applications, and 0.9% (1 of 117 users) of smartwatch users identified as exhibiting an inactive usage pattern.

Based on these preliminary findings, the study infers that a user who adopts a smartwatch is likely to exhibit the highest active usage pattern behaviour and less likely to exhibit a passive usage pattern behaviour. However, the inference that a consumer smartwatch user is likely to exhibit active usage behaviour and less likely to abandon the usage is at best preliminary and lacks in-depth understanding. An in-depth study essential to understand the social phenomenon beyond the descriptive findings of this study. Hence, a candidate for future research recommendation.

## 5.14 Conclusion

This study contributes new insights to address the research gap observed in Malaysia consumer smartwatch adoption and contribute new insights to the Malaysia smartwatch adoption research body of knowledge. This study followed a theory to practice approach to developed a conceptual study model and hypotheses based on adapting the constructs of UTAUT2 theory extended with Health Technology and Design Benefit. This study aims to achieve research objectives and address the research questions by empirically testing the seven hypotheses and observing the conceptual model R2 explanatory power, including understanding if this study has an adequate sample size to achieve substantial power.

The research design selected by this study is nonexperimental. The data collection strategy is a cross-sectional survey. Consistent with the research philosophical worldview, paradigm, research design and data collection strategy, this study developed a self-administered survey questionnaire to induce, measure and collect primary data from Malaysia residents. The self-administered survey questionnaire's development emphasises adhering to ethics practices approved for this study, quantitative practices, reducing responses bias, verifying reliability via a pilot study and initial content validity by adapting similar questionnaire from past successful smartwatch adoption studies

This study aims to achieve a confidence level of 95% with a margin of error of ±5%. The target population is Malaysian residents, preferably age 15 years and above, who have experience using a smartwatch or user of a smart band or a smartphone with health application interested in using a smartwatch in the future. The study employed an internet survey where a self-administered survey questionnaire distributed online to potential participants via social media applications such as WhatApps, FaceBook, LinkedIn, WeChat and email. This study employed convenience and snowball sampling due to low smartwatch diffusion in Malaysia, time constraints, and challenges this study faced in identifying adequate participants to execute probabilistic sampling.

This study employed a pilot study to verify the survey questionnaire's reliability using Cronbach's α internal consistency assessment before rolling out the primary data collection. This study primary data collection collected 393 sample data, and after primary data verification for missing, duplicate, unengaged responses and outlier assessment, twenty-two cases suspected as duplicate data and five outliers removed. The remaining 366 valid samples satisfied linearity, homoscedasticity and multicollinearity assumption and deviation from normality assumption justified as low impact because of large sample and the employment of MLE algorithm. Furthermore, the primary dataset met the preliminary reliability assumption based on Cronbach's α internal consistency and preliminary validity assumption based on communalities. A descriptive analysis of responses to each survey question and statistical summary of sample population characteristics presented. Non-parametric inferential analysis Mann-Whitney U test (alternative for parametric t-test) infer that there no perception or opinions differences between two independent groups (gender and nationality). Non-parametric inferential analysis Kruskal-Wallis test (alternative to single-factor ANOVA) infer that there no perception or opinions of multiple independent groups (age, education, income, and industry).

The outcome of multiple CMB assessments based on Harman's single factor test, correlational matrix, and full collinearity indicated that this study's primary dataset not influenced by common method bias. This study seeks to understand the phenomenon under study by employing two-stage SEM. The first stage is a confirmatory approach to examine the study's measurement model reliability and validity before the second stage, where study hypotheses tested using SEM. The primary dataset subjected to KMO sampling adequacy and Bartlett's sphericity assessment before the CFA step and satisfied the pre-requisite for factor analysis.

The study's measurement model satisfied the CFA composite reliability, convergence validity and two discriminant validity assessment: Fornell and Larcker (1981) method and Henseler et al. (2015) HTMT method, therefore, met CFA reliability and validity assumption. The compliances to GoF approximate indices and the standardised residual diagnostic further strengthen this study's measurement model validity assumption. In summary, the overall CFA quality assessment suggested this study's measurement model is reliable and valid at both the operational and theoretical levels (Hair et al., 2010).

The SEM hypotheses testing outcome suggested that the PE construct is the most critical factor and exhibited a strong positive relationship ($\beta = 0.518$, $p\text{-}value < 0.001$) toward Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context. The DB construct exhibited moderate positive relationship ($\beta = 0.242$, $p\text{-}value < 0.001$), HT construct exhibited weak positive relationship ($\beta = 0.176$, $p\text{-}value < 0.001$), SI construct exhibited weak positive relationship ($\beta = 0.112$, $p\text{-}value = 0.01$) and finally HM construct exhibited a weak negative relationship ($\beta = -0.108$, $p\text{-}value < 0.05$). Two construct Effort Expectancy and Price Value were statistically not significant, therefore, not supported. These hypotheses findings demonstrated the completion of RO1 to RO7 and answered RQ1 to RQ7.

The study's model $R^2$, based on seven determinants, could explain 65.5% of Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context. The study's model adjusted $R^2$, based on five statistically significant determinants, could explain 65% of Malaysia residents' Behavioural Intention to use a smartwatch in a consumer context. Based on adjusted $R^2$, this study acknowledges a 35% variance not explained by this study. Based on posthoc statistical power analysis, the study samples size of 366 adequate to achieve substantial statistical power. The findings demonstrated the completion of RO8 and answered RQ8. This study recognised that more is required to advance consumer smartwatch adoption in Malaysia, therefore, it hopes that this study's contribution could become a catalyst to spur more research interest to advance Malaysia consumer smartwatch adoption.

# REFERENCES


Adapa, A., Nah, F., Hall, R., Siau, K. and Smith, S. (2018) 'Factors influencing the adoption of smart wearable devices', *International Journal of Human–Computer Interaction*, 34(5), pp. 399-409.

Ajzen, I. (1991) 'The theory of planned behavior', *Organizational Behavior and Human Decision Processes*, 50(2), pp. 179–211.

Ajzen, I. (2002) 'Residual effects of past on later behavior: Habituation and reasoned action perspectives', *Personality and Social Psychology Review*, 6(2), pp. 107–122.

Ajzen, I. and Fishbein, M. (1980) *Understanding attitudes and predicting social behaviour*. Englewood Cliffs, NJ: Prentice-Hall.

Al-Gahtani, S., Hubona, G. and Wang, J. (2007) 'Information Technology (IT) in Saudi Arabia: Culture and the acceptance and use of IT', *Information & Management*, 44(8), pp. 681–691.

Aliverti, A. (2017) 'Wearable technology: Role in respiratory health and disease', *Breathe*, 13(2), pp. 27-36.

Alkhunaizan, A. and Love, S. (2012) 'What drives mobile commerce? An empirical evaluation of the revised UTAUT model.', *International Journal Management Marketing Academy*, 2(1), pp. 82–99.

Alrige, M. and Chatterjee, S. (2015), 'Toward a taxonomy of wearable technologies in healthcare', in Donnellan, B., Helfert, M., Kenneally, J., VanderMeer, D., Rothenberger, M. and Winger, R. (ed.), *New Horizons in Design Science: Broadening the Research Agenda. DESRIST 2015. Lecture Notes in Computer Science*. Cham.: Springer.

Anggraini, N., Kaburuan, E., Wang, G., Jayadi, R. (2019) 'Usability study and users' perception of smartwatch: Study on Indonesian customer', *Procedia Computer Science*, 161(2019), pp. 1266-1274.

Atkinson, R. and McKay, A. (2007) *Digital Prosperity: Understanding the Economic Benefits of the Information Technology Revolution.* Available at SSRN: https://ssrn.com/abstract=1004516 (Accessed: 12th January 2019).

Baabdullah, A., Dwivedi, Y., Williams, M. (2014) 'Adopting an extended UTAUT2 to predict consumer adoption of M-technologies in Saudi Arabia', UK Academy for Information Systems Conference Proceedings 2014, 5(2014). Available at https://core.ac.uk/download/pdf/301363521.pdf (Accessed: 12th January 2020).

Baba, N., Baharudin, A. and Alomari, S. (2019) 'Determinants of users' intention to use smartwatch.', *Journal of Theoretical and Applied Information Technology*, 97(18), pp. 4738-4750.

Bagozzi, R. (2007) 'The legacy of the Technology Acceptance Model and a proposal for a paradigm shift', *Journal of the Association for Information Systems*, 8(4), pp. 244-254

Bagozzi, R., Yi, Y., and Phillips, L. (1991) 'Assessing construct validity in organizational research.' *Administrative Science Quarterly, 36*(3), pp 421-458.

Bandura, A. (1977) 'Self-efficacy: Toward a unifying theory of behavioral change', *Psychological Review*, 84(2), pp. 191-215.

Bandura, A. (1986) *Social Foundations of Thought and Action: A Social Cognitive Theory*. Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. (1998) 'Health promotion from the perspective of social cognitive theory', *Psychology & Health*, 13(4), pp. 623-649,

Barfield, W., Baird, K. (1998) 'Issues in the design and use of wearable computers', *Virtual Reality*, 3, pp. 157–166.

Bauer, M., Brugge, B., Klinker, G., MacWilliams, A., Reicher, T., Sandor, C. and Wagner, M. (2002) 'An architecture concept for ubiquitous computing aware wearable computers' (Proceedings 22nd International Conference on Distributed Computing Systems Workshops, Vienna, Austria). *IEEE Xplore*, pp. 785-790.

Becker, M., Kolbeck, A., Matt, C. and Hess, T. (2017) 'Understanding the Continuous Use of Fitness Trackers: A Thematic Analysis', PACIS 2017 Proceedings. Available at: https://aisel.aisnet.org/pacis2017/40 (Accessed: 12th June 2020)

Beh, P., Ganesan, Y., Iranmanesh, M., and Foroughi, B. (2019) 'Using smartwatches for fitness and health monitoring: the UTAUT2 combined with threat appraisal as moderators.', *Behaviour & Information Technology*, pp. 1-18.

Bentler, P. and Bonett, D. (1980) 'Significance test and Goodness of Fit in the analysis of Covariance Structures', *Psychological Bulletin*, 88, pp. 588-606.

Bhattacherjee A. (2012) *Social science research: Principles, Methods, and Practices, Second Edition*, Open Access Textbooks. Available at https://scholarcommons.usf.edu/cgi/viewcontent.cgi?article=1002&context=oa_textbooks (Accessed: 12th June 2019)

Bank Negara Malaysia (2021) *Prestasi Ekonomi Suku Keempat Tahun 2020.* Available at https://www.bnm.gov.my/documents/20124/2294076/4Q2020_GDP_Slides.pdf (Accessed: 30th October 2021).

Bölen, M. (2020) 'Exploring the determinants of users' continuance intention in smartwatches', *Technology in Society*, 60, 101209.

Brown, S., and Venkatesh, V. (2005) 'Model of adoption of technology in the household: A baseline model test and extension incorporating household life cycle', *MIS Quarterly*, 29(4), pp. 399-426.

Bruno, T. (2015) *Wearable Technology: Smart Watches to Google Glass for Libraries*. Lanham, Maryland: Rowman & Littlefield.

Byrne, B. (2016) *Structural equation modeling with AMOS: Basic concepts, applications, and programming, Third Edition*. New York, NY: Routledge.

Canhoto, A. and Arp, S. (2016) 'Exploring the factors that support adoption and sustained use of health and fitness wearables', *Journal of Marketing Management*, 33(1-2), pp. 32-60.

Carlsson, C., Carlsson, J., Hyvonen, K., Puhakainen, J. and Walden, P. (2006) ‘Adoption of mobile devices/services - searching for answers with the UTAUT’ (Proceedings of the 39th Annual Hawaii International Conference on System Sciences (HICSS'06), Kauai, HI, USA). *IEEE Xplore*, pp. 132a-132a.

Cecchinato, M., Cox, A. and Bird, J. (2015) ‘Smartwatches: the good, the bad and the ugly?’ (Proceedings of the 33rd Annual ACM Conference Extended Abstracts on Human Factors in Computing Systems (CHI EA '15)). *Association for Computing Machinery*, New York, NY, USA, pp. 2133–2138.

Chang C., Liu L., Huang H. and Hsieh H. (2019) ‘Factors Influencing Online Hotel Booking: Extending UTAUT2 with Age, Gender, and Experience as Moderators’, *Information*, 10(9), pp. 281.

Chang, S., van Witteloostuijn, A. and Eden, L. (2010) ‘From the Editors: Common method variance in international business research.’ *Journal International Business Studies*, 41, pp 178–184.

Chau, K., Lam, M., Cheung, M., Tso, E., Flint, S., Broom, D., Tse, G. and Lee, K. (2019) ‘Smart technology for healthcare: Exploring the antecedents of adoption intention of healthcare wearable technology’, *Health psychology research*, 7(1), 8099.

Cheng, J. and Mitomo, H. (2017) ‘The underlying factors of the perceived usefulness of using smart wearable devices for disaster applications’, *Telematics and Informatics*, 34(2), pp. 528-539.

Choi, J. and Kim, S. (2016) ‘Is the smartwatch an IT product or a fashion product? A study on factors affecting the intention to use smartwatches’, *Computer Human Behaviour*, 63, pp. 777–786.

Chuah, H. (2019) ‘You inspire me and make my life better: Investigating a multiple sequential mediation model of smartwatch continuance intention’, *Telematics and Informatics*, 43(2019).

Chuah, H., Rauschnabel, P., Krey, N., Nguyen, B., Ramayah, T. and Lade, S. (2016) ‘Wearable technologies: The role of usefulness and visibility in smartwatch adoption’, *Computers in Human Behavior*, 65, pp. 276-284.

Compeau, D. and Higgins, C. (1995a) 'Application of social cognitive theory to training for computer skills', *Information Systems Research*, 6(2), pp. 118-143

Compeau, D. and Higgins, C. (1995b) 'Computer self-efficacy: Development of a measure and initial test', *MIS quarterly*, 19(2), pp. 189-211.

Conner, M., Warren, R. and Close, S. (1999) 'Alcohol consumption and the theory of planned behavior: an examination of the cognitive mediation of past behavior', *Journal of Applied Social Psychology,* 29, pp. 1676-1704.

Cook, D. and Song, W. (2009) 'Ambient Intelligence and Wearable Computing: Sensors on the Body, in the Home, and Beyond', *Journal of Ambient Intelligence and Smart Environments*, 1(2), pp. 83-86.

Cooper, D. and Schindler, P. (2014) *Business research methods, Twelfth Edition*. New York, NY: McGraw-Hill/Irwin.

Crano, W., Brewer, M. and Lac, A. (2015) *Principles and methods of social research, Third Edition*. New York, NY: Routledge.

Creswell, J. and Creswell, J. (2018) *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, Fifth Edition.* Thousand Oaks, California: SAGE Publications Inc.

Cronbach, L. (1951) 'Coefficient alpha and the internal structure of tests', *Psychometrika*, 16(3).

Curry, D. (2015) *Apple Watch hits 10,000 apps: How do Android Wear, Pebble, and Samsung compare?*
Available at http://www.digitaltrends.com/wearables/applewatch-apps-comparison/ (Accessed: 15th October 2019).

Davis, F. (1989) 'Perceived usefulness, perceived ease of use, and user acceptance of information technology.', *MIS Quarterly*, 13(3), pp. 319–340.

Davis, F., Bagozzi, R. and Warshaw, P. (1989) 'User acceptance of computer technology: a comparison of two theoretical models', *Management Science*, 35(8), pp. 982-1003.

Davis, F., Bagozzi, R. and Warshaw, P. (1992) ‘Extrinsic and intrinsic motivation to use computers in the workplace’, *Journal of Applied Social Psychology*, 22(14), pp.1111-1132.

Deci, E., and Ryan, R. (2008) ‘Self-determination theory: A Macrotheory of human motivation, development, and health’ *Canadian Psychology*, 49(3), pp. 182–185.

Dehghani, M. (2018) ‘Exploring the motivational factors on continuous usage intention of smartwatches among actual users’, *Behaviour & Information Technology*, 37(2), pp. 145–158.

Dehghani, M., and Kim, K. (2019) ‘The effects of design, size, and uniqueness of smartwatches: Perspectives from current versus potential users’, *Behavior & Information Technology*, 38(11), pp. 1143-1153,

Dehghani, M., Kim, K., Dangelico, R. (2018), ‘Will smartwatches last? Factors contributing to intention to keep using smart wearable technology’, *Telematics and Informatics*, 35(2), pp. 480-490.

Department of Statistics Malaysia (2019) *Population & Demography*. Available at: https://www.dosm.gov.my/v1/index.php?r=column/ctwoByCat&parent_id=115&menu_id=L0pheU43NWJwRWVSZklWdzQ4TlhUUT09 (Accessed: 15th October 2020).

Dodds, W., Monroe, K. and Grewal, D. (1991) ‘Effects of Price, Brand, and Store Information on Buyers’ Product Evaluations’, *Journal of Marketing Research*, 28(3), pp. 307–319.

Dudovskiy, J. (2018) *The Ultimate Guide to Writing a Dissertation in Business Studies: A Step-by-Step Assistance*. Available at: https://research-methodology.net/ (Accessed: 20th January 2019).

Dunton, G., Berrigan, D., Ballard-Barbash, R., Graubard, B. and Atienza, A. (2008) ‘Social and physical environments of sports and exercise reported among adults in the American Time Use Survey’, *Preventive Medicine*, 47(5), pp. 519-524.

Dwivedi, Y., Rana, N., Jeyaraj, A., Clement, M. and Williams, M. (2019) ‘Re-examining the unified theory of acceptance and use of technology (UTAUT): Towards a revised theoretical model’, *Information Systems Frontiers*, 21(3), pp. 719-734.

El-Gayar, O., Moran, M. and Hawkes, M. (2011) 'Students' acceptance of tablet PC's and implications for educational institutions', *Journal of Educational Technology & Society*, 14(2), pp. 58–70.

Ernst, A. and Ernst, C. (2016) 'Success Comes to Those Who Are Successful: The Influence of Past Product Expectation Confirmation on Smartwatch Usage', in Ernst C. (ed) *The Drivers of Wearable Device Usage, Progress in IS*. Cham: Springer International Publishing.

Faul, F., Erdfelder, E., Lang, A. and Buchner, A. (2007) 'G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences', *Behavior Research Methods*, 39, pp. 175-191.

Faul, F., Erdfelder, E., Buchner, A. and Lang, A. (2009) 'Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses', *Behavior Research Methods*, 41, pp. 1149-1160.

Fishbein, M. and Ajzen, I. (1975) *Belief, attitude, intention and behaviour: An introduction to theory and research*. Reading, Mass.: Addison-Wesley.

Fornell, C. and Larcker, D. (1981) 'Evaluating structural equation models with unobservable variables and measurement error', *Journal of Marketing Research*, 18(1), pp. 39–50.

Gao, Y., Li, H., and Luo, Y. (2015) 'An empirical study of wearable technology acceptance in healthcare', *Industrial Management & Data Systems*, 115(9), pp. 1704–1723.

Gaskin, J. (2016) *Data screening, Gaskination's StatsWiki.* Available at http://statwiki.kolobkreations.com/index.php?title=Data_screening (Accessed: 30th July 2020)

Gaskin J. and Lim J. (2016) *Master Validity Tool, AMOS 24 Plugin, Gaskination's Statistics.* Available at: http://statwiki.kolobkreations.com (Accessed: 30th July 2020)

Gaskin J. and Lim J. (2016) *Model Fit Measures, AMOS 24 Plugin, Gaskination's Statistics*. Available at: http://statwiki.kolobkreations.com (Accessed: 30th July 2020)

Gaskin J. and Lim J. (2016) *Multi-group Analysis, AMOS 24 Plugin, Gaskination's Statistics*. Available at: http://statwiki.kolobkreations.com (Accessed: 30th July 2020)

Ghosh S., Burns C., Prager D., Zhang L., Hui G. (2018) 'On nonparametric estimation of the latent distribution for ordinal data', *Computational Statistics & Data Analysis*, 119, p. 86-98.

Global System for Mobile communications Association (2015) *New Report Backs Mass Adoption of Wearables*. Available at: http://www.gsma.com/connectedliving/news/new-report-backs-massadoption-of-wearables/ (Accessed: 17th December 2019).

Greengard, S. (2019) 'A Healthy Dose of Wearables', *Communications of the ACM*, 11th April. Available at: https://cacm.acm.org/news/236113-a-healthy-dose-of-wearables/fulltext (Accessed: 01st February 2020).

Hair, J., Anderson, R., Tatham, R. and Black, W. (1998) *Multivariate Data Analysis*. Upper Saddle River, NJ: Prentice-Hall.

Hair, J., Black, W., Babin, B. and Anderson, R. (2010) *Multivariate Data Analysis, Seventh Edition*. Upper Saddle River, NJ: Prentice-Hall.

Hair, J., Hult, T., Ringle, C. M. and Sarstedt, M. (2014) *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM), Second Edition*. Thousand Oaks, CA: Sage Publications.

Hänsel, K., Wilde, N., Haddadi, H. and Alomainy, A. (2016) 'Wearable computing for health and fitness: Exploring the relationship between data and human behaviour', Cornell University. Available at: https://arxiv.org/pdf/1509.05238.pdf (Accessed: 6th June 2020)

Hart, S. (2020) *Best smartwatch 2020: top wearables reviewed and rated.* Available at: https://www.t3.com/au/news/best-smartwatch (Accessed: 22nd November 2020).

He, D. and Lu, Y. (2007) 'Consumers perceptions and acceptances towards mobile advertising: An empirical study in China', *2007 International Conference on Wireless Communications, Networking and Mobile Computing*, Shanghai, China, pp. 3775-3778.

Herbert, T. (1981) *Dimensions of Organisational Behaviour, Second Edition.* New York, NY: Macmillan.

Hermsen, S., Frost, J., Jan Renes, R. and Kerkhof, P. (2016) 'Using feedback through digital technology to disrupt and change habitual behavior: A critical review of current literature.', *Computers in Human Behavior*, 57.

Henseler, J., Ringle, C.M. and Sarstedt, M. (2015) 'A new criterion for assessing discriminant validity in variance-based structural equation modeling', *Journal of the Academy Marketing Science,* 43, pp. 115–135.

Hong, J., Lin, P. and Hsieh, P. (2017) 'The effect of consumer innovativeness on perceived value and continuance intention to use smartwatch', *Computers in Human Behavior*, 67, pp. 264–272.

Hooper, D., Coughlan, J. and Mullen, M. (2008) 'Structural Equation Modelling: Guidelines for Determining Model Fit', *Journal of Business Research*, 6(1), pp. 53-60.

Hoyer, W., MacInnis, D. and Peters, R. (2013) *Consumer Behaviour, Sixth Edition*. Andover: Cengage Learning.

Hsiao, K. (2017) 'What drives smartwatch adoption intention? Comparing Apple and non-Apple watches', *Library Hi-Tech*, 35(1), pp. 186–206.

Hsiao, K., and Chen, C. (2018) 'What drives smartwatch purchase intention? Perspectives from hardware, software, design, and value', *Telematics and Informatics, 35*(1), pp. 103–113.

Hu, L. and Bentler, P. (1999) 'Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives', *Structural Equation Modeling*, 6(1), pp. 1-55.

Huang, C. and Kao, Y. (2015) 'UTAUT2 based predictions of factors influencing the technology acceptance of Phablets by DNP', *Mathematical Problems in Engineering*, 2015, pp. 1-23.

Huzooree, G., Kumar Khedo, K. and Joonas, N. (2019) 'Pervasive mobile healthcare systems for chronic disease monitoring', *Health Informatics Journal*, 25(2), pp. 267–291.

Im, I., Hong, S., and Kang, M. (2011) ‘An international comparison of technology adoption: Testing the UTAUT model’, *Information & management, 48*(1), pp. 1-8.

Institut de Publique Sondage d’Opinion Secteur (2018) ‘Who are the World’s Biggest Wearable Tech Buyers?’ Available at: https://www.ipsos.com/en-si/who-are-worlds-biggest-wearable-tech-buyers (Accessed: 30th July 2019).

International Telecommunication Union (2002) *Multimedia Malaysia: Internet Case Study.* Available at: https://www.itu.int/ITU-D/ict/cs/malaysia/material/MYS%20CS.pdf (Accessed: 30th October 2021).

Jackson, S. (2016) *Research Methods and Statistics: A Critical Thinking Approach, Fifth Edition*. Boston, MA: Cengage Learning.

Jackson, D., Gillaspy, J., and Purc-Stephenson, R. (2009) ‘Reporting practices in confirmatory factor analysis: An overview and some recommendations’, *Psychological Methods*, 14(1), pp. 6–23.

Jasperson, 'J., Carter, P., and Zmud, R. (2005) ‘A comprehensive conceptualization of post-adoptive behaviors associated with Information Technology enabled work systems’, *MIS Quarterly, 29*(3), pp. 525-557.

Jeong, S., Kim, S., Park, J. and Choi, B. (2017) ‘Domain-specific innovativeness and new product adoption: a case of wearable devices’, *Telematics and Informatics*, 34(5), pp.399–412.

Jöreskog, K. (1993) ‘*Testing structural equation models*’, in Bollen, K. and Long, J. (ed). Newbury Park, CA: Sage Publication, pp. 294–316.

Jöreskog, K. and Sörbom, D. (1993) *LISREL 8: Structural Equation Modeling with the SIMPLIS Command Language*. Lincolnwood, IL: Scientific Software International.

Jung, Y., Kim, S. and Choi, B. (2016) ‘Consumer valuation of the wearables: The case of smartwatches’, *Computers in Human Behavior*, 63, pp. 899-905, Kalantari, M. (2017) 'Consumers' Adoption of Wearable Technologies: Literature Review, Synthesis, and Future Research Agenda', *International Journal of Technology Marketing*, 12(3), pp. 274-307

Kamišalić, A., Fister, I., Turkanović, M. and Karakatič, S. (2018) 'Sensors and Functionalities of Non-Invasive Wrist-Wearable Devices: A Review', *Sensors*. MDPI AG, 18(6), pp. 1714.

Kao, Y., Nawata, K. and Huang, C. (2019) 'An Exploration and Confirmation of the Factors Influencing Adoption of IoT-Based Wearable Fitness Trackers', *International Journal of Environmental Research and Public Health*. MDPI AG, 16(18), pp. 3227.

Kenney, B. (2014) *Smartwatches vs Fitness Bands: There is a Difference.* Available at: https://smartwatches.org/learn/smartwatches-vs-fitness-bands-difference/ (Accessed: 20th August 2019).

Kim, K. and Shin, D. (2015) 'An acceptance model for smart watches: implications for the adoption of future wearable technology', *Internet Research*, 25(4), pp. 527–541.

Kline, R. B. (2016) *Principles and practice of structural equation modeling, Fourth Edition.* New York, NY: Guilford Publications.

Kock, N. (2015) 'Common method bias in PLS-SEM: A full collinearity assessment approach', *International Journal of e-Collaboration*, 11(4), pp. 1-10.

Kranthi, A. and Ahmed, K. (2018) 'Determinants of smartwatch adoption among IT professionals - An extended UTAUT2 model for smartwatch enterprise', *International Journal Enterprise Network Management*, 9(3-4), pp. 294–315.

Krey, N., Chuah, S., Ramayah, T. and Rauschnabel, P. (2019) 'How functional and emotional ads drive smartwatch adoption: the moderating role of consumer innovativeness and extraversion', *Internet Research*, 29(3), pp. 578–602.

Legault, L. (2017) 'Self-determination theory', in Zeigler-Hill, V. and Shackelford, T. (eds), *Encyclopedia of Personality and Individual Differences*. New York, NY: Springer.

Lentferink, A., Oldenhuis, H., de Groot M., Polstra L., Velthuijsen H. and van Gemert-Pijnen J. (2017) ‘Key components in eHealth interventions combining self-tracking and persuasive eCoaching to promote a healthier lifestyle: A scoping review.’, *J Med Internet Res*, 19(8), pp. 277.

Levy, P. and Lemeshow, S. (2013) *Sampling of Populations: Methods and Applications, Fourth Edition.* New York, NY: John Wiley and Sons.

Lewis, C., Fretwell, C., Ryan, J., Parham, J., (2013) ‘Faculty use of established and emerging Technologies in Higher Education: A Unified Theory of Acceptance and Use of Technology Perspective’, *International Journal of Higher Education*, 2(2), pp. 22-34.

Li, M., Dong, Z. and Chen, X. (2012) ‘Factors influencing consumption experience of mobile commerce: A study from experiential view’, *Internet Research*, 22(2), pp. 120-141.

Li, J., Liu, X., Ma, L., & Zhang, W. (2018) ‘Users’ intention to continue using social fitness-tracking apps: expectation confirmation theory and social comparison theory perspective’, *Informatics for Health and Social Care*, 44(3), pp. 298–312.

Likert, R. (1932) ‘A technique for the measurement of attitudes’, *Archives of psychology*.

Limayem, M., Hirt, S. and Cheung, C. (2007) ‘How habit limits the predictive power of intention: the case of information systems continuance’, *MIS Quarterly*, 31(4), pp.705–737.

Lincoln, Y., Lynham, S. and Guba, E. (2011) ‘Paradigmatic controversies, contradictions, and emerging confluences revisited’, in N. K. Denzin & Y. S. Lincoln, *The SAGE handbook of qualitative research, Fourth Edition*. Thousand Oaks, CA: Sage Publication.

López-Nicolás, C., Molina-Castillo, F. J. and Bouwman, H. (2008) ‘An assessment of advanced mobile services acceptance: Contributions from TAM and diffusion theory models’, *Information and Management*, 45(6), pp. 359-364.

Mackenzie, N. and Knipe, S. (2006) ‘Research dilemmas: Paradigms, methods, and methodology’, *Issues in Educational Research*, 16(2), pp. 1-13.

Mafé, C., Blas, S. and Tavera-Mesías, J. (2010) 'A Comparative Study of Mobile Messaging Services Acceptance to Participate in Television Programmes', *Journal of Service Management*, 21, pp. 69-102.

Malaysian Communications and Multimedia Commission (2018) *Internet User Survey 2018: Statistical Brief Number Twenty-three.* Available at: https://www.mcmc.gov.my/skmmgovmy/media/General/pdf/Internet-Users-Survey-2018.pdf
(Accessed: 15th September 2019).

Malaysian Communications and Multimedia Commission (2019) *Industry Performance Report 2019: Empowering a Digital Nation.* Available at: https://www.mcmc.gov.my/skmmgovmy/media/General/pdf/ENG-MCMC_IPR_2019.pdf
(Accessed: 1st October 2020).

Malaysian Communications and Multimedia Commission (2020) *Internet User Survey 2020.* Available at: https://www.mcmc.gov.my/en/resources/statistics/internet-users-survey
(Accessed: 30th October 2021).

Mann, S. (1998), 'Wearable computing as means for personal empowerment', *Proceeding of International Conference on Wearable Computing (ICWC)* 12th – 13th May, Fairfax, VA, USA.

Maslow, A. (1943) 'A theory of human motivation', *Psychological Review*, 50(4), pp. 370-396.

Mathieson, K. (1991) 'Predicting user intentions: Comparing the technology acceptance model with the theory of planned behavior', *Information Systems Research*, 2(3), pp. 173-191.

McIntyre, A. (2014) *Wearable computing in the workplace to be dependent on apps and services*. Available at: www.forbes.com/sites/gartnergroup/2014/03/06/wearable-computing-in-the-workplace-to-be-dependent-on-apps-and-services (Accessed 15th October 2019).

Megadewandanu, S., Suyoto. and Pranowo. (2017) ‘Exploring mobile wallet adoption in Indonesia using UTAUT2: An approach from consumer perspective’, Proceedings - 2016 2nd International Conference on Science and Technology-Computer, *ICST 2016*, pp. 11–16.

Mertens, D. (2010) *Research and Evaluation in Education and Psychology: Integrating Diversity with Quantitative, Qualitative, and Mixed Methods, Third Edition.* Thousand Oaks, CA: Sage Publications.

Miles, J. (2014) ‘Tolerance and Variance Inflation Factor’, in Balakrishnan, N., Colton, T., Everitt, B., Piegorsch, W., Ruggeri, F. and Teugels, J. (ed). *Statistics Reference Online*: Wiley StatsRef.

Milosevic, B. and Farella, E. (2017) ‘5 - Wireless MEMS for wearable sensor networks’, in Uttamchandani, D. (ed). Wireless MEMS Networks and Applications, Woodhead Publishing Series in Electronic and Optical Materials, Woodhead Publishing.

MIMOS (2015) *National Internet of Things (IoT) Strategic Roadmap: A Summary* Available at: http://www.mimos.my/iot/National_IoT_Strategic_Roadmap_Summary.pdf (Accessed: 30th October 2021).

Moore, G. and Benbasat, I. (1991) ‘Development of an instrument to measure the perceptions of adopting an information technology innovation’, *Information System Research*, 2(3), pp. 192-222.

Morgan, D. (2007) ‘Paradigms lost and pragmatism regained: Methodological implications of combining qualitative and quantitative methods’, *Journal of Mixed Methods Research*, 1(1), pp. 48–76.

Negahban, A. and Chung, C. (2014) ‘Discovering determinants of users perception of mobile device functionality fit’, *Computers in Human Behavior*, 35(2014), pp. 75-84.

Netemeyer, R., Bearden, W. and Sharma, S. (2003) *Scaling Procedures: Issues and Applications*, Sage Publications.

Nevid, J. (2011) *Essential of Psychology: Concepts and Applications, Third Edition.* Boston, MA: Cengage Learning.

Niknejad, N., Ismail, W., Mardani, A., Liao, H. and Ghani, I. (2020) ‘A comprehensive overview of smart wearables: The state of the art literature, recent advances, and future challenges’, *Engineering Applications of Artificial Intelligence*, 90(2020), 103529.

Niknejad, N., Hussin, ARC., Ghani, I. and Ganjouei, F. (2019) ‘A confirmatory factor analysis of the behavioral intention to use smart wellness wearables in Malaysia’, *Univ Access Inf Soc,* 19, pp. 633–653.

Nor, KM. and Pearson, M. (2008) ‘An exploratory study into the adoption of internet banking in a developing country: Malaysia’, *Journal of Internet Commerce*, 7(1), pp. 29-73,

Novikov, A. and Novikov, D. (2013) *Research Methodology: From Philosophy of Science to Research Design.* Boca Raton, FL: CRC Press.

Pallant, J. (2016) *SPSS Survival Manual: A step by step guide to data analysis using SPSS, Sixth Edition.* Berkshire: McGraw-Hill Education.

Park E. (2020) ‘User acceptance of smart wearable devices: An expectation-confirmation model approach’, *Telematics and Informatics*, 47(2020).

Park, E., Kim, K. and Kwon, S. (2016) ‘Understanding the emergence of wearable devices as next-generation tools for health communication’, *Information. Technology and People*, 29(4) pp. 717–732.

Park, J., Moon, J., Kim, H., Kong, M. and Oh, Y. (2020) ‘Sedentary lifestyle: overview of updated evidence of potential health risks’ *Korean journal of family medicine*, 41(6), pp. 365–373.

Park, J., Yang, S. and Lehto, X. (2007) ‘Adoption of mobile technologies for Chinese consumers’, *Journal of Electronic Commerce Research*, 8(3), pp. 196-206.

Pavlou, P. A. and Fygenson, M. (2006) ‘Understanding and predicting electronic commerce
adoption: An extension of the theory of planned behaviour’, *MIS quarterly*, pp. 115-143.

Peake, J., Kerr, G. and Sullivan, J. (2018) ‘A critical review of consumer wearables, mobile applications, and equipment for providing biofeedback, monitoring stress, and sleep in physically active populations’, *Frontiers in Physiology*, 9.

Phillips, D. and Burbules, N. (2000) *Postpositivism and Educational Research.* Lanham, MD: Rowman & Littlefield.

Pituch, K. and Stevens, J. (2016) *Applied Multivariate Statistics for the Social Sciences, Sixth Edition.* New York, NY: Routledge.

Podsakoff, P. M., MacKenzie, S. B. and Podsakoff, N. P. (2012) ‘Sources of method bias in social science research and recommendations on how to control it’, *Annual Review of Psychology*, 63, pp. 539-569.

Podsakoff, P., MacKenzie, S., Lee, J., and Podsakoff, N. (2003) ‘Common method biases in behavioral research: A critical review of the literature and recommended remedies’, *Journal of Applied Psychology, 88*(5), pp. 879–903.

Poh, BK., Safiah, MY., Tahir, A., Siti Haslinda, Siti Norazlin, Norimah, AK., Wan Manan, Mirnalini, K., Zalilah MS., Azmi MY. and Fatimah S. (2010) ‘Physical activity pattern and energy expenditure of Malaysian adults: Findings from the Malaysian adult nutrition survey (MANS)’, *Malaysia Journal of Nutrition*, 16(1), pp. 13-37.

Price Waterhouse Cooper (2015) *The Wearable Future.* Available at: https://www.pwc.ru/en/retail-consumer/publications/assets/pwc-cis-wearable-future.pdf (Accessed: 11th July 2019).

Price Waterhouse Cooper (2016) *The Wearable life 2.0: Connected Living in a Wearable World.* Available at: https://www.pwc.com/ee/et/publications/pub/pwc-cis-wearables.pdf (Accessed: 11th July 2019).

Rauschnabel, P., Krey, N., Chuah, H.-W., Nguyen, B., Lade, S. and Ramayah, T. (2016) ‘Exploring the adoption of smartwatch’, in Hertweck D. and Decker C. (ed), Digital Enterprise Computing 2016, Lecture Notes in Informatics, Bonn, Germany.

Reeder, B. and David, A. (2016) ‘Health at hand: A systematic review of smart watch uses for health and wellness’, *Journal of Biomedical Informatics*, 63(2016), pp. 269-276, Rhodes, B. (1997) 'The wearable remembrance agent: A system for augmented memory', *Personal Technologies,* 1(4)**,** pp. 218–224.

Rhodes, B., Minar, N. and Weaver, J. (1999) 'Wearable computing meets ubiquitous computing: reaping the best of both worlds', Third International Symposium on Wearable Computers, San Francisco, CA, USA, pp. 141-149.

Richter, F. (2016) *Smartwatches Push Past Swiss Watches for the First Time*. Available at https://www.statista.com/chart/4386/smartwatches-vs-swiss-watches/ (Accessed: 15th October 2019).

Richter, F. (2017) *What Smartwatches Are Actually Used For*. Available at https://www.statista.com/chart/10783/use-cases-for-smartwatches/ (Accessed: 15th October 2019).

Richter, F. (2018) *The Global Wearables Market Is All About the Wrist*. Available at https://www.statista.com/chart/3370/wearable-device-forecast/ (Accessed: 15th October 2019).

Richter, F. (2020) *Apple Beats Swiss Watch Industry at Its Own Game*. Available at https://www.statista.com/chart/12878/apple-watch-vs-swiss-watches/ (Accessed: 11th November 2020).

Rocznik, D., Goffart, K., and Wiesche, M. (2017) 'Designing hedonic user experiences: The effect of Psychological need fulfilment on hedonic motivation', Proceedings of the 25th European Conference on Information Systems (ECIS), Guimarães, Portugal, June 5-10, pp. 3223-3233. Available at: https://aisel.aisnet.org/cgi/viewcontent.cgi?article=1068&context=ecis2017_rip (Accessed: 15th September 2020).

Rogers, E. (2003) *Diffusion of Innovations Fifth Edition.* The Free Press: New York.

Salah, H., MacIntosh, E. and Rajakulendran, N. (2014) 'Wearable tech: Leveraging Canadian innovation to improve health', Available at: https://learn.marsdd.com/wp-content/uploads/2015/02/MaRSReport-WearableTech.pdf (Accessed: 12th July 2019)

Sambamoorthi, U., Tan, X. and Deb A. (2015) ‘Multiple chronic conditions and healthcare costs among adults’, *Expert Review of Pharmacoeconomics & Outcomes Research*, 15(5), pp. 823-832.

Saunders, M., Lewis, P. and Thornhill, A. (2019) *Research Methods for Business Students, Eight Edition.* Harlow, United Kingdom, Pearson Education Limited.

Schiffman, L., Kanuk, L., and Hansen, H. (2012) *Consumer Behaviour: A European Outlook, Second Edition.* Essex: Pearson Education.

Schreiber, J., Nora, A., Stage, F., Barlow, E. and King, J. (2006) ‘Reporting structural equation modeling and confirmatory factor analysis results: A review’, *The Journal of educational research*, 99(6), pp. 323-338.

Sekaran, U. and Bougie, R. (2016) *Research Methods for Business: A Skill Building Approach, Seventh Edition*. John Wiley and Sons, Inc.

Sharma, R. and Mishra, R. (2014) ‘A review of evolution of theories and models of technology adoption’, *Indore Management Journal*, 2(2), pp. 17-29.

Sharma, S. and Chandel, J. (2013) ‘Technology Acceptance Model for the Use of Learning Through websites Among Students in Oman.’, *International Arab Journal of e-Technology*, 3(1), pp. 44-49.

Shi, W. (2009) ‘An empirical research on users' acceptance of smartphone online application software’, (International Conference on Electronic Commerce and Business Intelligence, Beijing, China), *IEEE Xplore,* pp. 106-110.

Silbert, S. (2020) *What Is a Smartwatch?*.
Available at: https://www.lifewire.com/an-introduction-to-smart-watches-3441381 (Accessed: 22nd November 2020).

Sinnadurai (2019) *A holistic approach to ageing needed in Malaysia*. Available at: https://www.thestar.com.my/news/nation/2019/09/15/a-holistic-approach-to-ageing-needed-in-malaysia (Accessed: 15th September 2019).

Solomon, M., Bamossy, G., Askegaard, S. and Hogg, M. (2013) *Consumer Behaviour: A European Perspective, Fifth Edition.* Essex: Pearson Education.

Stephens, C. and Dennis, M. (2000) ‘Engineering time: inventing the electronic wristwatch’, *The British Journal for the History of Science*, 33, pp. 477–497.

Stiglbauer, B., Weber, S. and Batinic, B. (2019) ‘Does your health really benefit from using a self-tracking device? Evidence from a longitudinal randomized control trial’, *Computers in Human Behavior*, 94(2019), pp. 131-139,

Stockemer, D. (2019) *Quantitative Methods for the Social Sciences: A practical introduction with examples in SPSS and Stata.* Cham: Springer International Publishing.

Sue, V. and Ritter, L. (2012) *Conducting Online Surveys, Second Edition.* Thousand Oaks, CA: SAGE Publications.

Sultan, N. (2015) ‘Reflective thoughts on the potential and challenges of wearable technology for healthcare provision and medical education’, *International Journal of Information Management*, 35(5), pp. 521-526.

Swan, M. (2012) ‘Sensor Mania! The Internet of Things, Wearable Computing, Objective Metrics, and the Quantified Self 2.0’, *Journal of Sensor and Actuator Networks,* 1(3), pp. 217-253.

Swan, M. (2013) ‘The quantified self: fundamental disruption in big data science and biological discovery’, *Big Data, 1*(2), pp. 85–99.

Syed Ali, S. (2018) ‘The important of physical activities in our life’, *International Physical Medicine & Rehabilitation Journal*, 3(4), pp. 308-310.

Tabachnick, B. and Fidell, L. (2019) *Using Multivariate Statistics, Seventh Edition.* Boston, Pearson Education, Inc.

Talukder, M., Chiong, R., Bao, Y. and Hayat Malik, B. (2019) ‘Acceptance and use predictors of fitness wearable technology and intention to recommend: An empirical study’, *Industrial Management & Data Systems*, 119(1), pp. 170-188.

Taylor, S. and Todd, P. (1995a) 'Understanding information technology usage: A test of competing models.', *Information Systems Research*, 6(2), pp. 144-176

Taylor, S. and Todd, P. (1995b) 'Decomposition and crossover effects in the theory of planned behavior: A study of consumer adoption intentions.', *International Journal of Research in Marketing*, 12(2), pp. 137-155.

Tehrani, K. and Andrew, M. (2014) *Wearable Technology and Wearable Devices: Everything You Need to Know.* Available at: https://www.webcitation.org/6t1sQoa7o (Accessed: 01st March 2020).

Thomas, T., Singh, L. and Gaffar, K. (2013) 'The utility of the UTAUT model in explaining mobile learning adoption in higher education in Guyana', *International Journal of Education and Development using ICT*, 9(3), pp. 71-85. Available at https://www.learntechlib.org/p/130274/ (Accessed 1st August 2020)

Thompson, R., Higgins, C. and Howell, J. (1991) 'Personal computing: toward a conceptual model of utilization', *MIS Quarterly*, 15(1), pp. 125-143.

Thorp, E. (1998) 'The invention of the first wearable computer', Second International Symposium on Wearable Computers, Pittsburgh, PA, USA, 1998, pp. 4-8.

Tornatzky, L. and Klein, K. (1982) 'Innovation characteristics and innovation adoption-implementation: A meta-analysis of findings,', *IEEE Transactions on Engineering Management*, 29(1), pp. 28-45.

Vallerand, R. (1997) 'Toward a hierarchical model of Intrinsic and Extrinsic Motivation', in Zanna, M (ed), Advances in Experimental Social Psychology, Academic Press., 29, pp. 271-360.

Van Raaij, E. and Schepers, J. (2008) 'The acceptance and use of a virtual learning environment in China', *Computers & Education*, 50(3), pp. 838-852,

Venkatesh, V. (2000) 'Determinants of perceived ease of use: integrating perceived behavioral control, computer anxiety and enjoyment into the technology acceptance model', *Information Systems Research*, 11(4), pp. 342–365.

Venkatesh, V. and Bala, H. (2008) ‘Technology acceptance model 3 and a research agenda on interventions’, *Decision Sciences*, 39(2), pp. 273–315.

Venkatesh, V. and Brown, S. (2001) ‘A longitudinal investigation of personal computers in homes: Adoption determinants and emerging challenges’, *MIS Quarterly*, 25(1), pp. 71-102.

Venkatesh, V. and Davis, F. (2000) ‘A theoretical extension of the Technology Acceptance Model: Four longitudinal field studies’, *Management Science*, 46(2), pp. 186-204.

Venkatesh, V. and Morris, M. (2000) ‘Why don't men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behaviour’, *MIS Quarterly*, 24(1), pp. 115-39.

Venkatesh, V. and Speier, C. (1999) ‘The hidden minefields in the adoption of sales force’, *Organizational Behavior and Human Decision Processes*, 79, pp. 1-28.

Venkatesh, V., Morris, G. and Davis, F. (2003) ‘User acceptance of information technology: Toward a unified view’, *MIS Quarterly*, 27(3), pp. 425-478.

Venkatesh, V., Thong, J. and Xu, X. (2012) ‘Consumer acceptance and use of information technology: Extending the Unified Theory of Acceptance and Use of Technology’, *MIS Quarterly*, 36(1), pp. 157-178.

Venkatesh, V., Thong, J. and Xu, X. (2016) ‘Unified Theory of Acceptance and Use of Technology: A synthesis and the road ahead’, *Journal of the Association for Information Systems*, 17(5), pp. 328–376.

Wheaton, B., Muthén, B., Alwin, D. and Summers G. (1977) ‘Assessing reliability and stability in panel models’, *Sociological Methodology*, pp. 84-136.

Wiegard, R. and Breitner, M. (2019) ‘Smart services in healthcare: A risk-benefit-analysis of pay-as-you-live services from customer perspective in Germany’, *Electron Markets,* 29, pp. 107–123.

Williams, M., Rana, N., Dwivedi, Y. and Lal, B. (2011) 'Is UTAUT really used or just cited for the sake of it? A systematic review of citations of UTAUT's originating article.', ECIS 2011 Proceedings. Available at: https://aisel.aisnet.org/cgi/viewcontent.cgi?article=1230&context=ecis2011 (Accessed: 15th June 2020).

World Health Organisation (2017) *Draft WHO Global Action Plan on Physical Activity 2018 – 2030.* Available at: https://www.who.int/ncds/governance/gappa_version_4August2017.pdf?ua=1 (Accessed 22 January 2020).

World Health Organisation (2019) *Sugary Drinks Tax Important First Step, but Obesity in Malaysia Demands Further Action.* Available at: https://www.who.int/malaysia/news/commentaries/detail/sugary-drinks-tax-important-first-step-but-obesity-in-malaysia-demands-further-action (Accessed 22 January 2020).

Wu, L., Wu, L. and Chang, S. (2016) 'Exploring consumers' intention to accept smartwatch', *Computers in Human Behavior*, 64, 383–392.

Yuan, S., Ma, W., Kanthawala, S. and Peng, W. (2015) 'Keep using my health apps: discover users' perception of health and fitness apps with the UTAUT2 model', *Telemedicine Journal and e-Health: The Official Journal of the American Telemedicine Association*, 21(9), pp. 735-741.

Zhang, A. (2020) *Smartwatch, Smart bracelet or Standalone Smartwatch…What's Best for You?*. Available at: https://blog.chinavasion.com/55291/smartwatch-smart-bracelet-or-standalone-smartwatchwhats-best-for-you/ (Accessed: 11th November 2020).

Zhang, L., Zhu, J., Liu, Q. (2012) 'A meta-analysis of mobile commerce adoption and the moderating effect of culture', *Computers in Human Behavior*, 28(5), pp. 1902-1911,

Zhou, T. (2008) 'Exploring mobile user acceptance based on UTAUT and contextual offering', *International Symposium on Electronic Commerce and Security*, Guangzhou, China, pp. 241-245.

Zhou, T., Lu, Y. and Wang, B. (2010) 'Integrating TTF and UTAUT to explain mobile banking user adoption', *Computers in Human Behavior, 26*(4), 760-767.

# APPENDIX A : SURVEY QUESTIONNAIRE

Online Self-administered Primary Survey Questionnaire

Examining the Malaysia Individual Resident Behavioural Intention to Use Smartwatch.

Dear participant,

I am Loo Chin Wah; thank you for accepting the invitation to participate in this online survey. I am a Doctor of Business Administration (DBA) student at the University of Wales (Trinity St. David), United Kingdom. The objective of this survey is to collect information on factors that affect Malaysia individual residents' intention to use a smartwatch.

The participation in this survey is voluntary; it is available to any individual who has experience using a smartwatch or a smart band, or a smartphone with physical tracking apps (with an intention to upgrade to a smartwatch in the near future). This survey does not collect any sensitive personal information; therefore, the participant identity will remain anonymous. The estimated duration to complete this survey is approximately 10 minutes and the data collected is solely for the completion of the researcher thesis. Finally, please confirm your participation by selecting the "Yes" radio button and click next to start the survey.

Thank you.

Regards,

Loo Chin Wah

## Collecting Participant Electronic Consent:

Please confirm your participation in this online survey.

* Required.

◯ Yes, I am glad to participate (if this option is selected, *proceed to Background Information)*

◯ No, I change my mind (if this option is selected, *proceed to Exit Survey)*

## Exit Survey:

"Thank you for showing interest in this survey. If you change your mind, please click the back button to reconsider. Else please click submit to end this survey."

( ) Back    ( ) Submit

## Background Information:

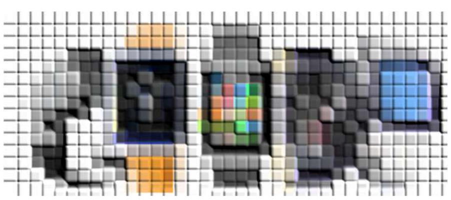
A smartwatch and smart band are worn on the human wrists; standard features are time telling, health and fitness features (sleep monitor, heart rate monitor, pedometer, tachometer, GPS, etc.). They can be synchronised with smartphones or other smart devices via a blue-tooth signal.

The noticeable differences between a smartwatch and a smart band are smartwatch has a bigger screen size, dimension, and sophisticated touch screen features. The recent smartwatch has become visually appealing, pack with advanced health technology and smartphone-like communications features (sim card, video, apps from a smartwatch app store). The visually appealing design and rich features can potentially position a smartwatch (similar to a smartphone) to become pervasive in daily human life.

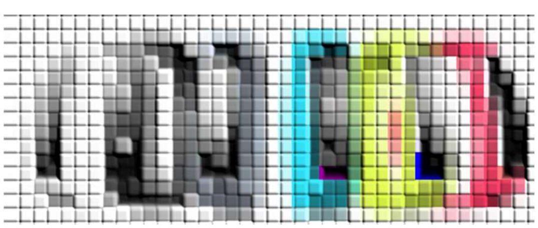
1. Please select a statement that matches your experience.

**Mark only one oval.*

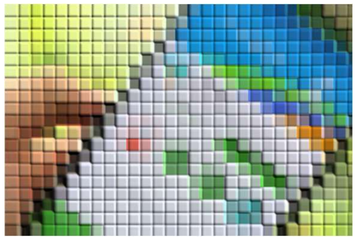
( ) I have experience using a smartwatch. (if this option is selected, *proceed to Smartwatch Brand)*



( ) I have experience using a smart band. (if this option is selected, *proceed to Device Usage Pattern)*



( ) I have experience using smartphone apps for physical activity tracking but intent to use a smartwatch in the future. (if this option is selected, *proceed to Device Usage Pattern)*



- I have no experience using a smartwatch, smart band and physical activity tracking on a smartphone. (if this option is selected, *proceed to Exit Survey1)*

- I am not interested in a smartwatch. (if this option is selected, *proceed to Exit Survey1)*

## Exit Survey1 (Nonexperience and Disinterested Participant):

Thank you for showing interest in this survey. This survey is for an individual who has some experience with a smartwatch or smart band, or smartphone physical tracking apps (with an intention to a smartwatch in the near future). Thank you for your interest and time. Please click submit to end the survey.

Submit

## Smartwatch Brand:

2. What is the current brand of your smartwatch?

*Mark only one oval.

- Apple
- Fitbit
- Garmin
- Huawei
- LG
- Motorola
- Samsung
- Xiaomi
- Other (Please input the brand name:) ________________________

## Device Usage Pattern:

3. Which statement best described the usage pattern of your device?

**Mark only one oval.*

- Daily
- Frequent (5 to 6 days a week)
- Moderate (a few days a week)
- Seldom (a few days a month)
- Stop Use

## Individual Opinions About Smartwatch Technology Advantages - Performance and Productivity:

(1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree)

4. I find that smartwatch is useful in my daily life compared to an ordinary watch.

**Mark only one oval.*

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Strongly Disagree | ⬭ | ⬭ | ⬭ | ⬭ | ⬭ | Strongly Agree |

5. I find that using smartwatch can helps me to accomplish my daily goals more efficiently compared to an ordinary watch.

*Mark only one oval.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Strongly Disagree | ⬭ | ⬭ | ⬭ | ⬭ | ⬭ | Strongly Agree |

6. I find that using smartwatch can increase my productivity compared to an ordinary watch.

*Mark only one oval.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Strongly Disagree | ⬭ | ⬭ | ⬭ | ⬭ | ⬭ | Strongly Agree |

Individual Opinions About the Ease of Using Smartwatch:

(1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree)

7. I find that learning how to use smartwatch is easy for me.

*Mark only one oval.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Strongly Disagree | ◯ | ◯ | ◯ | ◯ | ◯ | Strongly Agree |

8. I find that the touch screen menu of a smartwatch is clear and understandable.

*Mark only one oval.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Strongly Disagree | ◯ | ◯ | ◯ | ◯ | ◯ | Strongly Agree |

9. I find that it is easy for me to become skilful at using a smartwatch.

*Mark only one oval.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Strongly Disagree | ◯ | ◯ | ◯ | ◯ | ◯ | Strongly Agree |

Individual Opinions About Whether Social Influence Interest to Consider Using Smartwatch:

(1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree)

10. People in my social circle encourage the use of a smartwatch.

*Mark only one oval.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Strongly Disagree | ◯ | ◯ | ◯ | ◯ | ◯ | Strongly Agree |

11. People whom I trust in my social circle encourage the use of smartwatch.

*Mark only one oval.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Strongly Disagree | ◯ | ◯ | ◯ | ◯ | ◯ | Strongly Agree |

12. People around my social space (expert opinions, forum discussions and smartwatch advertisement) increase my awareness and consideration about using a smartwatch.

*Mark only one oval.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Strongly Disagree | ◯ | ◯ | ◯ | ◯ | ◯ | Strongly Agree |

## Individual Emotional State When Interacting with Smartwatch:

(1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree)

13. I find that interaction with a smartwatch is entertaining.

*Mark only one oval.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Strongly Disagree | ◯ | ◯ | ◯ | ◯ | ◯ | Strongly Agree |

14. I find that interaction with a smartwatch can bring enjoyment.

*Mark only one oval.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Strongly Disagree | ◯ | ◯ | ◯ | ◯ | ◯ | Strongly Agree |

15. I find that interaction with a smartwatch can bring satisfaction.

*Mark only one oval.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Strongly Disagree | ◯ | ◯ | ◯ | ◯ | ◯ | Strongly Agree |

Individual Opinions About Smartwatch Price And Value:

(1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree)

16. At the current price, I find that smartwatch is reasonably priced.

*Mark only one oval.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Strongly Disagree | ⬭ | ⬭ | ⬭ | ⬭ | ⬭ | Strongly Agree |

17. At the current price, I find that smartwatch offers good value relative to its cost.

*Mark only one oval.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Strongly Disagree | ⬭ | ⬭ | ⬭ | ⬭ | ⬭ | Strongly Agree |

18. At the current price, I find that the smartwatch price is affordable

*Mark only one oval.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Strongly Disagree | ⬭ | ⬭ | ⬭ | ⬭ | ⬭ | Strongly Agree |

Individual Opinions About Smartwatch as Technology to Motivate Health, Activity and Balance Diet:

(1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree)

19. I find that using smartwatch (by tracking my heartbeat patterns, sleep patterns, blood pressure patterns, etc.) can motivate a healthy lifestyle.

*Mark only one oval.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Strongly Disagree | ⬭ | ⬭ | ⬭ | ⬭ | ⬭ | Strongly Agree |

20. I find that using smartwatch (by tracking my physical movement goals: distance travelled, movement step, stair climb count) can motivate a physically active lifestyle.

*Mark only one oval.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Strongly Disagree | ◯ | ◯ | ◯ | ◯ | ◯ | Strongly Agree |

21. I find that using smartwatch (by tracking my calories and water intake) can help the achievement of a balanced diet.

*Mark only one oval.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Strongly Disagree | ◯ | ◯ | ◯ | ◯ | ◯ | Strongly Agree |

## Individual Opinions About Smartwatch Design Benefits:

(1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree)

22. I find that the overall look and feel of a smartwatch is visually appealing

*Mark only one oval.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Strongly Disagree | ◯ | ◯ | ◯ | ◯ | ◯ | Strongly Agree |

23. I find that smartwatch design attributes (size, weight, touch display, colour and materials) are attractive.

*Mark only one oval.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Strongly Disagree | ◯ | ◯ | ◯ | ◯ | ◯ | Strongly Agree |

24. I find that smartwatch design which is securely strapped on a human wrist is light, convenient to carry, non-intrusive, easily accessible and less likely to be misplaced compared to a loosely held smartphone.

*Mark only one oval.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Strongly Disagree | | | | | | Strongly Agree |

## Individual Opinions About Interest in Using Smartwatch:

(1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree)

25. I intend to consider using a smartwatch in the future.

*Mark only one oval.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Strongly Disagree | | | | | | Strongly Agree |

26. I would be willing to use a smartwatch if I possess one.

*Mark only one oval.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Strongly Disagree | | | | | | Strongly Agree |

27. I find smartwatch useful; I would be willing to use smartwatch frequently in my daily life.

*Mark only one oval.

| | 1 | 2 | 3 | 4 | 5 | |
|---|---|---|---|---|---|---|
| Strongly Disagree | | | | | | Strongly Agree |

# General Demographics Section

"Thank you for your perseverance. You have reached the final section of the online survey. Appreciate if you could complete all the question."

28. What is your gender?

*Mark only one oval.

- Male
- Female

29. Please choose a statement that best described your current status.

*Mark only one oval.

- Malaysia Citizen
- Malaysia Permanent Resident
- Foreign Citizen

30. What is your age group?

*Mark only one oval.

- Below 15 years old.
- 15 to 24 years old.
- 25 to 54 years old.
- 55 to 64 years old.
- 65 years old and above.

31. What is your highest educational level?

* Mark only one oval.

- School Certificate or Diploma (SPM/O Level/STPM/A Level/IB)
- Certificate/Diploma/Advance Diploma (Polytechnic/College/University)
- Bachelor Degree or equivalent professional qualification
- Postgraduate Degree

32. What is your gross monthly income?

*Mark only one oval.

- No income
- Less than RM2000
- RM2000 to RM5000
- Above RM5000 to RM10000
- Above RM10000

33. Which category best describes your current employment?

* Mark only one oval.

- Banking/Finance/Investment
- Civil/Construction.
- Education/Consulting.
- Entrepreneur/ self-employed.
- Information Technology.
- Manufacturing.
- Student.
- Telecommunications/Broadcasting.
- Unemployed / Retired.
- Other: ________________________________

## Survey Submission:

You have reached the end of this questionnaire survey. Thank you for volunteering your time to participate in this survey. Please select the "Submit" button below to submit your responses. If you wish to change your response, please click the back button to change.

Back ⬭ Submit ⬭

# APPENDIX B : STANDARDISED RESIDUALS DIAGNOSTIC

| | PE03 | PE02 | PE01 | DB03 | DB02 | DB01 | HT03 | HT02 | HT01 | EE03 | EE02 | EE01 | SI03 | SI02 | SI01 | HM03 | HM02 | HM01 | PV03 | PV02 | PV01 | BI03 | BI02 | BI01 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | | | | | | | | | | | | | | | | | | | | | | | |
| | 0.681 | 0 | | | | | | | | | | | | | | | | | | | | | | |
| | -0.288 | -0.313 | 0 | | | | | | | | | | | | | | | | | | | | | |
| | 1.056 | 1.905 | 2.331 | 0 | | | | | | | | | | | | | | | | | | | | |
| | -0.996 | -0.178 | 0.707 | -0.196 | 0 | | | | | | | | | | | | | | | | | | | |
| | -1.104 | -0.795 | 0.367 | -0.333 | 0.154 | 0 | | | | | | | | | | | | | | | | | | |
| | **2.784** | **3.168** | 1.362 | 1.771 | 0.302 | 1.107 | 0 | | | | | | | | | | | | | | | | | |
| | -0.954 | 0.309 | -0.137 | **2.948** | -0.586 | -0.638 | -0.112 | 0 | | | | | | | | | | | | | | | | |
| | -1.07 | -0.066 | -0.256 | **2.514** | -0.304 | -0.572 | -0.357 | 0.098 | 0 | | | | | | | | | | | | | | | |
| | -0.316 | -0.147 | 0.685 | 1.624 | -0.832 | -0.047 | -0.273 | -0.360 | 0.512 | 0 | | | | | | | | | | | | | | |
| | -0.806 | -1.007 | 1.006 | 1.075 | -0.207 | 0.083 | -0.491 | -1.089 | -0.974 | 0.046 | 0 | | | | | | | | | | | | | |
| | -1.044 | -0.202 | 1.042 | 1.768 | -0.553 | 0.515 | -0.676 | 0.671 | 1.201 | -0.048 | 0.025 | 0 | | | | | | | | | | | | |
| | 2.043 | 1.717 | 1.354 | **2.976** | 1.073 | 1.351 | 2.491 | 1.986 | 1.241 | 1.574 | 1.058 | 1.172 | 0 | | | | | | | | | | | |
| | -0.552 | -0.05 | -0.114 | 1.220 | -0.394 | -0.315 | **2.939** | -0.878 | -0.547 | -0.106 | -0.230 | -0.292 | -0.232 | 0 | | | | | | | | | | |
| | -0.667 | 0.24 | -0.083 | 0.713 | -0.166 | -0.330 | 2.227 | -0.588 | 0.033 | -0.067 | -0.260 | 0.055 | -0.022 | 0.036 | 0 | | | | | | | | | |
| | 1.073 | 1.035 | 0.563 | 0.919 | 0.358 | 0.550 | 2.463 | 0.168 | 0.793 | 0.789 | 1.143 | 0.707 | 1.820 | 0.540 | -0.063 | 0 | | | | | | | | |
| | -0.029 | -0.598 | -0.993 | -0.785 | -0.683 | 0.013 | **2.609** | -0.637 | -0.548 | -0.696 | 0.207 | -0.972 | 2.018 | 0.253 | -0.810 | 0.010 | 0 | | | | | | | |
| | 0.552 | -0.443 | 0.682 | 0.261 | -0.060 | 0.497 | 1.803 | -0.645 | -0.465 | 0.038 | 0.697 | 0.171 | 1.369 | 0.421 | -0.570 | -0.334 | 0.175 | 0 | | | | | | |
| | -0.221 | -0.67 | 0.434 | 0.544 | -1.070 | -0.264 | -0.315 | -0.570 | -0.273 | -0.370 | -0.018 | -0.603 | 0.554 | -0.568 | -0.125 | -0.519 | -0.633 | -0.540 | 0 | | | | | |
| | 1.743 | 0.774 | 2.059 | 2.464 | 1.796 | 1.772 | 1.064 | 1.585 | 1.390 | 0.636 | 1.772 | 1.197 | 1.831 | 0.895 | 1.179 | 2.196 | 1.973 | 1.845 | -0.120 | 0 | | | | |
| | -0.333 | -0.794 | -0.052 | 0.396 | -0.622 | -0.347 | 0.128 | -0.741 | 0.153 | 0.036 | -0.188 | -0.500 | 0.784 | -0.338 | -0.353 | 0.206 | -0.535 | -0.760 | 0.072 | -0.054 | 0 | | | |
| | -0.503 | -0.228 | 0.972 | 2.510 | -0.150 | -0.662 | 1.305 | 0.133 | 0.174 | 0.156 | -0.395 | 0.608 | 2.176 | -0.188 | -0.340 | 0.906 | -0.561 | 0.429 | -0.635 | 1.559 | -0.159 | 0 | | |
| | -0.749 | -0.81 | 0.625 | 2.076 | -0.646 | -1.141 | 0.472 | -0.625 | -0.102 | -0.257 | -1.296 | 0.875 | 1.428 | -0.396 | -0.459 | 0.681 | -0.823 | -0.305 | -1.033 | 1.318 | -0.384 | 0.023 | 0 | |
| | -1.226 | -0.393 | 1.424 | 1.589 | 1.061 | 0.418 | 0.430 | -0.685 | -0.492 | 0.144 | -1.395 | -0.080 | 2.364 | 0.530 | 0.537 | 1.340 | -0.425 | 0.069 | 0.013 | 1.418 | 0.187 | -0.118 | 0.193 | 0 |