The Sustainable Consumption of Wearable Healthcare Technology for Senior Citizens

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ABSTRACT

The 21st century has witnessed a marked surge in the ageing population, intensifying the need for robust and sustainable healthcare solutions. While the integration of digital healthcare services is increasingly acknowledged as a visual solution (Bokolo, 2021); its success hinges on the long-term adoption of continuous health information and monitoring technologies, notably Wearable Healthcare Technologies (WHTs) (Sneha and Varshney, 2009). However, the sustainable consumption of WHTs among senior citizens remains suboptimal, highlighting the imperative to discern the pivotal drivers that can foster sustained usage. The purpose of this study is to investigate, identify and measure the determinants in design leadership, technology leadership, brand leadership and customer experience aspects that would lead to the sustainable consumption of WHT among senior citizens.

The adoption of WHTs for senior citizens investigations in extant literature concentrates on the intention to accept WHT (L. Li *et al.*, 2019; Wulfovich *et al.*, 2019; Talukder *et al.*, 2020; Jaschinski *et al.*, 2021). There is limited research on the sustainable consumption of WHTs for senior citizens. While some studies have probed the positive correlation between customer experience and sustainable consumption, empirical explorations specific to the WHT domain are scant. Moreover, despite the burgeoning presence of enterprises in the WHT market, the critical roles of design leadership, technology leadership, brand leadership facets in shaping customer experience and sustainable WHT consumption have been largely overshadowed.

To fill this gap, a mixed-methods research study was conducted among senior citizens in China to explore determinants related to design leadership, technology leadership, and brand leadership influencing WHT user experience and its subsequent bearing on sustainable consumption. Semi-structured interviews with 20 senior citizens underwent thematic analysis to unearth salient design leadership, technology leadership and brand leadership attributes. This qualitative phase was complemented by a quantitative survey of 647 respondents to gauge the influence of these attributes on WHT user experience and sustainable consumption. The study also rigorously examined potential moderating variables bridging user experience and sustainable WHT adoption.

The research outcomes underscored the importance of an outstanding WHT user experience in championing its sustainable consumption among senior citizens. Design leadership, technology leadership, and brand leadership emerged as instrumental factors in enhancing this user experience. By formulating an innovative framework synthesising design leadership, technology leadership and brand leadership, user experience, and sustainable consumption perspectives about WHT, this study offers invaluable insights for stakeholders in the WHT ecosystem. Ultimately, the research aims to guide the establishment of sustainable and productive healthcare practices, thereby elevating the quality of life for senior citizens and addressing the challenges posed by an ageing population crisis.

DEDICATION

To my late grandmother, Yanfang Yang,

Whom I deeply miss and yearn to share this happiness with.

To my beloved parents, Yalan Ren and Quanbao Wei,

Thank you for your boundless love and unwavering support.

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List of Abbreviations

Abbreviation	Meaning
AI	Artificial Intelligence
AIDA	Attention–Interest–Desire–Action Model
AIUM	Artificial Intelligence-Based Usage Monitoring
AVE	Average Variance Extracted
BA	Brand Attitude
BCG	Ballistocardiogram
BOO	Brand of Origin
BP	Brand Prestige
CLV	Customer Lifetime Value
COB	Customer-Oriented Behaviour
CR	Composite Reliability
CX	Customer Experience
DP	Disclosure Policy
ECG	Electrocardiogram
EE	Energy Expenditure
EFT	Effectiveness
E-prescribing	Electronic Prescribing
ESM	Efficacy Of Self-Health Management
FS	Facilitating Support
FV	Functional Value
GRP	Government Regulation Policy
HER	Electronic Health Records
HIT	Health Information Technology
HTMT	Heterotrait–Monotrait Ratio
IIED	International Institute of Environment and Development
INT	Interactivity
IoMT	Internet of Medical Things
IoT	Internet of Things
IS	Information System
IT	Information Technology
JPOI	Johannesburg Plan of Implementation
LPRCPRIE	Law on the Protection of the Rights and Interests of the Elderly in the People's Republic of China
OCSC	Oxford Commission on Sustainable Consumption
PELU	Perceived Ease of Learning and Using
PHR	Personal Health Records
PQ	Perceived Quality
PR	Perceived Risk

Abbreviation	Meaning
PS	Perceived Severity
PSAT	Performance Satisfaction
PV	Perceived Vulnerability
REC	Recommendation
RTP	Real-Time Process
SC	Sustainable Consumption
SDGs	Sustainable Development Goals
STAM	Senior Technology Acceptance Model
STS	Socio-Technical System
TAM	Technology Acceptance Model
TAM2	Technology Acceptance Model 2
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
UN	United Nations
UNEP	United Nations Environment Programme
UTAUT	Unified Theory of Acceptance and Use of Technology
UTAUT2	Unified Theory of Acceptance and Use of Technology 2
UHC	Universal Health Coverage
VIF	Variance Inflation Factor
WCED	World Commission on Environment and Development
WHO	World Health Organisation
WHT	Wearable Healthcare Technology
WRB	Wearability
WSSD	World Summit on Sustainable Development

Chapter 1. Introduction

1.1 Research Background

This thesis delves into sustainable consumption of wearable healthcare technology (WHT) for senior citizens. The exponential growth of internet data has given rise to big data (Sena *et al.*, 2021). As a medium for the collection, utilization, and benefiting from big data, WHT is a growing area in the healthcare sector that provides much-needed support for senior citizens, especially in monitoring, detecting, and managing health conditions (Talukder *et al.*, 2020). The population is ageing worldwide; China, Japan, and Korea are regarded as the countries experiencing the fastest pace of ageing (Yannopoulou *et al.*, 2023). The focus is on sustainable consumption, with a specific look at senior citizens in the present societal situation of an ageing population. The positive correlation between customer experience and sustainable consumption has been confirmed (Gong *et al.*, 2023); this study aims to identify and measure the factors that can improve the customer experience (CX) of WHT and increase sustainable usage among senior citizens in China and other developing countries. It also seeks a suitable solution for elderly care in the face of a declining birth rate and an ageing society.

The current patterns of consumption and development are speeding up serious concerns such as climate change, poverty, inequality, and shortage of resources (United Nations, 2017b). The significance of sustainable consumption is well recognized. The ways people use specific products and choose services can indirectly affect personal well-being and the environment (Jackson, 2014). However, in wealthier countries, consumption is marked by short product usage and lifespan, driven by a throwaway culture (Cooper, 2013). The United Nations (UN) describes sustainable consumption and production as 'doing more and better with less' (United Nations, 2017a).

Nevertheless, there is a confusing tension of sustainable consumption as to what exactly is consumed or should be consumed (or should not be consumed) in a consumer society. Material resource consumption has been the principal focus of many debates about sustainable consumption, but they are not the only 'products' that customers purchase or consume; on the contrary, material resource consumption is rarely included in the purchasing list of so-called 'final consumers' (e.g., households), contrarily, goods and services are consumed by them. These goods and services employ several categories of materials input, leading to the influences of materials and the environment. It is essential to determine the differences between these two processes that are not identical or congruent (Jackson, 2014). Specifically, not all consumption is tied to resource consumption, as some forms exist outside the economic framework, and certain types of economic consumption require minimal resource usage.

Intriguingly, this lack of uniformity may have allowed the institutional perspective on sustainable consumption to retain some credibility. Furthermore, modern governments consider continual economic growth a fundamental political requirement. This growth necessitates the support of ongoing increases in household consumption; absent such backing; economies could be threatened by unemployment and the risk of recession. Additionally, a stagnant economy could undermine the government's political credibility. Thus, governments constantly strive to maintain levels of economic consumption. Some scholars assert the benefits of increased consumption for enhancing well-being and supporting continued economic growth, while others argue that these consumption patterns are environmentally and psychologically damaging (Jackson, 2005). As such, sustainable consumption variously emphasizes either impact reduction or an absolute decrease in consumption (Mont and Plepys, 2008) or the concurrent achievement of social well-being and resource efficiency (Tukker *et al.*, 2006). Therefore, sustainable consumption is defined as the shaping and fulfilling of consumer needs to continually amplify consumption's positive influence on improving quality of life.

Health Information Technology (HIT) encompasses a wide array of technologies. It involves using computer hardware, software, or infrastructure to record, store, protect, and retrieve clinical, administrative, or financial information (Kim and Ho, 2021). HIT includes electronic health records (EHRs), electronic prescribing (E-prescribing), and personal health records (PHRs) (Kim and Ho, 2021). Examples of WHT, like the Apple Watch, Fitbit, and Active blood glucose monitoring devices, are categorized as PHRs due to their different functions (Greaves and Rozenblum, 2017).

Typically, the market offers three types of wearable healthcare devices, each having distinct characteristics and functions: 1) Disease management devices, 2) Disease prediction devices, and 3) Activity monitoring devices (Lee and Lee, 2018). Disease management devices, designed for patients with chronic illnesses, help monitor their health situations to improve health status and aid in treatment. Disease prediction devices monitor physiological data to mitigate the risk of individuals developing undiagnosed diseases. Lastly, activity monitoring devices track daily activities, providing information such as calorie expenditure, the number of steps, and heart rate (J. Li *et al.*, 2019).

Wearable technology, which permits continuous monitoring of human physiological and biochemical parameters and physical activities during daily life, is prevalent among the younger generation. In the early stages of wearable technology, data commonly measured included vital signs like gait assessment, sleep status, heart rate, blood pressure, and body temperature. As technology advanced, more specialized data such as electrocardiogram (ECG), ballistocardiogram (BCG), and others could be collected by WHTs. Wearable devices can be attached to multiple inconspicuous locations, such as shoes, clothing, watches, and earrings. These devices can also be incorporated into the environment, such as chairs, car seats, and mattresses (Wu and Luo, 2019).

Despite significant strides in healthcare innovation and infrastructure, the global distribution of medical professionals remains alarmingly sparse. A staggering 49.2% of nations report a density of fewer than 15 doctors for every 10,000 inhabitants. Similarly, 47.7% of countries have a nursing staff density of less than 30 per 10,000 individuals (World Health Organization, n.d.). The adoption of Health Information Technology (HIT) products, such as wearable healthcare devices, electronic health records, telemedicine and online healthcare, have been shown to reduce healthcare budgets, enhance healthcare efficiency, and alleviate pressure on healthcare services (Alkhaldi *et al.*, 2014; Malwade *et al.*, 2018; Wu and Luo, 2019). Particularly in remote areas, WHT can serve as mobile health equipment (Al Bassam *et al.*, 2021). Moreover, wearable technology offers an innovative approach to rapidly collecting and analysing healthcare data, enhancing healthcare service quality by reducing injury-related risks due to information imbalance and providing communication channels for patients and doctors (Wu *et al.*, 2016).

The ageing population has seen exponential growth since the start of the 21st century (Lim *et al.*, 2017) The ageing population has seen exponential growth since the start of the 21st century (Lim *et al.*, 2017). As of 2019, approximately 9.1% of the global population was over 65. The United Nations estimates this figure to reach 11.7% by 2030 and to rise to 19% by 2050 (United Nations, 2019). The global ageing population is a critical and significant issue in both medical and sociodemographic contexts (Rudnicka *et al.*, 2020). A considerable proportion of the global economic burden of disease, approximately 23%, is associated with health disorders affecting individuals aged 60 and above (Prince *et al.*, 2015). In developed countries, several solutions, such as mature healthcare systems and nursing homes, can improve the quality of life for seniors and help governments address some issues caused by an ageing population (Malwade *et al.*, 2018). However, developing countries face severe challenges, including the inability of senior citizens to support themselves post-retirement, increased health monitoring and treatment requirements, insufficient care institutions for senior citizens, and inadequately trained caregivers (Malwade *et al.*, 2018).

Furthermore, the ageing population has led to increased healthcare demands. The 'ageing in place' programme, which allows senior citizens with chronic illnesses to stay at home while being remotely monitored, has been implemented in several countries (Jaschinski *et al.*, 2021). From the perspective of health and social care professionals, coupling these HITs with preventative measures for healthy and active ageing is seen as the way forward (Malwade *et al.*, 2018).

The ageing population in China is escalating rapidly due to the historical population expansion and improved life expectancy brought about by rapid economic development and elevated living standards over the past 50 years (Mao *et al.*, 2020). Meantime, the concomitant challenge posed by China's ageing population has garnered public attention. As per the 7th national census data released by the Chinese National Bureau of Statistics in 2021, about 190 million people, representing 13.5% of China's total population, are aged 65 and over. This figure represents a substantial increase of 4.63% from the 6th national census data in 2010 (National Bureau of Statistics of China, 2021a). In addition, the accompanying challenge posed by China's ageing population has garnered public attention. As per the 7th national census data released by the Chinese National Bureau of Statistics in 2021, about 190 million people, representing 13.5% of China's total population, are aged 65 and over. This figure represents a substantial increase of 4.63% from the 6th national census data 2010 (Mao *et al.*, 2020).

The need for nursing homes presents another hurdle in managing the ageing population in China. Due to the single-child policy implemented in China over the past 30 years, many families have expressed concern and strain in caring for older adults (Hua *et al.*, 2021). In essence, one young married couple is burdened with the care responsibilities of four ageing parents. Conversely, when the children leave home, the elderly parents are left to live alone and care for themselves (Yang *et al.*, 2021). This situation necessitates expanded medical support from primary healthcare facilities and increased nursing home services (Sanmargaraja and Wee, 2012). However, the current number of nursing homes in China exceeds the demand. As of 2019, China had 34,000 nursing homes, providing 7.614 million beds for senior citizens. Furthermore, China has 10.6 million medical professionals, including 4.08 million practising physicians and physician assistants and 4.71 million registered nurses (National Bureau of Statistics of China, 2021b). Given the escalating numbers of ageing individuals and growing demand for medical resources, improving post-retirement care for senior citizens and providing the necessary health management support is crucial. These efforts will reduce the strain on medical resources and improve seniors' quality of life.

As previously discussed, a promising avenue to alleviate the burden of burgeoning medical demand is through innovation in healthcare technology. WHT has seen extensive application in recent years (Kim and Ho, 2021). For senior citizens, two main categories of wearable technology are designed and employed for disease prevention, health maintenance, and patient and disease management (Wu and Luo, 2019). WHT exhibits considerable potential in identifying and preventing falls among senior citizens. Between 30% to 60% of seniors experience falls yearly, resulting in injury, hospitalization, or death in 10% to 20% of cases (Rubenstein, 2006). Furthermore, WHT has demonstrated notable results in fall identification and prevention by collecting and analysing gait data (manner of walking) (Awais *et al.*, 2016).

Utilizing WHT, based on early detection of health imbalances, can also enhance patient management efficiency in hospitals (Wu and Luo, 2019). Patients with chronic diseases or/and cancer can improve their self-management of health conditions with the support of WHT (Chiauzzi, Rodarte and DasMahapatra, 2015).

The use of WHT in disease management has grown significantly over the past decade, contributing to efficiency and convenience (Wu and Luo, 2019). For instance, in managing heart disorders, various research and brands have focused on monitoring and warning of heart attacks using WHT (e.g., Da He, Winokur and Sodini, 2012; Winokur, Delano and Sodini, 2012). For instance, in managing heart disorders, various research and brands have focused on monitoring and warning of heart attacks using WHT. While Falter *et al.* (2019) confirmed that the Apple Watch can provide accurate heart rate data for cardiac rehabilitation, they found its unreliable performance in estimating energy expenditure. They suggested it is time to utilize the Apple Watch for cardiac rehabilitation.

Considering the health-related features, senior citizens might have a higher adoption rate of WHTs. However, a current challenge is the sustainable consumption of WHT (Fox and Duggan, 2013; Eapen *et al.*, 2016). Although the benefits of WHT in disease management, health condition monitoring, and sudden disease prevention for senior citizens with chronic diseases have been confirmed, the question of how to ensure sustainable consumption of wearable healthcare devices by senior citizens warrants further research.

1.1.1 Overview of Research Problem

As a pioneering advancement in medical technology, WHT is gaining extensive traction. The wearable industry is poised for substantial growth in the imminent future, with projections indicating an annual growth rate surpassing 20%, potentially culminating in a market valuation of 150 billion

EUR by 2028 (Ometov *et al.*, 2021). Notably, the majority of this meteoric rise appears to be attributed to smart-related WHT. Contrastingly, healthcare-centric medical WHT has been relatively overshadowed in marketing discourses.

Although the benefits of WHT are evident, especially for senior citizens, it has not garnered sufficient interest from this demographic. Only 3.3% of users in the US are senior citizens (Wurmser, 2019). The literature also indicates that the sustainable consumption of WHT for senior citizens falls short of expectations (American Association of Retired Persons, 2015). This thesis aims to fill a critical gap in the literature by focusing on the sustainable consumption of WHT for senior citizens in developing countries from a marketing perspective.

There is an exigent demand for rigorous scientific investigation and nuanced management insight within WHT. This is especially pertinent when considering sustainable consumption among the elderly population in developing nations. Whilst the prevailing literature primarily focuses on the acceptance of technology and the intention to utilise WHT, there remains a conspicuous gap in marketing regarding strategies to foster sustainable consumption of wearable healthcare devices among senior citizens. Therefore, this research endeavours to elucidate and quantify the determinants influencing sustainable consumption patterns of these devices among senior citizens.

1.1.2 Research Objectives

The study delineates the following objectives:

- To identify and examine the determinants related to design leadership, technology leadership and brand leadership that influence the customer experience of senior citizens using WHT.

- To investigate the relationship between customer experience and the sustainable consumption of WHT, factoring in the moderating variables pertinent to senior citizens.

In order to achieve these objectives, this research develops an innovative framework for the sustainable consumption of WHTs among senior citizens. Specifically, it identifies and measures significant factors within the spheres of technology leadership, design leadership, and brand leadership that mould the experiences of senior citizens when interacting with wearable healthcare instruments. The role of design leadership in this study relates to how the WHTs are personalised to meet the unique needs and preferences of senior citizens so as to enhance the customer experience of using WHT. A comfort, clear interactive, easy to use and be with several valued functions design which is a direct outcome of effective design leadership, significantly influences customer experience of using WHT and, consequently, the long-term adoption of these technologies by senior citizens. This research underscores the importance of design leadership in enhancing the user experience, thereby making the consumption of WHT more sustainable to the senior citizens. Technology leadership plays a vital role in ensuring the advanced reliability, and security of WHTs. This study explored how WHT produced by companies with technology leadership directly impact the customer experience through a trust of the advancement of the technology within these WHTs. The sustainability of WHT usage is highly dependent on the perception of its technological robustness, which is a direct result of effective technology leadership. For brand leadership, A reputable and credible brand instils confidence in the WHT's efficacy and safety, which is particularly important for senior citizens. This research delves into how brand leadership shapes the customer experience of using WHTs and drives their adoption and long-term use to achieve sustainable consumption of it. The study further delves into the reciprocal relationship between sustainable consumption of WHT and the encompassing customer experience of using WHT among senior citizens. The insights from this research will lay the groundwork for crafting international marketing strategies to promote sustainable consumption within the WHT sector. Grounded on significant technology leadership, design leadership, brand leadership and mindful of senior citizens' needs, these strategies are tailored to resonate with this demographic. Lastly, the research introduces a comprehensive framework instrumental for guiding stakeholders in the WHT ecosystem. This framework, which details the interplay between design, technology, and brand leadership, aims to enhance the quality of life for senior citizens. It addresses the challenges posed by an ageing population crisis and could inform policy-making and regulatory approaches to support the adoption of WHTs among senior citizens. Overall, the study provides critical insights into how leadership across different domains can collectively contribute to the well-being of the elderly, offering a multidimensional approach to tackling the healthcare challenges in an ageing society.

1.1.3 Research Questions

Based on the stated research objectives, the research questions are set as follows:

Primary Research Question

How can the sustainable consumption of WHT by senior citizens be enhanced through customer experience?

Secondary Research Questions

How can design leadership, technology leadership, and brand leadership drive the experience of wearable healthcare technologies by senior citizens?

What factors moderate the sustainable consumption of wearable healthcare technologies by senior citizens?

Within secondary research questions, the first question, 'How can design leadership, technology leadership, and brand leadership drive the experience of wearable healthcare technologies by senior citizens?' focuses on the aspects of leadership in design, technology, and branding. This question delves into how these factors and their sub-components can enhance the user experience for senior citizens. It suggests that leadership in these domains is crucial in shaping seniors' customer experience, and long-term usage of these technologies.

The second question, 'What factors moderate the sustainable consumption of wearable healthcare technologies by senior citizens?' expands the exploration into the conditions that support sustainable use of these technologies. It aims to identify various external and internal factors that might influence the long-term use and effectiveness of these technologies. This implies that the customer experience, as shaped by design, technology, and brand leadership, and its role in driving sustainable consumption of WHT, is influenced by certain moderating factors.

The relationship between these two questions is complementary. While the first question investigates the direct impact of leadership on user experience, the second question provides a broader context by examining the factors that might affect the sustainability of this usage. Understanding the influence of leadership on experience is essential, but recognizing the factors that can enhance or impede long-term adoption and use of these technologies is equally important. Together, these questions offer a comprehensive view of both the immediate impact on user experience and the broader, long-term factors influencing sustainable consumption.

1.1.4 Contribution

Theoretical contribution:

This study makes a significant theoretical contribution by introducing a novel framework that integrates technology leadership, design leadership, brand leadership and customer experience concepts to examine sustainable consumption of WHT. It addresses a gap in existing literature, which heavily relies on models like the Unified Theory of Acceptance and Use of Technology (UTAUT), the Technology Acceptance Model (TAM), and the Theory of Planned Behaviour (TPB). These models, though widely used to understand user inclinations towards adopting WHT, have not adequately explored the sustained usage of these technologies among senior citizens.

This research represents a pioneering academic endeavour that combines design leadership, technology leadership, brand leadership, and customer experience perspectives to investigate the sustainable consumption of WHT in the elderly demographic. It notably incorporates the concept of brand leadership into the discourse on sustainable consumption of WHT, offering a new perspective for scholars in this field. The study encourages the academic community to view the sustainable consumption of WHT from a broader perspective than just functionality.

In the Information Systems (IS) field, the thesis explores how design and technology leadership can promote the sustainable use of wearable healthcare technologies among senior citizens. It focuses on developing user-friendly and sustainable systems, emphasizing the need for long-term adoption and effective utilization. The research provides valuable insights into creating systems that cater to seniors' immediate health needs while also being sustainable in terms of usability and environmental impact.

From a marketing standpoint, the study examines how brand leadership can impact the sustainable consumption of WHT. It delves into the role of branding in fostering consumer trust and loyalty, particularly focusing on strategies that encourage long-term adoption by senior citizens. Furthermore, the thesis contributes to the wider conversation on sustainability in healthcare technology, examining how sustainable practices can be integrated into the design, development, and marketing of WHT. The research highlights the importance of considering the long-term environmental and social impacts of these technologies, stressing the need for sustainable consumption patterns among senior citizens.

Additionally, this study explores the extended usage phase of WHT for senior citizens, leading to a deeper understanding of these technologies within this demographic. This approach enhances the precision of the findings, making a significant contribution to both theoretical knowledge and practical application in the field.

Managerial contribution:

This research offers practical insights and actionable strategies for manufacturers and stakeholders in the WHT industry, particularly in addressing the high abandonment rates among senior citizens. These insights are critical for key decision-makers, marketing, design, and technology departments within WHT manufacturing companies.

Firstly, the study underscores the significance of design leadership in enhancing the user experience for senior citizens. This involves a focus on wearability, interactivity, perceived ease of learning and use, and functional value. Recognizing that ageist stereotypes may hinder seniors' willingness to engage with new technology, it is imperative for WHT manufacturers to demonstrate design leadership. This can be achieved through user-friendly designs that facilitate ease of understanding and interaction with the technology. Including features such as intuitive interfaces, tactile feedback, voice control, and other senior-friendly forms of interaction is crucial. Moreover, while integrating various functions into the devices is important, manufacturers must balance between wearability and functional value to cater to seniors' needs effectively.

Secondly, the research highlights the importance of technology leadership, particularly the effectiveness and real-time processing capabilities of WHTs. Seniors depend on these technologies for health monitoring and value the accuracy and reliability of the data provided. WHTs that deliver precise and timely health feedback build confidence and satisfaction among senior users, enhancing their overall experience and trust in the technology.

Furthermore, the study delves into the impact of brand leadership on the customer experience, focusing on aspects such as brand attitude, perceived quality, and country of origin. It's found that seniors' attitudes towards a brand significantly influence their satisfaction and perception of the WHTs. Thus, fostering positive brand attitudes is crucial for manufacturers. Additionally, perceived quality plays a key role in shaping seniors' trust in the technology. High-quality perceptions lead to a more positive customer experience. Lastly, the country of origin of the WHTs also influences seniors' attitudes and preferences, with potential implications for their overall experience with the technology.

In practice, these findings suggest that WHT manufacturers should prioritize user-centric design, ensuring accessibility and relevance to seniors' specific needs. By focusing on design, technology, and brand leadership, manufacturers can enhance adoption and sustained use of WHTs among senior citizens. This not only promotes better health outcomes but also improves the quality of life for this demographic. Implementing these strategies can lead to a more engaged and loyal customer base, driving sustainable consumption of WHTs among seniors.

Policy contribution:

This research underscores the challenges and considerations around senior citizens' sustainable use of WHT. It offers actionable insights to policymakers in the WHT sector, centred on senior citizens' unique needs and experiences. Since many developing nations face hurdles to inequitable healthcare access, integrating WHT solutions becomes increasingly valuable. However, government agencies must establish protective measures through well-thought-out policies. This study offers recommendations aimed at safeguarding the privacy of personal healthcare information, with a particular emphasis on senior users.

Additionally, several WHT providers have features allowing users to share and access their health data, enhancing overall engagement and the tool's efficacy. This research presents policymakers with a clearer understanding of senior users' perspectives and potential concerns about such functionalities.

1.2 Research Methodology

The present study will utilise a mixed-methods strategy. Chapter 2 of the study will conduct an initial literature review to identify the current research gap. As a result of this recognised absence, a preliminary qualitative phase will follow. In accordance with the research goals, this study aims to investigate the impact of technology leadership, design leadership and brand leadership on the experiences of senior citizens who utilise WHT.

Subsequent to the qualitative exploration, quantitative research will be undertaken, leveraging hypothesis testing to quantify how technology leadership, design leadership and brand leadership influence the customer journey. Additionally, customer-centric moderators like 'perceived vulnerability', 'perceived severity', and 'efficacy of self-health management', complemented by corporate-level factors such as 'government regulation' and 'disclosure policy', will be probed to further understand sustainable consumption patterns of wearable healthcare devices among senior citizens.

The research context is squarely focused on Chinese senior citizens aged 60 and above. China has implemented a mandatory retirement age policy since the 1950s, which establishes retirement at 60 for men, and 55 for female professionals and other workers, respectively (Feng *et al.*, 2019). An individual's cognitive age is a construct shaped by societal norms and is influenced by their personal experiences and significant life events (Yannopoulou *et al.*, 2023). This policy significantly impacts the concept of cognitive age, which is not only shaped by societal norms but also deeply influenced by personal experiences and life events, including retirement, a pivotal life transition as highlighted by Schau, Gilly, and Wolfinbarger (2009). Furthermore, the Law on the Protection of the Rights and Interests of the Elderly in the People's Republic of China (LPRCPRIE) was enacted on August 29, 1996, and became effective on October 1 of that year. It has undergone amendments four times, specifically in the years 2009, 2012, 2015, and 2018 (Du and Xie, 2015; Chen *et al.*, 2023). Under the LPRCPRIE, individuals aged 60 and above are officially recognized as senior citizens in China (The Central People's Government of the People's Republic of China, 2018). Therefore, the intersection of the retirement age and the legal identification age of 60 marks a significant transition, defining when an individual is considered a senior citizen in China. This study adheres to this age criterion, aligning with the Chinese definition of a senior citizen.

As a rapidly developing country with the highest population globally, China faces the intricate challenges associated with an ageing population. In 2019, China had a population of 254 million persons who were 60 or older. This number is projected to reach 402 million by 2040, constituting nearly 28% of the populace (World Health Organization, 2021). China is projected to maintain its status as having the largest ageing population, and the proportion of senior citizens within the overall population is anticipated to keep rising

(Mao *et al.*, 2020). China therefore is representative in the study of aging issues.

This case study is understood to embody typical characteristics representative of the preferences of senior citizens in developing countries. Therefore, China has been chosen as the focal point for this study, owing to its growing aging population and status as the country with the world's largest population. Following the completion of the qualitative phase, the framework will undergo subsequent changes. Subsequently, an online quantitative analysis will be conducted based on the revised framework.

1.3 Overview of This Study

Chapter 1 offers an introduction to WHT and its significance in sustainable consumption, drawing from established literature. This chapter underscores the challenges brought about by an ageing global populace and advocates the benefits of WHT in catering to this expanding segment. The study's research objectives and questions have been specified.

Chapter 2 serves as a comprehensive literature review. It commences with an in-depth look into sustainable consumption, tracing its historical development, many discourses, and establishing its defining features. This chapter next examines the relationship between sustainable consumption and the integration of WHT for senior citizens, highlighting existing gaps in research. The inclusion of a comparative analysis of customer experience and technology leadership, design leadership and brand leadership in the WHT industry enhances the overall depth and breadth of the chapter.

Chapter 3 provides a comprehensive analysis of the research methods employed. This resource aims to elucidate the complexities associated with study design, data collection, questionnaire construction, and strategies to enhance research reliability and validity.

Chapter 4 presents the qualitative research findings. The results emphasise the significant influence of technology leadership, design leadership and brand leadership on the well-being, health, and technology experiences of senior citizens. Moreover, the chapter documents the progression of the basic framework, culminating in establishing the finished hypotheses and research framework.

Chapter 5 explores the quantitative research phase, which involves the validation of hypotheses. The study provides, analyses, and evaluates the results of analysis in accordance with the existing literature review and qualitative observations.

Chapter 6 introduces the conceptual framework that forms the foundation of this thesis, and readers are presented with the framework and assumptions derived from this literature review and qualitative study.

Chapter 7 of this study presents a comprehensive synthesis and analysis of the research findings, offering contributions to theory, practice, and policy. Furthermore, the limitations of this study and suggestions for future research are provided.

Chapter 2. Literature Review

2.1 Sustainable Consumption

2.1.1 Definitions

The discourse surrounding sustainable consumption could be traced back to the second or third century BC, which manifested as criticism of resource overconsumption (Jackson, 2014). However, it was not until the 18th century that early modern critics like Henry Thoreau (1854), Thorstein Veblen (1899) and William Morris (1891) developed an articulate critique of 'overconsumption' (Jackson, 2014). In the 1970s, sustainable consumption began to receive growing attention, particularly among policymakers and practitioners (Holt, 2012).

In 1949, the United Nations hosted the Scientific Conference on the Conservation and Use of Resources, which discussed sustainability and later revisited this issue at the United Nations Conference on the Human Environment in Stockholm in 1972 (Jackson, 2014). By 1987, sustainable consumption was incorporated into discussions of sustainable development in the report from the World Commission on Environment and Development, established by the General Assembly of the United Nations (WCED, 1987).

The 1992 United Nations Conference on Environment and Development (Rio Earth Summit) called for a better understanding of the role of consumption and ways to foster more sustainable consumption patterns (United Nations Conference on Environment and Development, 1992). The conference highlighted the significant part unsustainable consumption and production practices play in the continuous deterioration of the global environment (Quoquab and Mohammad, 2020). Since then, the traditional focus on producers' environmental responsibility has been progressively complemented by an emphasis on the role of consumers. Therefore, a 'working definition' of sustainable consumption was proposed at the Oslo Roundtable on Sustainable Consumption and Production in 1994:

"The use of services and related products which respond to basic needs and bring a better quality of life while minimising the use of natural resources and toxic materials as well as emissions of waste and pollutants over the life cycle of the service or product so as not to jeopardise the needs of future generations" (Oslo Roundtable, 1994).

In 1998, the Norwegian government organised a further workshop in Kabelvåg (IIED, 1998). In this workshop, the scholars proposed two definitions of sustainable consumption:

"The special focus of sustainable consumption is on the economic activity of choosing, using, and disposing of goods and services and how this can be changed to bring social and environmental benefit" (International Institute of Environment and Development, 1998).

"Sustainable consumption means we have to use resources to meet our basic needs and not use resources in excess of what we need" (participants definition, labelvåg, IIED, 1998).

The United Nations Environment Programme (UNEP) proposed the definition of sustainable consumption as:

"Sustainable consumption does not imply consuming less; rather, it entails consuming differently, more efficiently, and with a higher quality of life" (UNEP, 1999).

In 2001, The UNEP established a sustainable consumption network, the sustainable consumption policies were integrated into the Customer Protection Guidelines, and strategies documents were produced highlighting the benefits of the new sustainable consumption focus. In this network, the definition of sustainable consumption was explained as follows:

"Sustainable consumption is an umbrella term that encompasses a number of key issues, including meeting needs, improving quality of life, increasing efficiency, reducing waste, taking a lifecycle approach, and considering the equity dimension; integrating these component parts in the central question of how to provide the same or better services to meet the basic needs of life and the desire for improvement, for both current and future generations" (UNEP, 2001).

Over a decade, the concept of 'sustainable consumption' had been solidly established on the policy map when the World Summit on Sustainable Development (WSSD) was held in Johannesburg in 2002. 'Changing consumption and production patterns' had been recognised as one of the three 'overarching objectives' for sustainable development (United Nations, 2001). Following the Johannesburg World Summit on Sustainable Development in 2002, the environmental unsustainability of the economic system and the consumption and production systems supporting everyday life began to be increasingly cast in terms of sustainable consumption.

This growing emphasis on consumption can be seen against the backdrop of the rise of consumer society and an increasing cultural focus on consumption activities. Simultaneously, an expanding range of environmental impacts is associated with private household consumption activities, both directly and indirectly (Michaelis, 2003). According to the Johannesburg Plan of Implementation (JPOI) agreed upon at the Johannesburg World Summit on Sustainable Development in 2002, sustainable consumption and production were considered essential prerequisites for sustainable development (UNEP, 2012).

These movements heightened consumer awareness globally, encouraging individuals to reassess their consumption habits. Policymakers, practitioners, and scholars have worked tirelessly to bring sustainable consumption to the fore. However, a consensus on the definition of sustainable consumption has yet to be reached (Jackson, 2014), as shown in Table 1.

Organization/ conference and year	**Definition**
Oslo Roundtable (1994)	The use of services and related products which respond to basic needs and bring a better quality of life while minimizing the use of natural resources and toxic materials as well as emissions of waste and pollutants over the life cycle of the service or product so as not to jeopardize the needs of future generations.
IIED (1998)	Sustainable consumption focuses on the economic activity of choosing, using, and disposing of goods and services and how this can be changed to bring social and environmental benefits.
IIED (1998)	Sustainable consumption means we have to use resources to meet our basic needs and not use resources in excess of what we need.
UNEP (1999)	Sustainable consumption does not imply consuming less; it entails consuming differently, more efficiently, and with a higher quality of life.
OCSC (2000)	Sustainable consumption is consumption that supports the ability of current and future generations to meet their material and other needs without causing irreversible damage to the environment or loss of function in natural systems.
UNEP (2001)	Sustainable consumption is an umbrella term that encompasses a number of critical issues, including meeting needs, improving quality of life, increasing efficiency, reducing waste, taking a lifecycle approach, and considering the equity dimension, integrating these component parts in the central question of how to provide the same or better services to meet the basic needs of life and the desire for improvement, for both current and future generations.

Table 1 Definitions of Sustainable Consumption (Organisation and Conference)

Indeed, scholars often defined sustainable consumption from various perspectives (examples are provided in Table 2). Depending on the specific aspects of sustainable consumption phenomena they were focusing on, researchers offer different definitions of sustainable consumption.

Authors and year	**Definition**
Abdulrazak and Quoquab (2018)	Sustainable consumption examines how the economic activity of selecting, using, and discarding goods and services might be altered to benefit society and the environment.
Bennett and Collins (2009)	Sustainable consumption believes that minimising capital usage while reducing waste and pollution is beneficial, that consumption of 'environmentally friendly' or 'green' products should be encouraged, and that present generations should reduce their needs for the sake of future generations.
Haron *et al*. (2005)	Sustainable consumption is concerned with the economic activity of selecting, utilising, and discarding things and services. It is concerned with enacting social change in order to achieve environmental benefits.
Heiskanen and Pantzar (1997)	Sustainable consumption satisfies today's generation's requirements without risking future generations' needs.
Hornibrook *et al.* (2015)	Sustainable consumption properly uses goods and/or services to meet basic requirements and obtain a higher quality of life. It also reduces the consumption of natural resources, harmful materials, and waste and pollution emissions throughout the life cycle. It also considers future generations' needs.
Jones *et al.* (2011)	Sustainable consumption demands integration from all aspects, including customer decision-making, marketers for designing proper business strategy, and all levels of the organisation. It also necessitates an effective monitoring and public reporting system.
Lee (2014)	Sustainable consumption focuses on environmental issues people face when making private consumption decisions. To care for society and the environment, being an ecologically and socially responsible citizen is vital.
Lorek and Fuchs (2013)	Sustainable consumption is sustainable resource consumption that considers the entire product life cycle. The consumption patterns of industries,

	governments, households, and individuals all contribute to sustainable resource consumption.
Peattie and Collins (2009)	Sustainable consumption is a consuming practice in which everyone consumes only their 'earth-share' while also considering social and environmental well-being.
Seyfang (2004)	Sustainable consumption is the most effective manner of consuming goods and services. Individuals who adopt such consuming habits are the driving force behind market transformation since they consider social and environmental factors when making purchases.
Stevens (2010)	Sustainable consumption is inefficient for achieving long-term production and, eventually, long-term development. To solve the market and system problems that obstruct progress on sustainability, integrated government measures are required to address consumption and production simultaneously.
Tunn *et al*. (2019)	Sustainable consumption is shaping and satisfying consumer needs to continuously reduce the negative impacts of consumption on the environment and the wider society.

Table 2 Definition of Sustainable Consumption (Scholars)

2.1.2 Characteristics

In reviewing the prevailing definitions, it becomes evident that sustainable consumption can be conceptualised from four broad perspectives:

i The fulfilment of fundamental human needs

ii Contemplation of quality of life

iii Consideration for environmental well-being

iv Anticipation of the needs of future generations

The fulfilment of fundamental human needs

Historically, consumption has been interpreted predominantly from two main perspectives: satisfaction-seeking and pleasure-seeking (Godazgar, 2007). The satisfaction-seeking orientation primarily addresses basic human necessities, often termed 'constrictive consumption', as it addresses comfort, leisure, and pleasure-related needs (Wilk, 2004). In contrast, the pleasure-seeking orientation, synonymous with extravagance, luxury, and sometimes moral deviation, has garnered criticism (Quoquab and Mohammad, 2020). This approach is viewed as harmful due to its facilitation of an overreliance on labour-saving technology, high earning capacities, and substantial contribution to environmental degradation. (Wilk, 2004; Quoquab and Mohammad, 2020).

Contemplation of quality of life

In modern discourse, the implications of over-consumption are hotly debated. The emphasis by confident marketers on catering to the immediate whims of consumers often side-lines genuine needs, and overlooks longer-term impacts (Quoquab and Mohammad, 2020). While such consumption might momentarily elevate the consumer's quality of life, its longer-term implications, including resource wastage and potential negative effects on happiness and moral values, are questionable (Shrum *et al.*, 2014). In many ways, sustainable consumption offers a counter-narrative to rampant materialism's pitfalls.

Consideration for environmental well-being

Environmental degradation, resource overexploitation, and the unchecked use of natural resources epitomise over-consumption. Every product or service derives from natural resources (Magdoff and Foster, 2010), making over-consumption a direct precursor to environmental harm (Alisat and Riemer, 2015). This pattern poses a significant threat to the ecological future if left unaddressed. Hence, sustainable consumption becomes indispensable, ensuring both human needs and environmental welfare are balanced.

Anticipation of the needs of future generations

The potential depletion of our natural reserves is a concern due to excessive use, driven by intensified marketing efforts (Abela, 2006; Varey, 2010). The exclusive emphasis on immediate luxury, without considering the long-term implications, threatens future generations' ability to access essential resources (Daly *et al.*, 2007).

While a universal definition for sustainable consumption remains elusive, this study has adopted a definition in alignment with the objectives of this doctoral dissertation. Therefore, this study proposed an adjusted definition based on Tunn *et al.* (2019)'s definition and several discussions of sustainable consumption. Sustainable consumption involves shaping and satisfying consumer needs and utilising experiences to continuously enhance consumers' quality of life, all while minimising the adverse effects of consumption on society. Given the research scope centred on the sustainable consumption of WHT, this definition closely matched the research purpose and features of healthcare production.

One of the most salient aspects of sustainable consumption is environmental consideration. For instance, Chekima *et al.* (2016) examined the influence of environmental knowledge, environmental advertising, and cultural value on consumers' green purchasing intentions among Malaysians. Lee (2014) investigated the factors influencing sustainable consumption among young, educated consumers in Hong Kong, emphasising supportive behaviours for environmental organisations as significant influencers of sustainable consumption. Wang *et al.* (2014) analysed the factors influencing sustainable consumption, including environmental knowledge, perception of consequence, environmental responsibility, environmental value, environmental sensitivity, among rural residents in China. Concurrently, some researchers incorporated other environmental aspects when examining consumers' sustainable consumption behaviours, such as energy and water consumption (Marzouk and Mahrous, 2020), recycling behaviour (Park and

Lin, 2020), climate change and global warming (Chen *et al.*, 2019), organic products (Brach, Walsh and Shaw, 2018) and environmentally friendly behaviour (Thøgersen and Ölander, 2002). In other words, the environment often served as a proxy for sustainable consumption in research. Additionally, consumers were sometimes referred to as ‘green consumers’ in previous research. For example, Young *et al.* (2010) examined the purchase process concerning consumer technology products for participants who self-identified as green consumers in the UK. Paço *et al.* (2019) investigated the connections between a set of constructs to present a model for green consumer behaviour based on various purchasing behaviour antecedents, including a prosocial attitude, green value, and green communication.

In a significant proportion of academic literature, the term 'green' has been posited as synonymous with sustainability. However, one must critically evaluate whether 'green' adequately captures the entirety of the sustainability construct (Quoquab and Mohammad, 2020). Although 'green' undeniably addresses environmental stewardship, the broader definition of sustainable consumption encompasses not just environmental considerations but also the reasonable fulfilment of life's essential needs, the enhancement of quality of life, and a forward-looking concern for future generations.

Frequently, the label of 'green' consumer is ascribed to those individuals who exhibit environmental consciousness or demonstrate an aspiration towards this orientation. However, within real-world consumption paradigms, not all consumers fit neatly into the 'green' category, nor do they all aspire to do so. Moreover, products that are marketed as 'ethical' or 'green' account for a relatively minor fraction of the broader market offering.

Existing research on sustainable consumption exhibits several discernible gaps. Firstly, there appears to be a predominant trend towards categorising both products and consumers under the umbrella term of 'environmentally friendly'. Secondly, there is a conspicuous absence of research exploring sustainable consumption contexts wherein neither the consumers nor the products are inherently 'green' or eco-friendly. Lastly, many studies overlook other crucial aspects of sustainable consumption, satisfaction of fundamental requirements without excessive consumption, the improvement of quality of life, and the concern for the well-being of future generations.

2.2 Customer Experience

2.2.1 Definition

"What people really desire are not products but satisfying experiences"(Abbott, 1955, p. 40).

Abbott (1955) advanced an expansive conception of customer experience (CX), thereby initiating the research trajectory of experiential theory. From the 1980s, experiential research expanded to encompass human behaviours, accentuating the role of decision-making and the emotional ramifications of experiences (e.g., Hirschman and Holbrook, 1982; Thompson, Locander and Pollio, 1989). Concurrently, CX began to permeate marketing practices. Throughout the 1990s, influenced by service encounter theory (Bitner, 1990), various factors influencing CX were incorporated into the concept, such as employee interactions (Bitner, 1990), interferences between customers (Hui and Bateson, 1991), and physical context (Bitner, 1992).

In the period preceding the 21st century, some academics advocated for the differentiation of 'experience' from 'goods' and 'services'. For instance, Pine, Pine and Gilmore (1999) posited that when a consumer purchases an experience, it is perceived as "spending time enjoying a series of memorable events that can attract consumers in an inherently personal way". However, this perspective was subsequently challenged by other researchers who promulgated a more encompassing view of CX, as every service exchange could be linked to CX, regardless of its form and nature (Schmitt, Brakus and

Zarantonello, 2015). This view envisages CX from a holistic standpoint, incorporating aspects such as customers' emotions, perceptions, and interactions with a company or organisation (Lemke, Clark and Wilson, 2011; Bolton *et al.*, 2014). Thus, CX is related to every aspect offered by the firm, including the product, product features, service quality, advertising, and packaging (Meyer and Schwager, 2007).

Presently, scholars and practitioners have reached a consensus on the definition of CX. Verhoef *et al.* (2009, p.32) explicitly defined CX in retailing as "a holistic construct in nature and involves the customer's cognitive, affective, emotional, social and physical responses to the retailer". Brakus, Schmitt and Zarantonello (2009, p. 53) define brand experience as subjective, internal consumer responses (sensations, feelings and cognitions) and behaviours evoked by the brand's stimuli. A similar definition of CX was proposed by De Keyser *et al.* (2015, p.23), who described it as "comprised of the cognitive, emotional, physical, sensorial, spiritual, and social elements that mark the customer's direct or indirect interaction with (an)other market actor(s)".

In summary, CX emerges as a multidimensional construct focusing on a customer's cognitive, emotional, behavioural, sensory, and social responses to a company's offerings throughout the customer's entire purchase journey (Lemon and Verhoef, 2016).

2.2.2 Model Development

Customer purchase behaviour process model

In the 1960s, the foundation of marketing theory was developed, placing a spotlight on customer decision-making and their experiences during the purchasing journey. During this formative era, the Howard-Sheth Model of Consumer Behaviour proposed by Howard and Sheth (1969) emerged as the most influential research model for analysing the purchasing journey.

Additionally, the role of advertising was incorporated into this process to study the function of advertising in marketing. The attention–interest–desire–action (AIDA) model (Lavidge and Steiner, 1961) posited that customers must pass through each stage to progress to the next and has remained a successful, popular, and enduring research model. These theories have laid the groundwork for subsequent research on CX, informing the development of studies on multichannel marketing and path-to-purchase modelling. For instance, Neslin *et al.* (2006) delineated multiple channels for the process from problem recognition to research to purchasing to after-sales, based on the Howard and Sheth (1969) model. Subsequent studies, such as those by Puccinelli *et al.* (2009) and Verhoef *et al.* (2009), also took the purchasing process into account based on the Howard and Sheth model.

Customer satisfaction and loyalty

A pivotal component of managing CX revolves around gauging and supervising customer attitudes towards products and brands. The concept of satisfaction, formulated in the 1970s, reflects the comparison between the actual performance of a product and customer expectations. Several methods have been devised to measure satisfaction, including directly querying the degree of satisfaction (Bolton, 1998) and assessing customer emotions, such as happiness (Westbrook and Oliver, 1991). As the concept evolved, a broader spectrum of factors was incorporated into the assessment of CX, establishing satisfaction evaluation as a standard practice in marketing research (Lemon and Verhoef, 2016).

Service quality

Owing to the distinctive characteristics of service offerings, scholars and practitioners recognized the difference between service offerings and product offerings in marketing (Rathmell, 1966), leading to the emergence of service marketing as a separate discipline in the 1980s. Service quality became a crucial concept in service marketing, with the widely accepted SERVQUAL model and measurement scale developed by Parasuraman, Zeithaml, and Berry (1988). The SERVQUAL model was recognized as one of the most significant research models, exerting considerable influence in practice (Roberts, Kayande and Stremersch, 2014). Additionally, service blueprinting emerged as an early attempt to map the customer journey (Bitner, Ostrom and Morgan, 2008).

Relationship marketing

Beginning in the 1990s, the concept of establishing a robust relationship between a company and its customers garnered significant attention, particularly in the fields of B2B marketing, marketing channels research (e.g., Morgan and Hunt, 1994; Geyskens, Steenkamp and Kumar, 1998) and customer marketing (e.g., Berry, 1995). Key research areas in relationship marketing included trust, commitment, switching costs, and relationship quality (Lemon and Verhoef, 2016). Subsequent research in relationship marketing shifted its focus towards emotional relationships, such as passion and intimacy (Yim, Tse and Chan, 2008; Bügel, Verhoef and Buunk, 2011). The integration of relationship marketing with customer marketing provided more avenues for researchers to understand customer relationships and expanded the scope of CX research to encompass emotional and perceptual aspects.

Customer relationship management

Customer relationship management, a concept that became prominent in the 2000s, focused on extracting value from customer relationships. It prioritized optimizing customer profitability and lifetime value (CLV). Given the heterogeneity in costs and revenue, long-term relationships were not necessarily associated with higher profits (Reinartz, Krafft and Hoyer, 2004). Long-term relationships are not linked to more profit based on the heterogeneity in cost and revenue (Reinartz and Kumar, 2000). Consequently, customer relationship management research pivoted towards strategies to bolster customer acquisition, retention, and optimal CLV extraction, aligning the trajectory towards maximizing shareholder returns (Venkatesan and Kumar, 2004; Reinartz, Thomas and Kumar, 2005; Kumar and Shah, 2009).

Time frame	Research topic area	Notes	Sample	Contribution
1960s - 1970s	Customer purchase behaviour process model	Understanding CX and decision-making as a process	attention–interest–desire–action (AIDA) model (Lavidge and Steiner, 1961)	• Included path to purchase • Conceptual linkage model
1970s	Customer satisfaction and loyalty	Evaluating customer's perceptions and attitudes about CX	Satisfaction (Bolton, 1998)	• Identified the main measurement and key drivers of accessing customer experience in an overall view • Empirical linkage models
1980s	Service quality	Determining the context and element of CX and mapping customer journey	SERVQUAL model (Parasuraman, Zeithaml and Berry, 1988)	• Included atmospherics and environment into CX • Considered early customer journey via blueprinting
1990s	Relationship marketing	Extending scope of customer responses in CX	Berry (1995)	• Expanded research context to B2B context • Identified the attitudes that drive behaviour

2000s	Customer relationship management	Based on model to identify the specific factors of CX and their influences	Optimization of customer lifetime value (CLV) (Reinartz, Krafft and Hoyer, 2004)	• Evaluation of return on investment • Considered multiple channel • Identified the main touch points
2000s - 2010s	Customer centricity and customer focus	Interdisciplinary and organizational challenges in CX, managing CX	Four-stage path to a customer-focused culture (Gulati and Oldroyd, 2005)	• Customer perspective across the organization • Focused on customer perspective and redesign the CX
2010s	Customer engagement	Understanding the customer's role in CX	Customer brand engagement (Hollebeek, Glynn and Brodie, 2014)	• Highlighted value of nonpurchase interaction • Included social media platform • Included both sides of attitude, emotion and behaviour

Table 3 The Developing Map of CX Research

Customer centricity and customer focus

During the 2000s and 2010s, customer centricity emerged as a valuable strategic approach. Sheth, Sisodia and Sharma (2000) contended that customer-centric marketing should focus on understanding and delivering value to individual customers rather than mass or target markets. Gulati and Oldroyd (2005) outlined a four-stage path to a customer-focused culture: (1) communal collaboration: gathering all customer information; (2) serial coordination: deriving insights about customers from past behaviour and all information; (3) symbiotic coordination: developing an understanding of likely future customer behaviour; and (4) integral coordination: responding to customer needs in real-time (Gulati and Oldroyd, 2005, p. 97). Several managerial tools have been developed to champion customer centricity, notably customer personas (Lemon and Verhoef, 2016) and the 'jobs-to-be-done' perspective (Christensen *et al.*, 2007). Personas is defined as "*a semi-fictional representation of your ideal customer based on market research and real data about your existing customers*" (Lemon and Verhoef, 2016). While personas have been a fundamental component of user-centred design, their use has experienced significant growth within the domain of CX (Herskovitz and Crystal, 2010). Conversely, the 'jobs-to-be-done' approach focuses on discerning the triggers that catalyse the purchasing process in customers' lives. (Christensen *et al.*, 2007).

Customer engagement

In the current decade, customer management is mainly related to customer and brand engagement. It attempted to distinguish the attitudes and behaviours beyond the purchase. Brodie *et al*. (2011, p. 260) defined customer engagement from an attitudinal perspective as "*a psychological state that occurs by virtue of interactive, co-creative customer experiences with a focal agent/object (e.g., a brand) in focal service relationships*".

Engagement refers to a motivational state that prompts customers to interact with companies. Vivek, Beatty and Morgan (2012) and Dooren *et al*. (2019) defined customer engagement as the intensity of customer (individual) participation in and is connected to an organisation's offerings or activities, which is initiated by either consumers or firms. Kumar, Petersen and Leone (2010) noted that customer engagement value participates in customer behaviours in purchasing, referral, influencer and knowledge aspects.

Conceptualising Customer Experience

Although studies have acknowledged the significance of CX, there is still a lack of consensus and clarity on its conceptualisation and operationalisation (Mahr, Stead and Odekerken-Schröder, 2019; Becker and Jaakkola, 2020). Besides, CX is tethered to some specific encounters (Kumar *et al*., 2014), its ambit can extend to the overarching customer journey (Lemon and Verhoef, 2016). This suggests that slightly different conceptualisations of CX can lead to different interpretations of the same phenomenon (Silva *et al*., 2021). Moreover, multiple conceptualisations can also complicate the adoption of CX models (Bueno *et al*., 2019). Given the multidimensional nature of CX, the themes and theories about it are likewise diverse. As a result, the current state of CX research is characterised by a wealth of diverse yet fragmented knowledge (Silva *et al*., 2021). As the literature shows, different research areas alternately take precedence, and integrated theories or models cannot accommodate all these facets.

2.2.3 Design Leadership

In recent years, innovation in healthcare has predominantly focused on managing healthcare costs and addressing the effects of stagnant healthcare outcomes (Committee on Quality of Health Care in America, 2001). Nonetheless, innovation in this sector proceeds at a measured pace owing to the complex interplay of stakeholders and their respective roles. The shifting role of physicians, now expected to consider Key Performance Indicators alongside patient safety and quality of care, exemplifies this complexity (Lee, 2010). This shift has provoked concerns about balancing effective healthcare resource utilization and organizational fitness (McAlearney, 2006). Ultimately, all changes in healthcare ought to prioritize the value delivered to patients (Porter and Teisberg, 2006; Porter, 2009).

The integration of design as a core organizational capability and a cornerstone of value innovation demands a significant paradigm shift. This encompasses a focus on usability and customer-centricity, the use of design as a brand-differentiating tool, and the perception of design as a business instrument, facilitating transformation and manifesting as a cultural phenomenon(Gardien and Gilsing, 2013; Koomans and Hilders, 2016). Design leadership plays a pivotal role in this transition.

Turner and Topalian (2002) offered a clear-cut definition of design leadership: "*Where the organization should go; 1) Distinction in leading through design; 2) Sustaining design leadership over time; 3) the gaining of acknowledgement for achievements through design*" (Turner and Topalian, 2002, pp. 2–3). They proposed that design leadership could enhance organizational performance, enabling companies to swiftly make users' feel right' through their design solutions and ensuring the long-term effectiveness and contribution of these solutions. Turner encapsulated this as: "*Design leadership is about helping organizations to envision the future and to ensure design is used to turn those visions into reality*" (Turner, in Best, 2006, p. 186). In addition, Muenjohn (2015) perceived design leadership as a style that encourages and supports the inception of innovative design solutions.

For the purposes of this study, which explores sustainable consumption of WHT, the selected definition of design leadership should closely align with the research objective. Additionally, it should resonate with the characteristics of healthcare production. Therefore, in the context of this research, design leadership is defined, based on Muenjohn's perspective, as *a form of leadership that inspires and facilitates the development of innovative design solutions.*

2.2.4 Technology Leadership

Technology is swiftly evolving to serve as the foundational 'info-structure' for contemporary organisations (Bogdanovych *et al.*, 2006). The advent of the Internet and advancements in Mobile Internet Technology have engendered transformative shifts in service modalities. Characterised by its 'functional-oriented' stance, technology leadership endeavours to cultivate, steer, oversee, and assimilate IT within organisational processes (Dexter, 2011). In addition, technology leadership makes an effort to comprehend technological trends and directions before making solutions based on the technology's possible applications (Weng and Tang, 2014). For an organisation, the technology leadership can be 'narrowly' defined from four indexes: the number of the 'headline' figure of research and development (R&D) intensity, the number of R&D personnel, the number of scientific publications, and patents (Huang and Sharif, 2015). Srivastava and Dhar (2016) also presented technology leadership from the internal aspect of an organisation as: "*a combination of leadership qualities and the ability to implement change, provide technological resources, encourage employees' professional development, and use emerging techniques, equipment, and software to achieve organisational goals"* (Srivastava and Dhar, 2016, p. 79). However, Zhang *et al*. (2018) and Bendig (2022) defined the technology from the aspect of ability as:

- A positive impact on organisations' ability to respond to any unfavourable external condition by innovating in order to improve performance (Zhang, Zhao and Lyles, 2018).

- An ability to assist in facilitating change, alleviating adaptation pressure, and aligning with the environment (Bendig *et al.*, 2022).

Few studies investigated technology leadership in WHT scopes. In this research, based on the characteristics of WHT and the services provided by WHT, the technology leadership is defined as an ability to assist in the facilitation of change, present competitiveness in marketing, and guarantee the performance of the product.

2.2.5 Brand Leadership

A brand is defined as: "*a name, term, sign, symbol or design, or a combination of them, intended to identify the goods or services of one seller or group of sellers and to differentiate them from those of the competitors*" (American Marketing Association (AMA) 1960 in Wood, 2000, p. 664). Currently, brands are increasingly seen as a critical point of differentiation and a long-term source of competitive advantage for business-to-business (B2B) marketers (Low and Blois, 2002; Beverland, 2005). However, the difference between industrial brand management and consumers should be clarified. For customer marketers, the emphasis is on individual rather than corporate brands, brand managers concentrate their efforts on reducing the size of the brand portfolio while increasing coverage (Mudambi, 2002); contrarily, industrial marketers pay much more attention to establishing the brand at the corporate level (Mudambi, 2002). Meanwhile, industrial marketers highlight functional rewards; customer marketers considered more perspectives, including functional, emotional, and symbolic benefits of a brand (Mudambi, 2002). However, these are a narrow presentation of the industrial brand. The industrial brand can also deliver reliability, quality, and performance via the product (Bendixen, Bukasa and Abratt, 2004), otherwise, it also represents the significant intangible associations, such as expertise and trustworthiness (Webster and Keller, 2004).

The importance of a brand in the decision-making process for customers cannot be ignored as well. Generally, the reputation of brands or manufacturers is relevant to the customers' level of awareness and degree of loyalty (Mudambi, 2002). Sometimes, high brand equity would increase customers' willingness in paying a price premium for the product. This was accompanied by that customers are more inclined to spread positive information about the company and its brand (Bendixen, Bukasa and Abratt, 2004).

The definition of brand leadership is relatively consistent, Aaker (1996) provided the definition of brand leadership as a continuous process for a brand to achieve excellence; besides, he extended the definition to a fundamental brand identity association, as it not only develops equity, but is essential to the success of the brand (Aaker and Joachimsthaler, 2000). There are some researchers who defined brand leadership as an ability. For instance, Keller (2012) stated brand leadership refers to the ability to influence a customer's purchase decision by assigning a differentiated value to a product or service; Gehlhar *et al*. (2009) defined it as an ability to set itself apart from competitors in terms of products and services. In addition, Chang and Ko (2014) defined brand leadership from the customer perspective as Consumers' perception of a brand's relatively unique ability to consistently achieve excellence in an industry sector through a sufficient combination of trend-setting and brand positioning. Due to the research aim and context, this research would adopt Gehlhar *et al*.'s definition of brand leadership as an ability to differentiate its product and services from competitors.

Aaker and Joachimsthaler (1999) developed a framework of brand leadership which intergrade three essential dimensions for establishing a relevant brand. 1) branding needs to consider tangible and intangible dimensions, including company reputation, country of origin, product performance, quality associations and perceived reliability (Michell, King and Reast, 2001); 2) when a company reinforces a brand's meaning over time through consistent imaging and delivery, it achieves brand success, which necessitates supportive organisational structures and processes. (Michell, King and Reast, 2001; Lindgreen *et al.*, 2012); 3) for the marketers who may not have the opportunity to take part in standardised branding programmes to match the individual needs of their client segments, it is critical for marketers to adapt branding programs across nations and customer segments (Webster and Keller, 2004). However, the limitation of this framework is that due to its size, ownership structure, experience, and strategy, the framework does not expressly take into consideration organisations' particular strengths (Lindgreen *et al.*, 2012).

Beverland, Napoli and Lindgreen (2007) examined the global brand programs of five industrial companies in New Zealand, they identified five capabilities: relational support, coordinating network players, leveraging brand architecture, adding value, and quantifying the intangible. These capabilities are essential for the establishment of brand identification. Furthermore, in order to underpin the brand identification and build up the brand leadership, there are five supported by five organizational supportive capabilities: entrepreneurial, reflexive, innovative, brand supportive dominant logic, and execution capabilities.(Beverland, Napoli and Lindgreen, 2007).

Chang and Ko (2014) conceptualized four customers perceived dimensions of brand leadership: quality, value, innovativeness and popularity. 1) Quality: customers' assessment of a product's relative market supremacy; 2) Value: consumers' appraisal of a product's relative financial value based on what they provide and receive; 3) Innovation: consumer perceptions of a brand's relative ability to embrace innovative ideas and develop new solutions; 4) Popularity: "*consumers' perception about a brand's relative popularity reflected by brand awareness and consumption*" (Chang and Ko, 2014, p. 67).

Healthcare services stand apart from the majority of products or services, primarily because they represent some of the most vital and personalised experiences a consumer can have (Kemp, Jillapalli and Becerra, 2014). Leading healthcare institutions like the Mayo Clinic, Johns Hopkins, and Massachusetts General Hospital have amplified their branding initiatives (Kemp, Jillapalli and Becerra, 2014). Such branding can be perceived as an assurance of superior healthcare services that these organisations pledge to deliver to their customers (Kemp, Jillapalli and Becerra, 2014). Concurrently, it acts as both a binding commitment and a motivational force, pushing healthcare organisations to maintain or elevate their service quality, thereby enhancing the overall consumer experience (Sparer, 2011).

The intrinsic nature of healthcare services mandates a profound level of trust. Moreover, these services exhibit intricate and unique characteristics (Hariharan *et al.*, 2004). The operational performance of healthcare institutions is often moulded by a confluence of qualitative elements (Thantry *et al.*, 2006). For instance, patients' perceptions of high-quality services might extend beyond the mere expertise of medical personnel. It could encompass service attitudes, competitive pricing, the adoption of advanced equipment, and more. As a result, brand leadership within healthcare institutions has been somewhat underrepresented in scholarly literature, especially when contrasted with other service sectors. Kim *et al.* (2008) investigated brand equity in healthcare organisation marketing; they stated that healthcare institutions should emphasise nurturing customer relationships to bolster brand equity. Hausman (2004) pinpointed patients' benefits and physicians' autonomy as critical in fostering brand allegiance. Chahal and Bala (2012) suggested that the service brand equity in a healthcare institution is significantly impacted by perceived quality and brand loyalty; brand image played the mediating role. Kemp, Jillapalli and Becerra (2014) proposed that trust, referent influence, and corporate social responsibility are crucial determinants in cultivating a potent bond between customers and healthcare brands. Once an affective commitment is established, consumers might resonate with the healthcare provider's brand, forging a self-brand connection. Subsequently, they might also play a role in shaping the brand's reputation.

2.3 Wearable Healthcare Technology

2.3.1 Origins of Wearable Healthcare Technology

The initial idea of utilising wearable computers was first traced back to 1955, when Edward Thorp and Claude Shannon created a device small enough to be worn on a person's body. This device was designed to predict where the ball would land on a roulette wheel in a Las Vegas casino (Fernández-Caramés and Fraga-Lamas, 2018). Since the 1960s, there had been significant progression in the field of wearable technology due to technological advancements. Experiments with smart glasses and helmets occurred in the 1960s, followed by the development of wearable lighting for photographers in the 1970s and smart shirts, which were used to monitor individuals' vital signs, from the 1980s to 1990s (Fernández-Caramés and Fraga-Lamas, 2018).

The history of WHT extended back to the 13th century when Roger Bacon created corrective lenses. In the 17th century, the ear trumpet was documented by Jean Leurechon (Casselman, Onopa and Khansa, 2017). The mid-20th century witnessed the rapid advancement of electronic technology, leading to the production of more WHTs resembling those of today, such as long-term implantable pacemakers in 1960 (Aquilina, 2006), insulin pumps in 1971 and digital hearing aids in 1987 (Casselman, Onopa and Khansa, 2017).

In the 21st century, thanks to advances in sensor and information technology, individuals gained the ability to continuously monitor various physiological conditions. An increasing number of WHTs were introduced into people's lives. These technological advancements brought several innovative changes to the physical and operational efficiency of WHTs (Erdmier, Hatcher and Lee, 2016). During this time, technology companies turned their attention towards producing a multitude of wearable healthcare devices, such as smartwatches that could monitor activities, fitness bands that could measure Energy Expenditure (EE) and sleep conditions, and flexible patches that could monitor vital signs such as temperature and heart rate (Erdmier, Hatcher and Lee, 2016).

2.3.2 Definition

Despite the broad acknowledgment of the health-related functionality of WHT, a universally accepted or applied definition of WHT had not been established, as noted by Li, Lin and Chib (2021).

Several scholars have offered definitions for WHT, reflecting the evolution of the field and its growing complexity.

Fotiadis, Glaros and Likas (2006) identified WHT as an *"a device that is autonomous, that is non-invasive, and that performs a specific medical function such as monitoring or support over a prolonged period of time."*

In contrast, Wright and Keith (2014) presented a broader perspective, defining WHT as *"wearable technology, wearable devices, or simply wearables as intelligent computers incorporated into different accessories, including clothing, fashion accessories, and other everyday items worn by consumers."*

Further broadening the scope, Sultan (2015) described WHT as *"electronic technologies or computers that are incorporated into items of clothing and accessories which can be worn comfortably on the body."*

However, the definition has continuously evolved with the ongoing advancements in WHT, introducing capabilities like ECG, blood pressure monitoring, and fall detection.

Bruno *et al*. (2018) expanded the definition to emphasise its application, describing WHT as a device that *"enables the monitoring of an individual's health status through a remote interface, allows a non-invasive and continuous assessment over time in non-traditional healthcare settings."*

Shin *et al*. (2019) honed in on the fitness tracking capabilities of WHT, characterising them as tools that *"enable users to track and monitor their health-related physical fitness metrics including steps taken, level of activity, walking distance, heart rate, and sleep patterns."*

Farivar, Abouzahra and Ghasemaghaei (2020) articulated WHT as *"the devices that will be physically attached to the users in order to monitor some aspects of their behaviours, such as their physical activity (number of steps, distance, calories burned, etc.) and their vital signs (heart rate, blood pressure, etc.)."*

Most recently, Li, Lin and Chib (2021) provided a comprehensive definition of WHT as *"wearable health technologies as body-attached or body-implanted smart devices capable of tracking physiological signals for health-related purposes."*

In summary, the definition of WHT has undergone a progressive refinement towards specificity. Although a universally accepted definition of WHT remains to be established, the majority of contemporary definitions underscore the continuous monitoring of health conditions. In alignment with the healthcare focus of this study and considering the research objectives and scope of this doctoral thesis, this thesis adopted Li, Lin and Chib's (2021) definition, *"WHT is a body-attached or body-implanted smart device capable of tracking physiological signals for health-related purposes."*

Authors and year	Definition
Fotiadis, Glaros and Likas (2006)	*"A device that is autonomous, that is non-invasive, and that performs a specific medical function such as monitoring or support over a prolonged period of time."*
Buenaflor and Kim (2012)	*"Electronic devices that provide the functions of a computer or system, and are able to be attached to or worn on the body."*
Wright and Keith (2014)	*"Wearable technology, wearable devices, or simply wearables as intelligent computers incorporated into different accessories, including clothing, fashion accessories, and other everyday items worn by consumers."*
Sultan (2015)	*"Electronic technologies or computers that are incorporated into items of clothing and accessories which can be worn comfortably on the body."*
Bruno *et al.* (2018)	*"Enables the monitoring of an individual's health status through a remote interface, allow a non-invasive and continuous assessment over time in non-traditional healthcare settings."*
Shin *et al.*, (2019)	*"Enable users to track and monitor their health-related physical fitness metrics including steps taken, level of activity, walking distance, heart rate, and sleep patterns."*
Farivar, Abouzahra and Ghasemaghaei (2020)	*"The devices that will be physically attached to the users in order to monitor some aspects of their behaviours, such as their physical activity (number of steps, distance, calories burned, etc.) and their vital signs (heart rate, blood pressure, etc.)"*
Xing *et al.* (2021)	*"In essence IoT-based wearable devices, which can take the form as remote body trackers, wristbands or smart watches."*
Li, Lin and Chib (2021)	*"Body-attached or body-implanted smart devices capable of tracking physiological signals for health-related purposes."*

Table 4 Key Wearable Healthcare Technology Definitions from Scientific Sources

2.3.3 Development

As previously discussed, the development of traditional wearable medical technologies, such as corrective lenses, hearing aids, contact lenses, followed by more advanced devices like insulin pumps, heralded a notable expansion in WHT (Casselman, Onopa and Khansa, 2017). This burgeoning assortment of WHTs empowered users with the tools to monitor and autonomously manage their health conditions.

In recent times, WHT has achieved significant advancements within the fitness sector, setting benchmarks in terms of popularity, innovation, and multifunctionality. Numerous technology companies, including Nike, Fitbit, Apple, and Garmin, have unveiled an eclectic mix of wearable healthcare solutions. These offerings span functionalities from fitness monitoring to real-time textual and call notifications.

The popularity of fitness-related wearable products brought about further developments in WHT. By 2012, health-related wearable devices constituted 35.1% of the wearable technology market (Casselman, Onopa and Khansa, 2017). Moreover, the global enterprise wearable market reached a valuation of over EUR 18 billion in 2017, and it was predicted to experience an 11.8% compound annual growth rate from 2019 to 2026 (Ometov *et al*., 2021). These market analyses underscored the significant potential for WHT's further development.

2.3.4 Adoption

In this section, the review of current research on the adoption of WHT was grounded on the Socio-Technical System (STS), incorporating elements such as external effects, people, physical aspects, and economy (Bostrom and Heinen, 1977). When these systems functioned synergistically, optimised outputs could be produced. The social system was composed of the attributes of people, including attitudes, skills, values, interpersonal relationships, and authority structures. The technical system incorporated the process, required technology, and tasks (Bostrom and Heinen, 1977).

External effect

A robust corpus of academic literature has focused on privacy and security, examining these from the vantage points of technological advancement and commercial strategies. A notable trend in the evolution of WHT posits it as poised to become an indispensable facet of home-based healthcare or telehealth. This is facilitated by advancements in the Internet of Things (IoT), 5G, and the Internet of Medical Things (IoMT) (Majumder *et al.*, 2017; Sheth, Jaimini and Yip, 2018; Gu *et al.*, 2019; Jiang, Ming and You, 2019; Somasundaram and Thirugnanam, 2021). In tandem with this evolution, contemporary studies increasingly emphasise the imperatives of privacy and security within WHT, particularly given the escalating integration of IoT and 5G technologies.

Moreover, the growing prevalence of medical wearable devices amplifies the stakes concerning privacy and security threats. Such risks may, in some instances, eclipse the dangers posed by identity theft. Respondents articulated apprehensions regarding the privacy implications of data dissemination to affiliated bodies, such as governmental agencies and insurance firms. There exists a predominant anxiety about potential biases in insurance rate determinations or overall welfare, particularly when individuals present suboptimal health conditions (Tedesco, Barton and O'Flynn, 2017; Kim and Choi, 2019; Paluch and Tuzovic, 2019). These concerns highlight the necessity for regulatory entities to develop and enforce rigorous regulations and procedures in order to safeguard user welfare (Sun *et al.*, 2016; Banerjee, Hemphill and Longstreet, 2018).

Furthermore, several studies discussed the repercussions of WHT on professional workload. While WHTs efficiently collect patients' vital signs automatically, their efficacy in diminishing professional workload has been a subject of contention. This criticism mainly stems from the extensive amount of data and the subsequent challenges in familiarising and educating older users about these devices.

People

Contemporary society is deeply embedded within an intricate web of networks. However, discussions centred on senior citizens, particularly those with limited internet proficiency, are often scant in several positivist online studies. Moreover, the design features of WHT intended for senior citizens need careful adjustments to accommodate their distinct needs. This includes optimising screen proportions and simplifying training regimens in order to alleviate emotional load (Mercer *et al.*, 2016). This emotional load is not exclusive to senior citizens; it also resonates with patients suffering from specific ailments like epilepsy and asthma. For instance, epileptic patients prefer inconspicuous wearable medical technologies that continually monitor their condition, alleviating emotional load. Contrarily, certain tech-savvy users exhibited a penchant for avant-garde wearables with ornate or ostentatious features, mirroring their cutting-edge and modish sensibilities (Choi and Kim, 2016; Kim and Park, 2019). Therefore, product vendors should offer a range of options to potential adopters, considering their diverse needs and adoption conditions.

Another challenge in WHT adoption is increasing user engagement. Health monitoring is an activity that requires long-term perseverance (Koivisto and Hamari, 2019). However, formulating, supervising, and enumerating objectives and advancements present formidable challenges. The gamification in health monitoring primarily aims to support individual motivations such as self-management and self-care. However, the design of gamification is not straightforward. Currently, gamification in wearable healthcare devices is limited to including points, badges, and leaderboards as user catalysts. Designing effective gamification in healthcare services is complex and multi-faceted, demanding a comprehensive understanding of motivation from a psychological perspective (Hamari, 2015).

While studies exploring the use of gamification within the healthcare domain have gained notable traction, evidencing positive outcomes in diverse areas such as promoting physical activity (Chen and Pu, 2014; Hamari and Koivisto, 2014), facilitating disease monitoring and recovery (Elias *et al*., 2013; Allam *et al*., 2015; Adlakha, Chhabra and Shukla, 2020), fostering healthy eating habits (Jones, Madden and Wengreen, 2014). However, there were some arguments for gamification; for example, questions arise about the long-term benefits of gamification in interventions (Biddiss and Irwin, 2010) and whether gamification is more appropriately suited for younger generations (van Dooren *et al*., 2019). Vendors considering the integration of gamification ought to ensure that game designs are meticulously tailored to the inherent nature of the activity and the specific context in which they are employed, rather than merely relying on personal or demographic characteristics.

Physical aspect

Transitioning from traditional product and consumer categories, wearable marketers faced challenges in marketing and positioning wearable technology. To effectively capture consumer interest, there is a pronounced need to underscore the perceived utility of such wearable devices (Cheong *et al.*, 2018; Liang *et al.*, 2018; J. Li *et al.*, 2019; Shan, Sarkar and Martin, 2019). This necessitates a keen focus on the physical aspect of WHT. However, the perceived utility could not independently influence the adoption of WHT in all instances. For example, while perceived ease of use in smart wearable healthcare devices was most appealing to older users, it was often not a priority for other users (Farivar, Abouzahra and Ghasemaghaei, 2020).

Conversely, the perceived ease of use was infrequently underscored within the medical wearable technology research domain. This can be attributed to the fact that participants, within professional research environments such as hospitals and labs, often had the luxury of accessing requisite support from dedicated staff. However, in the absence of such technical assistance, the emphasis on ease of use intensifies considerably. For instance, Wulfovich *et al.* (2019) analysed the utilisation of smart devices among 200 users and found that users struggled with critical positioning, webpage scrolling, and screen resizing. Besides, Farivar, Abouzahra and Ghasemaghaei (2020) pointed out that the perceived complexity of devices, especially in interpreting and outputs is the major factor that makes senior citizens would not like to adopt them.

In addition, several wearable products were still criticised for their accuracy, including features such as floor climb and sleep trackers (Chong *et al.*, 2020), heart rate in the level of specificity, positive predictive value and moderate sensitivity (Kroll *et al.,* 2017) and pathology (Pevnick *et al.*, 2018). Such data inaccuracies could invite adverse feedback from end-users, and potentially affect the long-term adoption of WHT (Amft, 2018; Sheth, Jaimini and Yip, 2018). Furthermore, internet connection quality also emerged as a critical determinant in the adoption of WHT. Suboptimal network conditions can result in data loss and botched monitoring attempts, thus dampening the user experience (Donnelly *et al.*, 2018; Keikhosrokiani, Mustaffa and Zakaria, 2018; Hathaliya and Tanwar, 2020).

From a hardware perspective, aspects like screen size, overall product dimensions, battery longevity, and wear location significantly influenced user sentiments towards WHT. Notably, the device's size and wearing location were associated with negative emotional responses, especially amongst users of medical WHT. Oversized, conspicuous medical wearables could induce embarrassment and discomfort, leading to potential hesitancy in their adoption and sustained use (Bruno *et al.*, 2018).

Economy

Wulfovich *et al.* (2019) noted a minimal subset of participants in their study viewed cost as a determinant impacting their user experience. Park (2020) presented that perceived cost had a significant impact on intention. Park further elaborated that those who have owned and used gadgets might overlook the first financial barriers, such as acquiring the devices and related accessories, since they consider them as economic constraints. Patel *et al.* (2016) suggested that a reasonable price range for participants with epilepsy was between $200 and $300. Moreover, due to the swift transmission of data, the implementation of WHT has the potential to assist individuals in reducing expenses associated with healthcare (Jiang, Ming and You, 2019). As mentioned in the insurance section, numerous insurance companies and employers grant premium reductions to adopters of wearable devices, suggesting potential monetary advantages through their integration (Tedesco, Barton and O’Flynn, 2017; Aria and Archer, 2018). Nevertheless, wearable devices might remain inaccessible for lower-income households, notwithstanding their evident benefits. Furthermore, a majority of wearable healthcare devices are not categorised as medically essential, leading many insurance providers to refrain from covering their expenses. Coverage is typically granted only when users present a valid prescription (Casselman, Onopa and Khansa, 2017).

In summary, privacy and security emerge as the predominant factors underpinning the external effects on the adoption of WHT. Some researchers advocate for robust regulatory frameworks, positing that directives from governmental and affiliated bodies could offer substantial benefits to end-users. Moreover, there are many factors potentially influence the uptake of WHT among stakeholders (users and practitioners), including unfamiliarity with cutting-edge technology (IT or WHT), inadequately conceived design attributes, user emotional load (especially for some medical WHT), and low engagement. Some academics have argued that the perceived utility of WHT, which includes criteria like perceived ease of use and perceived usefulness, may not have an independent influence on the adoption of WHT in some situations (Farivar, Abouzahra and Ghasemaghaei, 2020). As a healthcare monitor, the accuracy of WHT and its functions (support features, such as battery capability and screen size) can profoundly influence user adoption. Finally, from an economic standpoint, whilst the potential savings on travel and accommodation expenses for individuals residing in rural areas have been acknowledged, the inherent cost of WHT poses a challenge for those facing financial constraints.

2.4 Sustainable Consumption of Wearable Healthcare Technology for Senior Citizens

The ageing population has emerged as a critical concern for significant countries worldwide in recent years. Concurrently, there has been a rising demand for sustainable systems that support the independence, daily routines, and wellbeing of senior citizens (Baig *et al.*, 2019). On the contrary, another pressing challenge presented by the ageing generation is the augmented pressure on healthcare infrastructures and resource allocation (Nguyen *et al.*, 2018).

WHT is championed as an effective healthcare monitor, and the market for WHT has rapidly grown (Mercer *et al.*, 2016; Casselman, Onopa and Khansa, 2017). Long-term users of WHT have often attested to its beneficial effects on their health (Fritz *et al.*, 2014). However, an alarming trend in WHT adoption is the significant attrition rate observed post-initial adoption (Clawson *et al.*, 2015; Epstein *et al.*, 2016). It is reported that over 50% of users stop using WHT usage within six months of its adoption (Ledger and McCaffrey, 2014). This pattern is equally evident among senior citizens. Several studies have indicated that the retention rate of WHT among senior citizens is notably low. For instance, Clawson *et al.* (2015) and Epstein *et al.* (2016) have documented significant drop-off rates post-adoption. A particularly striking statistic from an American Association of Retired Persons (AARP) report in 2015 reveals that although half of the senior participants initially planned to continue using WHT, an alarming 75% ceased using it within just four weeks (American Association of Retired Persons, 2015). Furthermore, research by Lee *et al.* (2019) and Talukder *et al.* (2021) also supports the notion that the intention for sustainable consumption of WHT among senior citizens is low. These studies collectively provide compelling evidence that the current patterns of WHT use among senior citizens are not aligned with sustainable consumption. Enhancing sustainable consumption is crucial for assisting them in effectively managing health conditions and achieving personal well-being.

In addition, some scholars suggested that six months is marked as a dividing point between short-term and long-term adoption (Ledger and McCaffrey, 2014; L. Li *et al.*, 2019). However, there is no standard to distinguish between short-term and long-term adoption. Lee *et al*. (2019) set 3 months as a long-term adoption, while Ledger and McCaffrey (2014) believed that the point of distinction between long-term and short-term should be six months; this dividing point is also adopted by Kononova *et al.* (2019) and L. Li *et al.* (2019). In this thesis, the author reviewed the selected empirical studies which focused on senior citizens and sustainable consumption[1] of WHT. The sustainable consumption of WHT involves its long-term and responsible utilisation, aimed at reducing adverse effects on the environment, society, and individual health (Powell and Godfrey, 2023). In the context of WHT, continuous use implies that a consumer consistently uses wearable health devices, though not necessarily the same model over time. This concept emphasizes the habitual incorporation of the product type into one's lifestyle, regardless of changes in specific models or brands. This distinction highlights the deeper considerations involved in sustainable consumption, beyond just the frequency or regularity of use. Unlike many devices, WHT tends to have a shorter lifespan due to rapid technological advancements, continuously iterative design concepts, and challenges in maintenance and operation (Gurova *et al.*, 2020). Furthermore, sustainable consumption of WHT uniquely encompasses the ethical and responsible management of personal healthcare data produced by these technologies. This aspect focuses not only on environmental concerns but also on the prolonged health implications associated with the usage of WHT.

2.4.1 Literature review

2.4.1.1 Eligibility Criteria

Initially, the author chose studies centred on outcomes related to WHT that met the following criteria:

(i) Emphasis on the sustainable consumption of WHT.

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[1] The participants have adopted WHT for 6 months, or the authors claimed that their research are about long-term adoption of WHT.

(ii) Devices used exclusively for health monitoring, excluding educational or operational purposes.

(iii) The participants comprised senior citizens.

The search criteria encompassed the sustainable or long-term adoption of WHT by senior citizens. Studies concentrating on technological enhancements, such as material innovation, improvements in sensor performance, and battery or energy life testing, were overlooked. Subsequently, papers that did not meet our specified academic standard, including books, book chapters, and patent reports, were excluded. In the third step, we refined our selection to include only papers from Quartile 1 or Quartile 2 journals, based on two established journal rankings (JCR and SJR), to ensure the quality and relevance of our sources.

2.4.1.2 Search Strategy

The literature search used three renowned databases: Web of Science, Scopus, and Science Direct. Keywords deployed for the search encompassed terms such as 'wearable healthcare technology', 'wearable health technology', 'wearable technology', 'wearable devices', 'seniors', 'senior citizen', 'older people', 'older adult', 'long-term adoption', and 'sustainable consumption'. Filters applied during the search included language (English), document type (journal articles), indices (Science Citation Index Expanded and Social Sciences Citation Index within Web of Science), and publication years (2015-2022).

The rationale for this time frame is multiple:

- In 2016, the World Health Organization (WHO) asserted that e-health's support is imperative for realising Universal Health Coverage (UHC). Moreover, the WHO emphasised that UHC aligns with the 'post-2015' directive to achieve the Sustainable Development Goals (SDGs). They recognised the substantial potential for e-health to bolster various components of UHC (World Health Organization, 2016).

- The use of wearable devices had a twofold growth after 2014 (Greiwe and Nyenhuis, 2020).
- Between late 2014 and 2015, tech giants Apple, Samsung, and Xiaomi sequentially declared their intentions to enter the healthcare arena, subsequently introducing their wearable offerings. This emergence presented a diversified range of options for prospective wearable device adopters (Chandra, 2014).

According to these considerations, 2015 was appropriately chosen as the starting point for this review study.

2.4.1.3 Selection Process

Based on the selected keyword searches, an initial search using the specified keywords identified 61 studies across the three databases. After eliminating duplicates and studies that did not meet the required standard, 44 studies remained. Upon a detailed assessment of the full texts, 27 studies were shortlisted. Additionally, during this assessment, 5 important conference papers which were cited by selected articles were included. In line with the eligibility criteria, 15 articles published in journals ranked in Quartiles 1 or 2 of JCR and SJR were excluded. Consequently, 17 pertinent empirical studies were finalised for this review. The criteria and process for literature selection are presented in Table 5.

Initial sample	61
Author first used various combinations of keywords (‘wearable health technology’ ‘wearable technology’, ‘wearable devices’, ‘seniors’ ‘senior citizen’, ‘older people’, ‘older adult’; ‘long-term adoption’ and ‘sustainable consumption’) within three well-known academic literature databases, including Web of Science, ScienceDirect, and Scopus databases, to search for articles that examine the sustainable consumption of WHT for senior.	61
-Remove duplicates, books, working papers, and dissertations.	(17)
Subtotal	44
-Remove articles based on full text assessment. -Append the important conference papers which are highly relevant to this review through the selected papers’ citations	(17) 5
Subtotal	32
-Author only remain articles included in Quartiles 1 or Quartiles 2 of JCR and SJR.	(15)
Final sample	17

Table 5 Shows the Selection Criteria for The Literature Review

2.4.1.4 Data Extraction

The data extraction procedure consists of two rounds. In the initial round, a predefined data extraction template was employed to aggregate fundamental information from the qualifying studies. Each study provided details such as the authors, publication year, research sample and context, methodology, and the role of technology leadership, design leadership and brand leadership in the sustainable consumption of WHT for senior citizens. Additionally, a concise summary of the primary findings, penned by the reviewer, was incorporated into this data extraction form, as presented in Table 6.

In the second round, insights related to sustainable consumption and the mediating variables utilised in the research were organised. The author subsequently discerned the influential factors from these studies, organising them into t technology leadership, design leadership and brand leadership categories, which are detailed in Table 7.

Study of analysis	Research sample and context	Method	Position of leadership in sustainable consumption of wearable technology for senior citizens	Major findings
Lee *et al.* (2019)	17 senior citizens from US	Semi-structured interview	Independent variables mentioned by participants	Specific design factors must be considered for senior citizens. Early training and detailed instructions are essential. The product's wearability, effectiveness, and the provision of real-time or historically processed results are crucial to encourage their usage.
Chu *et al.* (2019)	15 senior citizens from Taiwan	Semi-structured interview	linear relation from perception of use (ease of use), learning, and actual system experimentation to accept or reject	Most senior citizens are hesitant to adopt wearable technology. Participants express concerns about its functional value, ease of use, and the learning curve. Many seniors find it challenging to obtain information about wearable technology, which affects their consideration of using it.
Lee *et al.* (2020)	20 senior citizens from UA	Questionnaire	Independent variables	Participants often overlook the benefits of sustainably consuming wearable technology and lack motivation and interest in using the device long-term. While self-efficacy can promote sustainable consumption, it requires personalized customization.

L. Li *et al.*, (2019)	214 senior citizens (65+) from the US	Questionnaire	Independent variables	A significant relationship exists between sustainable consumption and several factors: using a wide range of wearable technology functions, daily use of wearable technology, being female, exercising regularly, possessing a higher education, not competing based on step counts, and not having chronic diseases.
Kononova *et al.* (2019)	26 senior citizens from the US	10 focus groups	Independent variables	Better-designed wearable technology (with improved wearability) and results (real-time processed or based on historical data) can promote sustainable consumption among participants. However, low effectiveness and a lack of usage guidance can negatively impact their experience.
Liao *et al.* (2020)	149 female senior citizens from China	Questionnaire	Independent variables moderated by intervention (support of learning and encouragement in sharing with peers)	Intervention can significantly enhance motivation, perceived usefulness, and ease of use, increasing acceptance. The perceived ease of use and learning curve can influence participants' sustainable consumption.
O'brien *et al.* (2015)	34 senior citizens from US	Pilot study	Independent variables	Senior citizens find it easy to understand how to use the WHT. Their health conditions improve after participating in the EBMM programme supported by WHT. Furthermore, they become more receptive to exercising with support from WHT.
Brickwood *et al.* (2020)	20 senior citizens	Focus groups	Independent variables	Major findings: 1. An increased awareness of activity levels correlates with motivation. 2. The degree of engagement with the activity tracker affects the user experience. 3. Feedback from health professionals plays a vital role in offering ongoing support.

				4. Habits are instrumental in fostering long-term behaviour change. In both research and practical contexts, it is important to consider users' prior technology experiences and the design and accuracy of wearable technology.
Puri *et al*. (2017)	20senior citizens from Canada	20 questionnaire and 4 semi-structured interviews	Independent variables	The interaction between wearable technology and smartphones is vital. Users prioritize design leadership and often overlook privacy risks.
Nguyen *et al*. (2017)	14 female senior citizens from Australia	Questionnaire	Independent variables	When comparing different wearable health technologies (WHT) for female senior citizens who are breast cancer survivors, the study identified barriers faced by seniors in using WHT. The research discussed specific barriers and perceived risks that concern breast cancer survivors. Adopting WHT can reduce costs for these survivors during the post-therapy period.
Goldberg *et al*. (2022)	11 physicians who must have cared for patients 65 years and older in-person or via telehealth, from US	Semi-structured interviews	Independent variables concluded from interview	Policy regulations play a pivotal role in the sustainable consumption of telemedicine, including WHT. Adoption helps balance medical resources. However, technological issues, such as internet connectivity, can result in partial failures. Patients often have concerns about the system's reliability and security. Yet, the use of such technology can reduce the health management costs for senior citizens

Kim and Choudhury (2020)	15 senior citizens	Semi-structured interviews	Independent variables	For senior citizens, the perceived ease of learning is crucial for adopting wearable technology. This challenge can be mitigated with support from peers and professionals. Social influence positively impacts senior citizens' adoption. Still, their exploration of the technology is often driven by specific needs or benefits realized after familiarizing themselves with it
Cruz-Sandoval *et al.* (2021)	10 senior citizens	Observe research	Independent variables	For PwD (People with Disabilities), support from peers and physicians is crucial. Some participants even exhibited an excessive attachment to the devices.
Peng *et al.* (2021)	20 senior citizens from US	Semi-structured interview	Independent variables	The study confirmed eight themes related to forming the habit of sustainable consumption of WHT among senior citizens. These seniors are inclined to adopt WHT in a meaningful and sustainable manner.
Mercer *et al.*, (2016)	100 senior citizens from Canada	Focus groups	Independent variables	Senior citizens with chronic diseases prefer multi-functional wearable technology and integrate it into their healthcare routines. However, a lack of clear tutorials can make these seniors feel pressured, hindering their understanding and use of the technology. Proper design leadership is essential for seniors to embrace wearable technology. There is not a significant preference among three specific brands (products) for this demographic
Ku, Lai and Hsieh (2020)	150 senior citizens from Taiwan	Questionnaire	Independent variables but attitude is moderated by perceived enjoyment and concentration	Attitude strongly influences the intention to continue using a product. It's suggested that aligning wearable technology with the beliefs and needs of middle-aged and elderly individuals, coupled with design simplicity, can foster a positive attitude towards these devices. If middle-aged or elderly individuals perceive that most of their loved ones think they should

				continue using wearable technology, they are more likely to yield to this sentiment.
Rosales, Fernández-Ardèvol and Ferran-Ferrer (2018)	5 senior citizens	Mixed method (semi-structured interview+ observe research)	Independent variables	Design leadership positively impacts the sustainable consumption of wearable technology among senior citizens. While participants acknowledged the usefulness of WHT, it isn't the primary reason for adoption. Both functional value and desirability are key factors in the sustainable consumption of WHT for this demographic.

Table 6 A Summary of Selected Studies on Technology Leadership, Design Leadership and Brand Leadership in Sustainable Consumption of Wearable Technology for Senior Citizens

Study of analysis	Sample	Sustainable consumption	Mediating variables employed	Types of leaderships		
				Design leadership	**Technology leadership**	**Brand leadership**
Lee *et al.* (2019)	17 senior citizens from US	14 weeks experience	Demographic factors (Gender, age, education, race)	Wearability	Effectiveness (Health information sensitivity, perceived informativeness) Perceived risk (Privacy risk, Legislative protection)	
Chu et al. (2019)	15 senior citizens from Taiwan	Participants have adopted WHT	Demographic factors (Gender and Age) Cultural concern (passive and active)	Perceived ease of use and learning Functional value (Transparency)	Effectiveness (Accuracy and reliability)	
Lee *et al.* (2020)	20 senior citizens from US	Adopt more than 3 months	Demographic factors (Gender, age, height, weight, BMI, race)	Functional value	Effectiveness (Health information sensitivity, perceived informativeness) Perceived risk (Privacy risk, Legislative protection)	
L. Li *et al.*, (2019)	314 senior citizens from US	Adopt more than 6 months	Demographic factors (Gender, age, education, house income, marital status) Health status	Functional value		
Kononova *et al.* (2019)	26 senior citizens from US	Adoption more than 6 months	Demographic factors (Gender, age, education)	Wearability Ease of use and learning	Effectiveness (accuracy)	

			Chronic conditions, physical activity levels, and activity tracker use length	Functional value Interaction		
Liao *et al*. (2020)	149 female senior citizens from China	12 months experiment	Demographic factors (age, gender, marital status, children) socioeconomic status (education, retirement status, income) self-reported health (Chronic) Cognitive Status Support of learning Encouragement in sharing with peer	Perceived ease of use Interaction	Effectiveness	
O'brien *et al.* (2015)	34 senior citizens from US	12 weeks experiment	Demographic factors (gender, race, marital status, income, education)	Perceived ease of learning Interaction		
Brickwood *et al*. (2020)	20 senior citizens	12 months adoption	Demographic factors (age, BMI, Chronic condition, used devices, support, education)	Wearability (comfort, design)	Effectiveness(accuracy)	Customer-oriented behaviour (physician support)
Puri *et al*. (2017)	20senior citizens from Canada	Authors claimed research as a long-term acceptance	Demographic factors (age, gender, marital status, education, income, computer use, smartphone ownership, smart wearable technology ownership, heard of smart wearable technology)	Perceived ease of use	Effectiveness Perceived risk (privacy)	Brand technology experience

Nguyen *et al.* (2017)	14 female senior citizens from Australia	11 months experiment and claimed as long-term adoption	Demographic factors (age, breast cancer stage, treatment received)	Wearability Functional value	Effectiveness Perceived risk	
Goldberg *et al.* (2022)	44 senior citizens from Canada and US	Physician	Demographic factors (Gender, age, income)	Functional value	Effectiveness (reliability) Perceived risk (privacy)	
Kim and Choudhury (2020)	15 senior citizens	Using experience (long-term)	Demographic factors (Gender, age) Device type Duration of use	Perceived ease of use and learning	Effectiveness	
Cruz-Sandoval *et al.* (2021)	10 senior citizens	9 weeks adoption	PwD patients	Wearability Perceived ease of use Interaction	Effectiveness AI-based usage monitoring (support)	Customer-oriented behaviour (physician support)
Peng *et al.* (2021)	20 senior citizens from US	adoption over 6 months	Demographic factors (age, gender, race)	Functional value Interaction		
Mercer *et al.*, (2016)	100 senior citizens from Canada	5 months experiment	Demographic factors (Gender, age, chronic diseases, BMI, Blood pressure, Heart rate, Family history, education, income, skill with computers, use of a computer, use of a smartphone or tablet)	Perceived ease of use Functional value Interaction		Customer-oriented behaviour (physician support) Brand comparison
Ku, Lai and Hsieh (2020)	150 senior citizens	75% participants	Demographic factors (age, gender, education, and	Wearability		

	from Taiwan	have adopting experience over 2 years	wearable technology use experience)	Perceived ease of use
Rosales, Fernández-Ardèvol and Ferran-Ferrer (2018)	5 senior citizens	12 months adoption and 12 months follow up	Demographic factors (age, gender)	Functional value Perceived ease of use and learning Wearability

Table 7 A Summary of Empirical Research on Sustainable Consumption, Design Leadership, Technology Leadership, and Brand Leadership of Wearable Healthcare Technology for Senior Citizens

2.4.2 Theoretical underpinning

As highlighted in Chapter 1, the most commonly adopted models in the selected studies remain the TPB, TAM, and UTAUT (e.g., Mercer *et al.*, 2016; Ku, Lai and Hsieh, 2020). Notably, the Senior Technology Acceptance Model (STAM), an adaptation of TAM tailored to the characteristics of senior citizens, has been employed in several studies (e.g., Chu, Chen and Wang, 2019; Kim and Choudhury, 2020). While a subset of researchers refrained from specifying a distinct research model, owing to the nature of their research questions and methodologies (such as focus groups and observational research), many of the influencing factors identified in their studies are grounded in the tenets of these foundational models.

2.4.2.1 Theory of Planned Behaviour Model

The PB model originates from the Theory of Reasoned Action (TRA), formulated by Ajzen in the 1980s. Azjen (1980) assumed that individuals act rationally, systematically utilising the information. TRA's primary objective is to comprehend and anticipate user behaviours and attitudes. Significantly, within this theoretical framework, 'behavioural intentions' supplant 'attitude' as the primary determinant of behaviour (Azjen, 1980). According to Azjen (1980), an individual's actual behaviour can be predicted by considering their prior intention and the beliefs that this individual would have for the given behaviours. Consequently, 'behavioural intention' emerges as the chief predictor of behaviour, with 'intention' serving as a mediator between attitude and the resultant behaviour (Marangunić and Granić, 2015). However, this theory's main argument is that the awareness-lacked individual will have little control over their 'behaviours' and 'attitudes'. According to TRA, Azjen (1980) conceptualised every facet of behaviours and attitudes as a continuum, ranging from minimal to substantial control. To address this, TRA was augmented with the concept of 'perceived behavioural control' (Ajzen, 1985).

The Theory of Planned Behaviour (TPB) was evolved from the extended TRA, proposing that an individual's execution of a specific behaviour largely depends on their intent to engage in it. That is to say, 'attitude' towards 'behaviours' is either a positive or negative evaluation of how that 'behaviour' is carried out. Central to TPB is the individual's intention to undertake a specific behaviour. The theory also introduces a direct connection between 'perceived behavioural control' and the realisation of the behaviour. TPB posits that, given similar intentions, individuals with higher confidence in their capabilities are more likely to successfully perform the intended behaviour (Ajzen, 1991). TPB's primary goal is to forecast and understand motivational factors that influence behaviours beyond personal willpower, and to pinpoint optimal avenues for instigating behavioural changes (Marangunić and Granić, 2015).

TPB was developed to address limitations in the TRA; it is also challenged by its limitation as this theory can only work under the idealised scene. As mentioned before, a prerequisite for applying the TPB assumes that individuals are entirely rational and have access to all pertinent information. However, real-world scenarios often differ; unconscious motives and other factors such as personality, gender, and education level can influence behaviours (Mathieson, 1991).

2.4.2.2 Technology Acceptance Model

The Theory of Reasoned Action (TRA) and the Theory of Planned Behaviour (TPB) can be regarded as the root of Technology Acceptance Model (TAM) (Azjen, 1980; Ajzen, 1985), In essence, the emergence of TAM was substantially influenced by TRA and TPB (Davis, 1989). Davis (1985) formulated TAM to anticipate the actual usage patterns of specific technologies. He posited that the genuine utilisation of a system is equivalent to behaviour. Consequently, Davis incorporated two significant modifications to TRA and TPB:

1) the attitude of an individual to technology is the only factor that replaces the subjective norm in predicting actual behaviour.

2) perceived usefulness and perceived ease of use are identified as distinct beliefs.

Since TAM was developed by Davis in 1985, TAM has found extensive application across diverse research domains, notably within online-related studies encompassing online banking, education, healthcare, and small to medium enterprises (Al-Emran and Granić, 2021). The evolution of TAM has been a subject of continuous research, evolving from the seminal TAM model, often referred to as the parsimonious TAM (Davis, 1985, 1989), to the more recent TAM 2 model (Venkatesh and Davis, 2000).

Davis (1985) stated that the ‘actual system use’ is a response that can be understood or predicted by the ‘user’s motivation to use the system’, while this motivation is stimulated and impacted by ‘system features and capabilities’ (shown in figure 1).

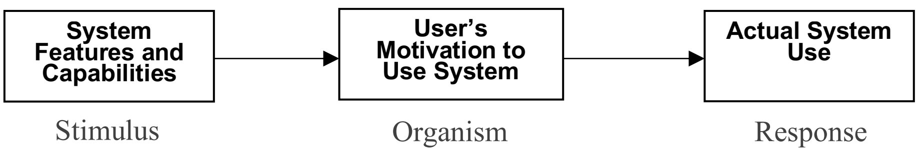

Figure 1 Conceptual Model for Technology Acceptance (Chuttur, 2009)

This conceptual model was further refined by Davis in 1985 as explaining the user’s motivation by three factor: ‘perceived usefulness’, ‘perceived ease of use’ and ‘attitude toward using’ (shown in figure 2).

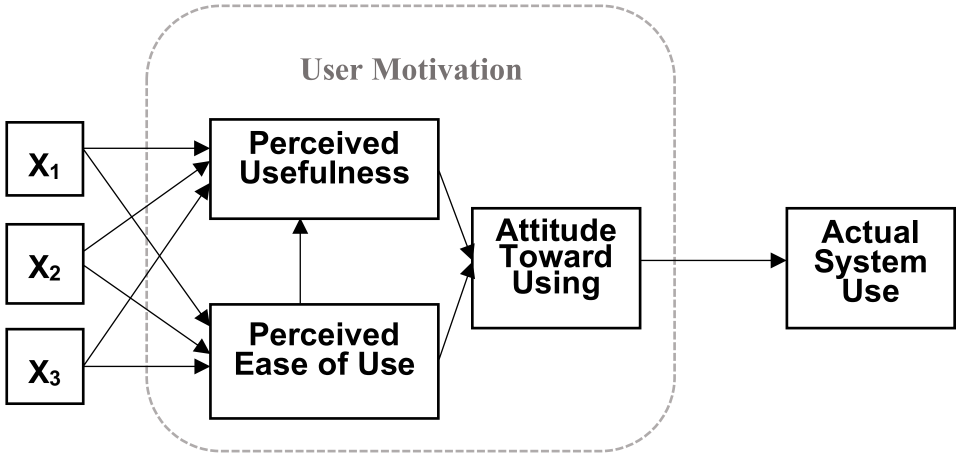

Figure 2 Technology Acceptance Model (Davids, 1989)

In TAM, Davis hypothesized that a user's 'attitude' toward using a system is the primary deciding factor of whether the users would like to or not use the system. Consequently, the user's 'attitude' could be impacted by 'perceived usefulness' and 'perceived ease of use', which are seen as beliefs. Moreover, 'perceived usefulness' was directly influenced by 'perceived ease of use' (Davis, 1989). The 'perceived usefulness' was defined as the degree to which a user believes that adopting a particular system would improve their working efficiency; however, the 'perceived ease of use' was the degree to which an individual believes that adopting a specific system would be painless (Sharp, 2007). Besides, it was also hypothesized that different system designs would directly impact these two central beliefs.

Davis (1989) stated that 'perceived ease of use' and 'perceived usefulness' cannot be entirely mediated by 'attitude'; thus, 'attitude' was removed from TAM and 'behavioural intention' was included in the modified TAM as a new construct (Davis, Bagozzi and Warshaw, 1989). They suggested that in some cases when an individual believes a system is perceived useful, they would form a strong 'behavioural intention' to use this system without forming any 'attitude' (Marangunić and Granić, 2015). This approach directly explained the influence of 'perceived usefulness' on 'actual system use'. Besides, any unexplained direct influence of system variables on ‘attitude’ was also eliminated due to this approach (Venkatesh and Davis, 1996). Moreover, ‘external variables’ such as system characteristics, implementation process and user-related factors were considered and included in the modified TAM (Venkatesh and Davis, 1996).

Venkatesh and Davis (2000) tried to clarify the variables of ‘perceived usefulness’ and proposed an extended model named TAM2 (shown in Figure 3). In TAM 2, ‘subjective norm’, ‘image’, ‘job relevance’, ‘output quality’ and ‘result demonstrability’ were included in the model as the variables of ‘perceived usefulness’ (definitions are shown in Table 8), besides, ‘experience’ and ‘voluntariness’ were also involved in as the moderating factors from ‘subjective norm’ to ‘perceived usefulness’ and ‘intention to use’.

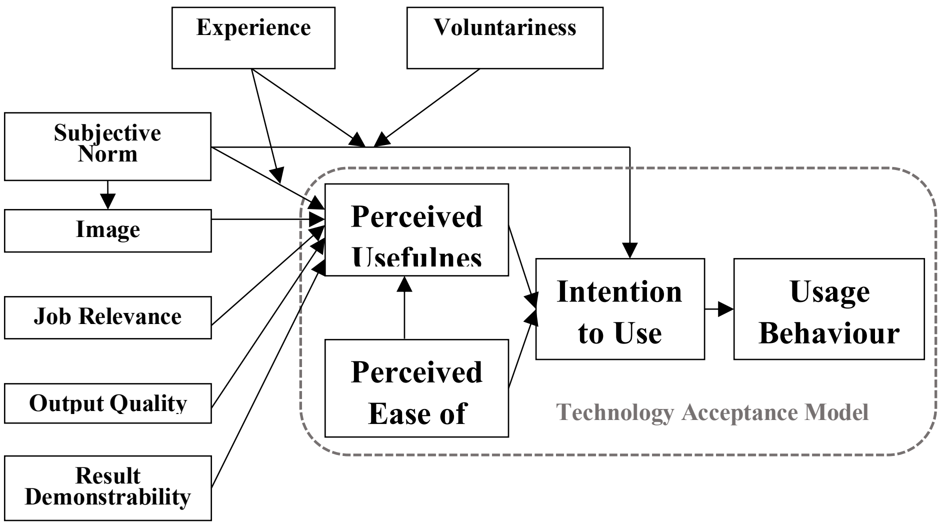

Figure 3 TAM2 (Legris, Ingham and Collerette, 2003)

Variable	Definition
Subjective Norm	Other people's effect on a user's decision to utilise or not use technology.
Image	The user's desire to retain a positive reputation among others.
Job Relevance	The extent to which the technology could be used.
Output Quality	The degree to which the technology is capable of completing the specified tasks.
Result Demonstrability	The achievement of measurable outcomes.

Table 8 Definitions of Variables in TAM2

Venkatesh and Davis (2000) undertook longitudinal research on voluntary and involuntary contexts. The consolidated findings highlighted a significant relationship between 'subjective norm', 'image', 'job relevance', 'output quality', 'result demonstrability', and 'perceived usefulness'. Furthermore, the study underscored that the 'intention to use' was distinctly influenced by 'subjective norm', 'perceived ease of use', and 'perceived usefulness' (Venkatesh and Davis, 2000).

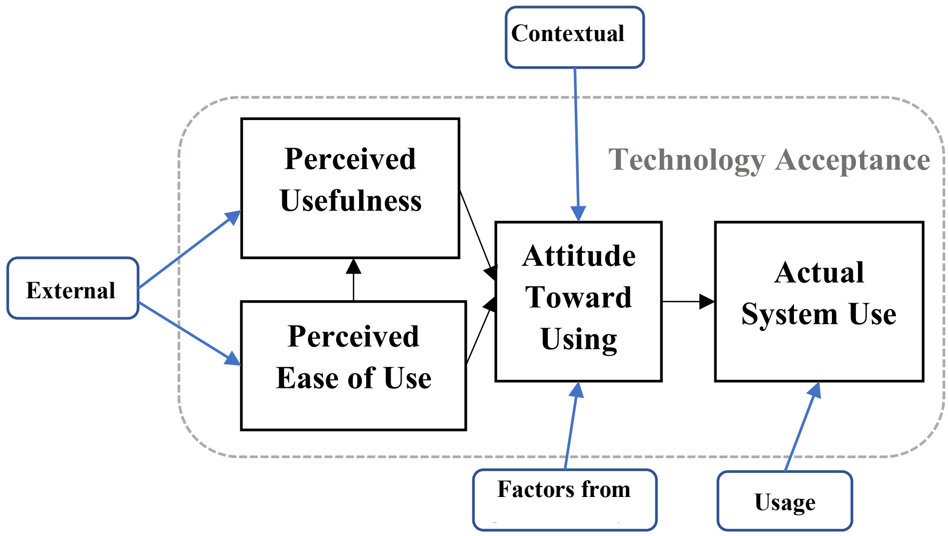

Figure 4 Four Major Categories of TAM Modification (King and He, 2006)

Since 1985, TAM has been developed and extended in several research areas based on the basic TAM constructs. King and He (2006) classified these refinements into four primary categories (illustrated in Figure 4): external predictors, factors derived from alternative theories, contextual determinants, and usage metrics (elaborated upon in Table 9).

Categories	**Definition**	**Research example**
External predictors	External predictors of perceived usefulness and perceived ease of use	• Technostress (Saadé and Kira, 2006) • Prior usage experience (Oh, Ahn and Kim, 2003) • Self-efficiency (Venkatesh and Davis, 1996) • Technology-confidence (Amoako-Gyampah and Salam, 2004)
Factors from other theories	Variables derived from various theories of technology acceptance to improve the TAM's predictive validity	• Subjective norm (Hardgrave, Davis and Riemenschneider, 2003) • Expectation (Venkatesh *et al.*, 2003) • Risk (Featherman and Pavlou, 2003) • Participants (Amoako-Gyampah, 2007)
Contextual factors	Moderately impacted contextual factors	• Gender (Huang, Lu and Wong, 2003) • Cultural diversity (Padilla-Meléndez, del Aguila-Obra and Garrido-Moreno, 2013) • Technology characteristic (Plouffe, Hulland and Vandenbosch, 2001)
Usage measures	Utilization measures are used to operationalize actual system usage	• Attitude toward technology (Davis, Bagozzi and Warshaw, 1989) • Usage perception (Horton *et al.*, 2001)

Table 9 Explanations of Four Major Categories of TAM Modification

In conclusion, even though over a quarter of a century has passed since the inception of TAM, both the original model and its subsequent extensions remain prominent in research domains such as e-banking, e-learning, and e-healthcare. Notably, when research focuses on senior citizens, this demographic is often perceived to exhibit a 'lower' and 'slower' rate of acceptance relative to other group (Marangunić and Granić, 2015). However, senior citizens arguably stand to gain the most from the adoption of new technologies. As such, examining their receptivity to these innovations is of paramount importance.

2.4.2.3 The Unified Theory of Acceptance and Use of Technology

The Unified Theory of Acceptance and Use of Technology (UTAUT) and the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) are frequently employed to scrutinise adoption behavioural intentions and the influencing factors. The UTAUT model (shown in Figure 5) comprises four central constructs: performance expectancy, effort expectancy, social influence and facilitating conditions. These constructs directly influence a

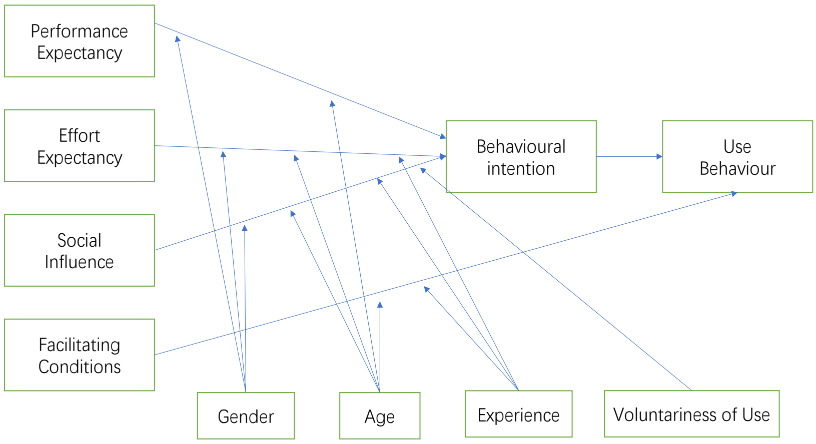

Figure 5 UTAUT Model (Venkatesh *et al*., 2003)

user's behavioural intention, subsequently shaping their actual behaviour. Furthermore, variables such as gender, age, experience, and voluntariness of use modulate the relationships within these primary constructs (Venkatesh *et al.*, 2003). This model is underpinned by eight predominant theories and models: the TRA, TAM, the Motivational Model, TPB, a merged TPB/TAM, the Model of PC Utilisation, the Innovation Diffusion Theory (IDT), and the Social Cognitive Theory (SCT) (Williams, Rana and Dwivedi, 2015).

Venkatesh *et al.* (2003) posited that the UTAUT offers superior predictive performance compared to each of the eight individual models. Detailed definitions of the constructs are presented in Table 10.

Items	Definition
Performance expectancy	*"The degree to which an individual believes that using the system will help him or her to attain gains in job performance"* (Venkatesh *et al.*, 2003, p. 447).
Effort Expectancy	*"The degree of ease associated with the use of the system"* (Venkatesh *et al.*, 2003, p. 450).
Social Influence	*"The degree to which an individual perceives that important others believe he or she should use the new system"* (Venkatesh *et al.*, 2003, p. 451).
Facilitating Conditions	*"The degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system"* (Venkatesh *et al.*, 2003, p. 453).
Attitude	The positive or negative feelings that an individual has about performing the target behaviour (Davis, Bagozzi and Warshaw, 1989).
Behavioural Intention	A measure indicating the level of one's desire to carry out a specific behaviour (Fishbein and Ajzen, 1977).

Table 10 Definitions of the Items of UTAUT Model (Venkatesh *et al.*, 2003)

Venkatesh *et al*. (2012) extended the UTAUT to UTAUT2 (shown in Figure 6) by introducing three items: hedonic motivation, price value and habit. Concurrently, the "voluntariness of use" was omitted from the list of moderators. Both UTAUT and UTAUT2 are frequently employed by researchers to devise more contextually apt research models for analysing WHT across varied research scenarios. For example, Wang *et al.* (2020) developed a model by integrating the UTAUT and Task-technology Fit models to investigate how consumers accept WHT. Drawing from an analysis of 406 participant samples, they deduced that consumers' behavioural intention towards WHT adoption is influenced by user perceptions, encompassing performance expectancy, effort expectancy, facilitating conditions, social influence, and task-technology fit. However, UTAUT and UTAUT2 are criticised that the moderators cannot be suitable for all the research conditions. Additionally, there have been suggestions to incorporate specific individual characteristics, such as attitude, into the UTAUT framework (Dwivedi *et al.*, 2019).

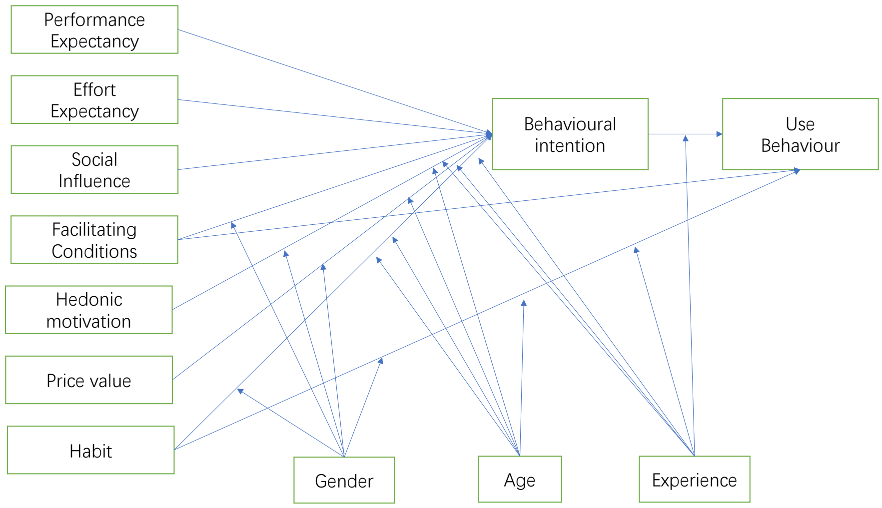

Figure 6 UTAUT2 Model (Venkatesh *et al*., 2012)

2.4.2.4 The Senior Technology Acceptance Model

Renaud and Van Biljon (2008) developed the Senior Technology Acceptance Model (STAM) based on the concepts of TAM (Davis, 1985) and UTAUT (Venkatesh *et al.,* 2003). The STAM has three phases (shown in Figure 7): objectification, incorporation and non-conversion.

Renaud and Van Biljon (2008) defined several constructs in the objectification phase: 'user context' includes 'social influence' and 'personal factors[2]', 'intention to use', and 'perceived usefulness'. In the incorporation phase, 'experimentation and exploration' is involved. Experimentation and

[2] Personal factors generally include the age and functional ability for senior citizens.

exploration constitute a module where users gain their initial experience with the technology. This action serves to solidify the first impression of ease of use and then further recognize its usefulness for users (Chu, Chen and Wang, 2019). Besides, 'perceived ease of learning and use' results from 'perceived

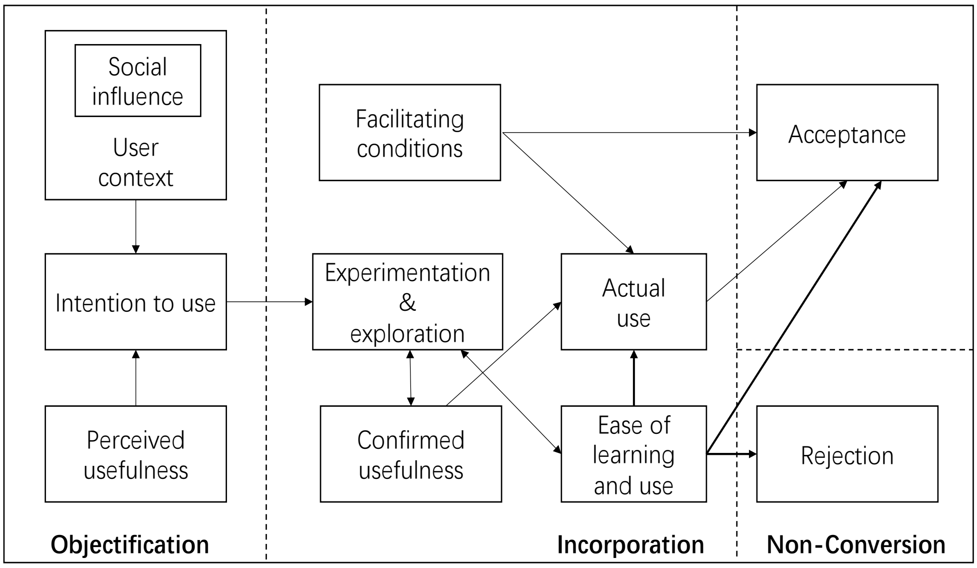

Figure 7 STAM (Renaud and Van Biljon, 2008)

ease of use', but consider the characteristics of senior citizens (Renaud and Van Biljon, 2008). There is an interplay between 'perceived ease of learning and use' and 'experimentation and exploration'. Similarly, 'confirmed usefulness' also has an interactive relationship with 'experimentation and exploration'. Facilitating conditions and the other mentioned constructs will impact the actual use. In the non-conversion phase, 'facilitating condition', 'actual use' and 'ease of learning and use' will lead the research of acceptance. If the 'ease of learning and use' cannot be recognized by users, users would not actually use the technology, and it will directly lead to the 'rejection'.

Kim *et al*. (2016) have modified STAM and added 'perception of learning' as a new phase into STAM (shown in Figure 8). In Kim *et al*.'s framework, there are four phases:

- Perception of use: users establish their intention to use the system.

- Perception of learning: users establish their intention to learn how to use the system.
- In system exploration, users explore and experiment with the method of the system.
- In decision making, users decide to accept or reject the use of the system.

In addition, Kim *et al*. (2016) pointed out that facilitating conditions, peer support, conversion readiness and self-efficacy would impact senior citizens perceived ease of learning about new technology. They also claimed the importance of distinguishing the differences between perceived ease of use and perceived ease of learning because senior citizens are used to distinguishing themselves from younger people in perceived ease of use when they use new technologies (Kim and Choudhury, 2020). Furthermore, senior citizens tend to give up on learning new technology, whether the new technology is valid or not (Kim *et al.*, 2016).

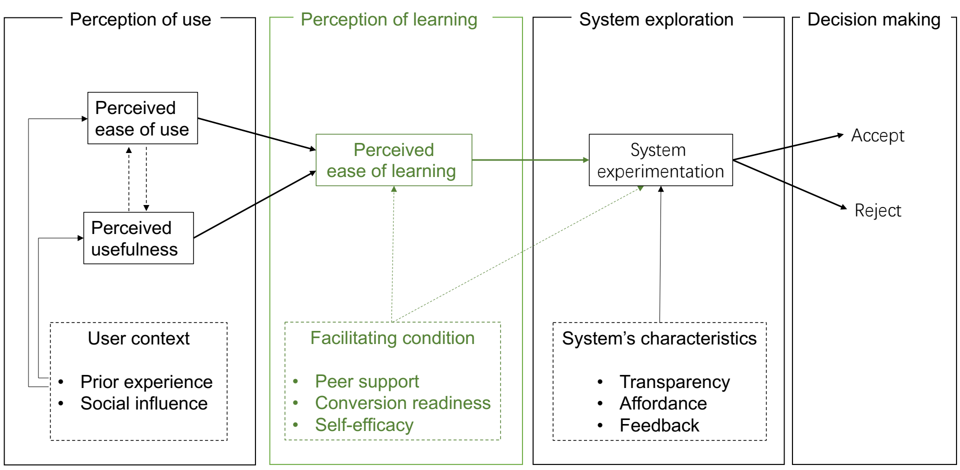

Figure 8 The Proposed Procedural Model for Older Adults' Acceptance of Mobile Technology for Health Care (Kim *et al*., 2016)

Note: The green-boxed section is a new phase with accompanying constructs that is proposed to be crucial for senior citizens.

Factors	TAM (Davis, 1985)	UTAUT (Venkatesh *et al.*, 2003)	STAM (Renaud and Van Biljon, 2008)	Proposed STAM (Kim *et al.*, 2016)
Perceived usefulness	Yes	Yes	Yes	Yes
Perceived ease of use	Yes	Yes	Yes	Yes
Attitude toward using	Yes	No	No	No
Actual use	Yes	No	No	Yes
Social influence	No	Yes	Yes	Yes
Facilitating conditions	No	Yes	Yes	Yes
Behavioural intention to use	No	Yes	Yes	Yes
Self-efficiency	No	Yes	Yes	Yes
Exploration and experimentation	No	No	Yes	Yes
Ease of learning	No	No	Yes	Yes
Intention to learn	No	No	No	Yes
Demographic factors	No	Yes	Yes	Yes

Table 11 The Impact Factors of Acceptance of Technology for Senior Citizens (Adjusted from Renaud and Biljon (2008))

As presented in Table 11, the evolution of STAM can be traced back to elements intrinsic to both TAM and UTAUT. Several primary factors transitioned from TAM and UTAUT to inform the structure of STAM. Notably, the 'perception of learning' is emphasised in STAM, reflecting the distinct attributes of senior citizens. Additionally, the ease of use is invariably shaped by the stages of 'exploration' and 'experimentation' (Van Biljon and Kotzé, 2007; Renaud and Van Biljon, 2008). Consequently, mitigating obstacles in learning and adopting new technologies is imperative for senior citizens.

2.4.2.5 Affordance Theory

Origins of Affordance Theory

Affordance theory was developed by Gibson in 1977; the core tenet of this theory is "the possibilities for action". To be more specific, the affordance of an object as perceived in an environment is centred on its potential utility for a goal-directed actor. The functionality of this utility is beyond the mere inherent qualities or properties of the item and functions autonomously, irrespective of the characteristics of the actor (Gibson, 2014). Additionally, these affordances can be intuitively discerned by actors, obviating the need for a cognitive exploration of the object's features. For instance, a cup inherently suggests the possibility of drinking to a user, irrespective of a conscious assessment of its weight, volume, or colour.

However, Gibson did not define affordances as whether affordances are object attributes or the relationship between objects and actors. Thus, affordance theory was argued by several cognitive and behavioural psychologists as that perception ultimately exists in cognitive processes. Turvey (1992) posited that an affordance is an environmental property, contingent upon actors who can realise it. Conversely, Stoffregen (2003) presented a departure from Gibson's perspective, suggesting that affordances are not standalone properties of objects or environments. Instead, he described them as "relational properties of the animal-environment system". Chemero (2003) suspected this view, asserting that affordances are not just properties of a relationship, but rather embody the interactions between specific animal traits and specific environmental circumstances. As the discourse evolved, a consensus began to emerge, as: "both Turvey and Chemero understand their views of affordances as claiming that affordances are emergent, relational properties of animal-environment systems" (Chemero and Turvey, 2007, p. 34).

Throughout these debates, the concept of affordances permeated various research domains. Regrettably, this led to inconsistent and sometimes contradictory usage of the term. Yet, in the realm of technology, a prevailing interpretation emerged: affordances are principally anchored in the relationship between users and technology, rather than being exclusive to the technology itself.

Norman (1999) adopted the affordance theory in Human-Computer Interaction. He defined affordance as "the perceived and actual properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used". Norman underscored the user's ability to recognise and interpret affordances embedded in a design. He argued that affordances are intentional design properties of products. According to Norman (1999), users tend to focus more on the effects of perceived affordances rather than their actual counterparts.

This perspective distinguishes between perceived and actual affordances. However, it also highlights a disagreement between Norman and Gibson regarding the understanding of affordances. While Norman posited that affordances are grounded in a user's interaction process and environment, Gibson contended that affordances remain unchanged across different contexts. Norman (1999) outlined three primary distinctions between his and Gibson's viewpoints: 1) the nature of affordance, 2) the user's perception of the affordance (which may or may not align with the actual affordance), and 3) the visual cues or information an object provides, suggesting its affordance.

It presents the difference in understanding affordances between Norman and Gibson: Norman believed affordance is related to the usability of an object, but Gibson thought affordance is relevant to usefulness (McGrenere and Ho, 2000). Gibson approached affordances from a functional standpoint, emphasising the outcome of the user-technology relationship rather than the specifics of interactions in various situations (Volkoff and Strong, 2017).

Affordance theory in IS research

One of the primary themes in IS research is examining how technology is selected and used by individuals or organizations, as well as the subsequent changes it introduces to organizational processes and structures. This type of research confirms the importance of technology's materiality but avoids being trapped in extremes of technological determinism and social constructivism (Leonardi and Barley, 2010). Affordance theory is beneficial as it is based on a socio-technical perspective to provide research with a deeper understanding of social and contextual elements in researching technology.

Hutchby is one of the early researchers who shifted utilizing the affordance theory from the environment to technologies. Affordance is the relationship between IT artefacts, users and organizations (Hutchby, 2001). He stated that affordances are not just properties of users or IT artefacts; they are embedded in the interaction between people and the physical qualities of artefacts. According to different targets and requirements, users can perceive the technology and use the physical artefact to achieve the proposed results. As mentioned before, this view provided a balance for affordance theory from extremes of technological determinism (only people's interpretations can give meaning and structure to technology) and social constructivism (technology can determine people's behaviours) (Zammuto *et al.*, 2007). To be more specific, the affordance existence is objective and does not depend on whether humans will give meaning and interpretation to it or not. In addition, people are subjective; the perception and actualization of affordance are based on people's goals to achieve the affordance effect.

In the last decades, researchers have recognized the possibilities of traditional Gibson's affordance theory. For example, Zammuto *et al*. applied the affordance theory in explaining the Enterprise Resource Planning (ERP) system and analysed the ERP practice implementational difference between an advanced manufacturing company and a small company with scarce resources and inexperienced IT. They noted that the ERP organizing possibilities (Zammuto *et al.* defined them as affordance or organizing) are created by the connections between the functionalities of IT and the context of the organization (Zammuto *et al.*, 2007). Beyond the affordance of ERP, Zammuto *et al*. talked about the affordance of working processes, which are based on the implementation and utilization of ERP in an organization. Thus, they concluded that "an affordance perspective recognizes how the materiality of an object favours, shapes, or invites, and at the same time constrains, a set of specific uses" (Zammuto *et al.*, 2007, p. 752).

Similarly, Leonardi (2011) also defined affordances in a relationship approach; he claimed that affordance exists "between people and an artefact's materiality; artefacts can be used in myriad ways and have multiple effects on the organization of work" (Leonardi, 2011, p. 153). He drew a comparison between affordances and constraints, observing that they represent opposing facets of the perceived capabilities of technology, contingent upon individuals' objectives and specific contexts. Besides, Leonardi provided the concept of imbrication between humans and organizations for affordances. Leonardi created an intermediary concept to explain how target-hold people might actively rearrange material and human agencies in their working routine. "As people attempt to reconcile their own goals with the materiality of technology, they actively construct perceptual affordances and constraints. Depending on whether they perceive that technology affords or constrains their goals, they make choices about how they will imbricate human and material agencies" (Leonardi, 2011, p. 154). Leonardi defined affordances as actively constructed, departing from Gibson's original definition (directly perceived). Additionally, Leonardi's research lacks empirical examples of constructing affordances or constraints. These studies have portrayed affordance from a relational perspective.

However, Robey, Raymond and Anderson (2012) reviewed the concept of affordances and its adoption in IS research. They highlighted the importance of adopting a clear ontological perspective on affordances, as they can be regarded as real or relational. They confirmed the conceptional contribution of affordance theory for theorizing IT as a material artefact in related research. In addition, they highlighted that it is important for defining technology to take a realist or relational interpretation. Robey, Raymond and Anderson (2012) discussed that if the researchers would like to adopt the affordances of IT research from a realist perspective, the technology and human actors should be distinct. From realist perspective, researchers need to claim the classification of all possible affordances within different types of technology as "taken to an extreme, IS researchers would need to develop descriptions of features at a highly detailed level, effectively assuming the essentialist position that specific technologies provide specific affordances and not others" (Robey, Raymond and Anderson, 2012, p. 224). On the contrary, relational perspective is selected by many researchers as an alternative understanding of affordances that "properties of the relationship between actors and their environment" (Robey, Raymond and Anderson, 2012, p. 225). The relational perspective asks for a high level of abstraction. Still, it is without clear guidance in recognizing affordances, although it is more fruitful in understanding the influence of technology in shaping social practice (Fayard and Weeks, 2014). This view was argued by Faraj and Azad in 2012; their definition of affordances is "multifaceted relational structure, not just a single attribute or property or functionality of the technology artefact or the actor" (Faraj and Azad, 2012, p. 254). They highlighted the "multifaceted relations" between the technology and the actor. They emphasized the importance of understanding technology in practice and that affordances are about "actions in the world that involve technology" instead of "technology as an object" (Faraj and Azad, 2012, p. 255). They believed it is important to focus on tech-related actions and practices rather than only focus on technology. The multiple relations between the technology and the user are highlighted in their relational interpretation. Besides, they also interpret the related affordances of the technology as based on users, using goals and the organization environment.

Pozzi, Pigni and Vitari (2014) developed a widely accepted model of affordance theory, which is based on Bernhard *et al.*'s model of affordance perception and actualization in 2013 (shown in Figure 9). Pozzi, Pigni and Vitari (2014) set four steps in this model based on the temporal-causal relationship, including affordances existence, perception, actualization and effects. In Bernhard *et al.*'s original model, they claimed the existence of affordance from the relationship between actor and object. Pozzi *et al.* emphasized that affordance existence is relationally from the intertwining of a feature-rich IT artefact and a knowledgeable and goal-oriented organization. The chosen term "IT artefact" aligns with the trend in the development of affordance theory, merging IS and technology (Treem and Leonardi, 2013; Strong *et al.*, 2014). The IT artefact generally includes the "technical objects, objects' component parts, the interface which the actors interact with, and the output of IS" (Pozzi, Pigni and Vitari, 2014, p. 2). Similarly, the selected term "organization" is consistent with IS research (Leonardi, 2013; Strong *et al.*, 2014). The organization is seen as a group of actors involved in the relation of the specific technology and can perceive affordance and perform actions based on its potential. Pozzi, Pigni and Vitari (2014) defined the difference between their model and Bernhard *et al.*'s original model as: "other than external information and actualization effort, influence affordances' perception and actualization." (Pozzi, Pigni and Vitari, 2014, p. 3). In addition, Pozzi, Pigni and Vitari (2014) stated that affordance existence and perception are two definite processes of cognition and recognition; affordance actualization supports the organization's behaviours to realize the intended outcome. Furthermore, the goal-driven affordance actualization results in the affordance effects. In the following part, these four steps will be explained in detail.

Affordance existence is a cognitive process; actors might realize that there are several potentials for actions when they interact with objects within this period. Affordance is an independent existence from people's perception, and it exists in IS space where interactions happen between IT artefacts and organizations. In addition, affordance is relational between IT artefacts and organizations (Zammuto *et al.*, 2007). It means that affordance is the relationship and the result of the dynamic interaction between IT artefact and organization, rather than exclusive properties of each of them. This view came from Markus and Silver in 2008; they provided the first definition of functional affordance as "the possibilities for goal-oriented action afforded to specified user groups by technical objects" (Markus and Silver, 2008, p. 622). In this definition, the close and bi-directional relationship between IT artefacts and users is fully indicated. Moreover, the "goals" are nonnegligible as the affordance related to goals is meaningful and helpful in analysing how actors behave based on particular affordances.

Because in IS research, the possibility to simultaneously act can inevitably be enabling and constraining, some researchers (e.g., Leonardi, 2011, 2013; Volkoff and Strong, 2013) suggested that the affordances should include the properties of enabling and constraining. Take the implementation of an ERP system in an organization as an example; ERP systems play an important role in improving organizational efficiency by unifying the business processes. However, with the adoption of this business process, along with the standardization and unification of the data flow system in operation, it is inevitable that capabilities in some departments might be significantly constrained. Thus, it is essential to understand the enable and constraint of affordance when implanting IS in a specific context.

Perception of affordance is a process of recognizing the existence of affordances and can be influenced by the information related to the affordances perceived by the actor. The symbolic expression of objective is seen as one of the actors perceived and confirmed the affordance existence. This symbolic expression is defined as "the communicative possibilities of a technical object for a specified user group "the communicative possibilities of a technical object for a specified user group" (Markus and Silver, 2008, p. 623). Furthermore, affordance perception is impacted by features of IT artefacts, which are not only from designers but also from actors' abilities and goals.

However, the perception of affordances is not the same as their existence. When actors recognize certain affordances, what they perceive is a subset of existing affordances. Due to the misunderstanding and incomplete design of features of objects, the actors might perceive "wrong" affordances which are not designed. As Gaver (1996) claimed, affordances and perceived information are different concepts. Affordance is the possibilities of real action, but perceived information is the messages of action perceived by actors. Thus, there are four categories of affordances, including perceptible affordance (existed affordance and its information), false affordance (inexistent affordance and information but perceived by actors), hidden affordance (inexistent information of affordance, so actors need to recognize affordance via other clues) and correctly rejected (inexistent affordance and information which cannot be perceived by actors) (Gaver, 1996). Therefore, it is necessary to provide suitable information and affordances when designing IT artefacts.

Ecological psychology researchers believe that it is easy for actors in affordance actualization process; however, it is suspected by IS researchers (e.g., Bernhard, Recker and Burton-Jones, 2013; Volkoff and Strong, 2013; Bygstad, Munkvold and Volkoff, 2016). They believed that recognizing affordance is the first step in understanding the change of organization in IS research, but there are several difficulties in actualizing affordances for actors. Strong *et al.* (2014) provided a clear definition of actualization of affordance as "the actions taken by actors as they take advantage of one or more affordances through their use of technology to achieve immediate concrete outcomes in support of organizational goals". Actualization is a goal-oriented and iterative process (Leonardi, 2011; Strong *et al.*, 2014). When goal-oriented actors interact with IT artefacts, the subsequent actions they undertake aim to actualize the affordances in support of their objectives by realizing specific outcomes. Conversely, actors can also offer feedback to refine both the actions taken and the actualization of the affordances (Strong *et al.*, 2014).

The affordance effect is produced by previous behaviours. Actors can achieve several observed effects in the "empirical" process; these effects are defined as "immediate concrete outcomes" (Bygstad, Munkvold and Volkoff, 2016) in the short term. These effects (immediate concrete outcomes) can support the organization in achieving primary goals. Take the ERP system as an example; the primary goal of an organization for implementing an ERP system could be improving the efficiency of resources. Based on the interaction between the IS and the organization, actors can act to actualize the affordances and achieve some concrete outcomes (e.g., standardization), then these immediate concrete outcomes will lead to the effect in the long term (e.g., efficient use of resource) (Wang, Wang and Tang, 2018).

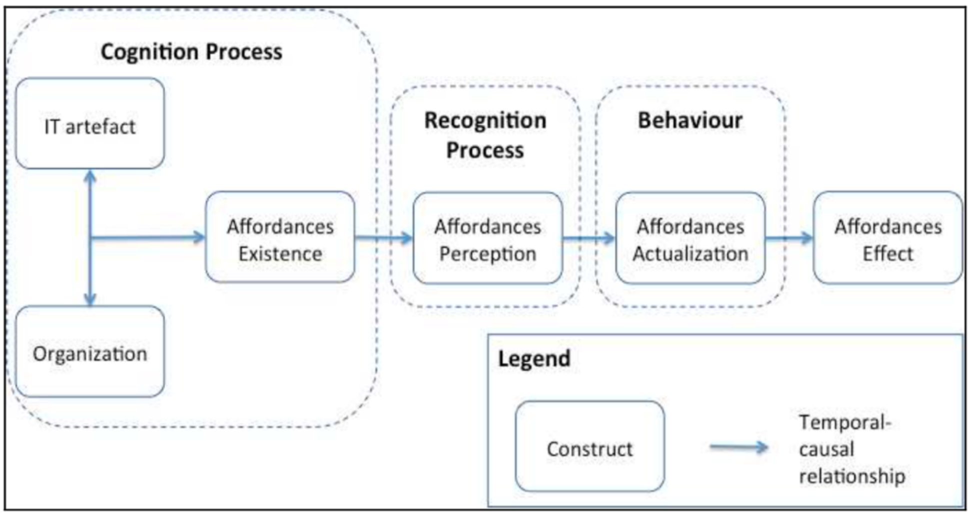

Figure 9 Affordance Theoretical Model (Pozzi, Pigni and Vitari, 2014)

Although affordance theory is popular in IS research, there is broad consensus on how to differentiate technology affordance from technology use. These definitions and views of affordance highlighted that affordance is an action or could be seen as a potential action before it is actualized. It should be a fundamentally different perspective compared with the perspective of technology use or technology feature use. However, several IS affordance studies do not clearly differentiate between features, use, and action. For instance, Treem and Leonardi (2013) claimed that persistence, visibility, editability and association are the four affordances of social media. However, these are the attributes of technology instead of action. Furthermore, Strong *et al.* (2014) utilized affordance theory in analysing electronic healthcare record (EHR) affordances; they described the affordances of EHR as "capturing and archiving digital data about patients", "accessing and using patient information anytime from anywhere" and "Monitoring organizational operation" (Strong *et al.*, 2014, p. 67). However, these "affordances" are the direct use of system features instead of action (users). In addition, the imprecise distinguishment of use in affordances and of affordances from outcomes leads to a muddled result in clarifying use, affordances and outcomes (Leidner, Gonzalez and Koch, 2018). Take Strong *et al.*'s research as an example; the "capturing and archiving digital data about patients" and "digital data about patients are captured and archived" are defined as affordance and outcome, which have basically the same meaning.

Leidner, Gonzalez and Koch (2018) stated that it is an important stage to move forward in affordance research to meticulously and intentionally separate technology use from technology affordance and distinguish technology from outcomes of the affordance. They took commuting to work as an example to understand these elements. A person may choose the train as a transportation tool to go to work. Taking a train can be seen as using the technology. In this case, the technology in question (e.g., the train) is a moving object. Based on the definition, to "take" is to be provided by a moving object. When someone uses this technology (taking the train), many affordances can arise during this period, such as listening to music, watching movies, chatting, and working. These affordances are possible by the fact that this person chooses to take the train (e.g., use the technology). However, these affordances can be achieved when individuals choose other transportation tools, and even their goals are not commuting to work. On the contrary, if the goal is defined as commuting to work, the individual uses a moving object to commute to work (e.g., take the train), then this individual can achieve the specific goal (commute to work) by taking the train, and get other benefits (e.g., listen to music, watching movie, sleep) from other affordances along the way. In other words, taking the train is the direct use of the object; listening to music, watching movies, and sleeping are not actual uses of the train, but the affordances provided by the train journey. To clarify further, reaching the workplace cannot be considered an outcome, as it is the result of taking the train, not an affordance created by the act of train travel. But an outcome affording by taking the train could be working on the rail travel can make an individual finish more work compared with driving to work by himself/herself in each day. Thus, the affordance lens can help IS researchers understand individuals' choice of technology and the outcome of these choices (Leidner, Gonzalez and Koch, 2018). Besides, it is also helpful to understand how the utilization of technology features provides affordances to individuals and how the affordances result in outcomes. From a theoretical perspective, affordance theory can be utilized in understanding how and why technology results in affordances and outcomes. From a methodology perspective, affordance theory guides the researchers to process a meticulous clarification of use, affordance and outcomes (Leidner, Gonzalez and Koch, 2018).

To sum up, the conclusion of affordances as:

- Affordances are potentials for action and independence. Existent affordances are not dependent on whether actors can perceive or actualize them or not.
- Affordances are relational. Affordances are embedded in the relationship between actors and IT artefacts during the interaction process instead of "exclusively properties of people or of artefacts" (Hutchby, 2001).
- Actors' goals and intentions could decide the perception of affordances and actualization of affordances. The actualized affordance which can help actors to achieve their goals is usually the priority one.
- It is important to distinguish the technology use from technology affordances and the technology from outcomes from the affordances.

2.4.3 Design Dimension

Design emerges as the predominant dimension in the reviewed literature. This section delves into a comprehensive discussion of design through four distinct facets: wearability, interaction, perceived usability, and functional value.

2.4.3.1 Wearability

Wearability refers to the degree how products are designed to fit the human body (Gemeperle *et al*., 1998). A salient advantage of WHT is its capacity to chronicle health metrics throughout the day. However, especially for senior citizens, suboptimal wearability can result in discomfort during nocturnal use, leading some to forgo wearing the device entirely (L. Li *et al.*, 2019). This determinant of sustainable consumption of WHT for senior citizens is underscored by multiple scholars (Kononova *et al.*, 2019; Abouzahra and Ghasemaghaei, 2020; Brickwood *et al.*, 2020; Ku, Lai and Hsieh, 2020; Cruz-Sandoval *et al.*, 2021).

Cruz-Sandoval *et al.* (2021) highlighted this point in their research on the adoption of WHT for Persons with Dementia (PwD)[3]. They advocated for offering WHT in various sizes and types, particularly tailored for PwD. According to their disease condition, this customisation might bolster adoption rates. Furthermore, this variability aids medical professionals in distinguishing between devices associated with individual patients, minimising the potential for errors. In addition, Rosales, Fernández-Ardèvol and Ferran-Ferrer (2018) noted that the design of WHT is not only about the functions, but also about the emotional value obtained from WHT. This necessitates a harmonious balance between comfort and aesthetic appeal in WHT design. Should users not derive a satisfactory wearing experience, sustained adoption becomes improbable. In Kononova *et al*. (2019)'s research, the participants describe the WHT they employed:

"*It's very rigid. The design is poor. It collects water underneath. I end up having a really loose bracelet. Which could have some effect on accuracy. I don't know. I found it totally uncomfortable. It's really ugly*"(Kononova *et al.*, 2019, p. 7).

A similar complaint also be stated in Brickwood *et al*. (2020)'s research; they observed that these oversight-laden designs regarding wearability occasionally engender frustrations among senior citizens:

"I found it wasn't quite robust enough, it would catch on stuff. I had a couple of panics where it was gone (Male, 75 years)"(Brickwood *et al.*, 2020, p. 8).

"Yes, it would catch on things, and towards the end it was getting quite lose and it was a pain because I like my big watch, and it used to get caught

[3] The participants in this research are senior citizens.

underneath it. Mine pulled off in the garden, a few times. I hauled it out of the compost bin at least once! (Female, 68 years)" (Brickwood *et al.*, 2020, p. 8).

Battery capability is a common concern of wearability for senior citizens. Numerous studies have underscored that insufficient battery capacity can become a source of inconvenience for this demographic (Puri *et al.*, 2017; Chu *et al.*, 2019; Kononova *et al.*, 2019; Liao *et al.*, 2020; Cruz-Sandoval *et al.*, 2021). Puri *et al*. (2017) reported that most of their participants preferred the 30-day battery life offered by the Xiaomi Band. They highlighted that the comparatively limited battery lifespan of the Microsoft Band could adversely impact its adoption.

"*I was able to wear it [the Microsoft Band] 2, 3 days and charge it and, you know, like you didn't feel you had to do this all the time or you had to be home…because of my lifestyle, I am not usually home at certain times* [Francine]"(Puri *et al.*, 2017, p. 11).

Similarly, Chu *et al*. (2019) also presented the concerns about the battery capability of WHT from their participants:

"*Even though the product provided electrocardiogram (ECG) and fall down detecting function, that's up to my expectation. However, I am worried the battery need to recharge while I have heart attack, what should I do? Therefore, the durability of battery is a critical issue. Unless the duration of battery can be improving, then I will accept it"*(Chu, Chen and Wang, 2019, p. 7).

Wearability forms the initial impression for the consumer. If a WHT fails to excel in wearability, it becomes challenging to secure its sustained adoption by consumers (Kononova *et al.*, 2019).

2.4.3.2 Interactivity

Interactivity can be defined and understood in a variety of ways based on the different adoption approaches (Downes & McMillan, 2000; Walther *et al.*, 2005). For instance, if interaction happens in user perceptions, communication settings, and technology, according to the locus of interactivity, it can be defined as subjective experience, messages exchanged, and/or interface (media) features (Bucy, 2004).

In the interactivity of adopting WHT for senior citizens, several authors of selected research noted the concerns in this aspect (e.g., Mercer *et al.*, 2016; Kononova *et al.*, 2019; Lee *et al.*, 2019; Wang *et al.*, 2019; Abouzahra and Ghasemaghaei, 2020; Ku, Lai and Hsieh, 2020; Cruz-Sandoval *et al.*, 2021). Lee *et al.* (2019) researched the sustainable consumption of WHT for 17 senior citizens. In their research, some participants stated that they could not receive feedback through the low interactive WHT, which reduced their interest in the long-term adoption of WHT. Mercer *et al.* (2016) that using devices and apps necessitates technological knowledge, sometimes lacking in senior citizens.

"I think the right person is someone who has patience and a real understanding that this person doesn't get it because they're simple or stupid or whatever, it's only because it is like a foreign language to them. So for our generation, they need to back it up and simplify the steps"(Mercer *et al.*, 2016, p. 9).

Ku *et al*. (2020) suggested that the design of WHT and related apps for senior citizens should be simple and straightforward; it can foster their positive attitude toward WHT. This point is also mentioned in Kononova *et al.* (2019) research; they noted that a WHT should have better visual design because many senior citizens are struggling with the degeneration of vision capability. Scholars and companies should examine the age-specific needs rather than basic design specifications or functional improvements to the WHT (Lee *et al.*, 2020).

2.4.3.3 Perceived Usability

In this section, the perceived ease of use, perceived usefulness and perceived ease of learning and use will be discussed. Perceived usefulness and perceived ease of use are included in the TAM model; they are widely involved in the research of WHT.

Perceived usefulness is the degree to which an individual believes using it would improve life and work quality, provide helpful service and information, and enhance productivity and effectiveness (Shin, 2007). Kim and Choudhury (2020) noted that the participants in their research claimed the perceived usefulness of WHT, especially the potential benefits in health management, as:

"...I think it's a good thing because it helps you to understand how healthy you are and what you're doing with yourself during the day to keep yourself healthy as you get older" (Kim and Choudhury, 2020, p. 4).

However, they also noted that the social influence[4] would impact perceived usefulness. For senior citizens, their friends and others in their social circles to assist them in discovering and comprehending the potential usefulness of WHT, but for young participants, social influence would negatively impact the perceived usefulness, as:

"...You don't want to be seen with a Fitbit in high school. It would make you look 30. A suburban soccer mom trying to get into shape, I assume, would

[4] Social influence refers to the degree to which family members or important peers believe that the participant should accept a technology (Venkatesh *et al.*, 2003)

love the Fitbit. Kids don't want to do stuff like that. I didn't really see anyone else with a Fitbit because people are going to be like oh, why is he tracking his steps? Is he like a soccer mom who just got it to get active?" (Kim and Choudhury, 2020, p. 5).

This point is also claimed by Mercer *et al.* (2016) and Puri *et al.* (2017), as the health condition will impact perceived usefulness, as the participants in suboptimal health conditions would be more positive to perceived usefulness. However, Lee *et al.* (2019) stated that the senior citizens in their research ignored the perceived usefulness of WHT.

Similarly, perceived ease of use is widely examined in the acceptance of technologies. In selected research, few researchers included perceived ease of use in their research. Puri *et al.* (2017) stated that some WHTs have to be supported by smartphones in presenting the visual data; in some cases, senior citizens would perceive the WHT as not easy to use because they are not familiar with the use of the smartphone, even are fearful of using, losing and breaking the smartphone.

"*To tell you the truth, I was afraid to use it just in case I broke it because I didn't know anything about it.* [Paula]" (Puri *et al.*, 2017, p. 9).

"I'm not one to take a phone with me. [Francine]" (Puri *et al.*, 2017, p. 9).

Contrarily, J. Li *et al.* (2019) pointed out that perceived ease of use does not significantly affect the intention of adopting WHT for their participants; they explained the reason as the majority of participants thought the WHTs were easy to use.

There are only two groups of researchers (Chu, Chen and Wang, 2019; Kim and Choudhury, 2020) who mentioned perceived ease of learning among the selected studies. Both of them noted that perceived ease of learning only exists among the senior citizens in the learning phase. Besides, perceived ease of learning is regarded as a significant negative impact factor in the adoption of WHT for senior citizens (Chu, Chen and Wang, 2019; Kim and Choudhury, 2020). Chu, Chen and Wang (2019) suggested to concern the learning issue among senior citizens since learning ability will decrease with age. Thus, it is essential to encourage the motivation of learning for senior citizens, which is vital for senior citizens in adopting WHT.

"*I am afraid people laughing at me as I don't know how to use the smartwatch/bracelet. Therefore, I don't want to know how to use the smartwatch. It doesn't matter whether I try to learn or not.* (N6_1) " (Chu, Chen and Wang, 2019, p. 7).

Kim and Choudhury (2020) noted that a large number of senior participants believe that new technology is too hard to learn; some senior citizens even think they do not have the learning ability to learn any new technology. Besides, some of them also express their fear and embarrassment of learning.

"*...At this age, to learn everything is not possible. I do emailing and certain things by myself, but I don't want to learn everything because I may not be able to remember all that. But, certain things, if it is required for my Fitbit, I try to learn that. I will have to catch up with my grandson.* [Participant O8]"(Kim and Choudhury, 2020, p. 5).

"*...I know technology is useful, but I don't make an effort to learn it. If you go to the phone company, they'll help you... I'm afraid to touch buttons because I might throw the whole thing out of whack. I just feel like I can't do it.* [Participant O11]" (Kim and Choudhury, 2020, p. 5).

Kim and Choudhury (2020) provided three constructs to encourage senior citizens to learn new technology: peer support[5], conversion readiness[6], and self-efficacy[7]. Peer support does not always play a positive role in encouraging senior citizens to learn new technology. Some senior citizens hoped to avoid seeking help from other people as possible as they could.

"*…Unfortunately, as much as I hate to admit, I will ask my friend for help. I really don't like asking him because I want to know how to do it on my own. But if I'm really stuck, then I'll ask him and then I can continue.* [Participant O5]" (Kim and Choudhury, 2020, p. 6).

Senior citizens are reluctant to change their current routines, regardless of how valuable a new technology is, because they are established in their methods of doing things without the assistance of technology (Kim and Choudhury, 2020). This reason caused a negative impact on learning and using new technology. In addition, senior citizens are seen as lacking self-efficiency, which will negatively impact them in learning new technology. However, while perceived ease of learning is a challenge in adopting new technology for senior citizens, once this barrier was successfully overcome, they quickly became active users (Kim and Choudhury, 2020).

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[5] Peer support refers to *'support from people in a close social network.'* (Kim and Choudhury, 2020, p. 5).

[6] Conversion readiness refers to the extent to which a person is willing to accept something new (Kim and Choudhury, 2020).

[7] The extent to which a person believes he or she is capable of completing a task (Kim and Choudhury, 2020).

2.4.3.4 Functional Value

Functional value is one of the critical determinants of customer purchase behaviour. It refers to the perceived ability of a product or service to have a functional, practical or physical purpose (Sheth, Newman and Gross, 1991). Thus, functional value can be regarded as the perceived ability to achieve the purpose. The initial purpose of using WHT is a factor which can explain the sustainable consumption of WHT (Gouveia, 2016). Functional value is widely considered as a critical predicted factor in examining sustainable consumption of WHT for senior citizens in the selected studies (e.g., Chu, Chen and Wang, 2019; Kononova *et al.*, 2019; L. Li *et al.*, 2019; Lee *et al.*, 2019, 2020; Abouzahra and Ghasemaghaei, 2020; Liao *et al.*, 2020).

L. Li *et al.* (2019) reviewed the previous research and set the initial purpose including *(i) becoming more active, (ii) managing a chronic illness, (iii) losing weight, (iv) monitoring health, (v) monitoring diet, (vi) supporting a family member or friend, (vii) following doctor's recommendation, and (viii) receiving WAT as a gift*—as predictors of sustainable consumption of WHT for senior citizens (L. Li *et al.*, 2019, p. 769). Furthermore, they integrated these purposes into three factors of functional values: regular monitoring (purpose i, ii, iii, iv, v), social exchange (purpose vi, vii), and receive approaches[8] (purpose viii) (L. Li *et al.*, 2019). However, according to the investigation results, L. Li et al. (2019) stated that the initial purpose of adopting WHT cannot predict the sustainable consumption of WHT for senior citizens. They claimed that the multiple functions, which are regarded as the functional value can positively impact the sustainable consumption of WHT for senior citizens. Chu, Chen and Wang (2019) claimed a similar result: if

[8] Receive approaches: receive WHT as a gift or purchase WHT by him/herself (L. Li et al., 2019).

the functional value of WHT is not attractive for seniors, they would not consider long-term adopt it.

"The function is not attractive enough, which the cell phone I am now using already got the APP health management. Also, the product cannot keep valuable as Rolex. In addition, the screen is pretty small not easy see it clear. I am thinking to have one until it becomes branded and the popular trend (N2_1)*"* (Chu, Chen and Wang, 2019, p. 7).

The view that functional value presented by multiple functions of WHT can enhance the sustainable consumption of WHT for senior citizens is also stated in Kononova *et al.* (2019)'s research.

2.4.4 Technology Dimension

In this section, the factors influencing the sustainable consumption of WHT for senior citizens within the technological dimension will be critically reviewed and discussed. The examination of the technological dimension will be structured around three primary elements: effectiveness, perceived risk, and AI-supported technology.

2.4.4.1 Effectiveness

The effectiveness of WHT refers to the ability to obtain data that can provide reliable and acceptable quality and accuracy as obtained by a regular healthcare system (adjusted from Park and Jayaraman, 2009). WHT is adopted in a real-life context; systems may experience a variety of unexpected issues, such as high bio-signals noise, measurement errors and weak contact of the sensor with skin (Meng, Choi and Kim, 2011). Thus, accuracy is the most complained factor for customers. In selected studies, several researchers noted that the low level of accuracy makes participants feel disappointed with WHT and query the quality of WHT (Nguyen *et al.*, 2017; Chu, Chen and

Wang, 2019; Kononova *et al.*, 2019; Lee *et al.*, 2019, 2020; Brickwood *et al.*, 2020).

One of the most frequent complaints about the accuracy of WHT is that the WHT cannot accurately record the data of the physical activity.

Besides, the number of steps is the most common method that WHT represents the level of physical activity. However, other exercises, such as swimming and cycling are partially tracked, miss-tracked or untracked (Kononova *et al.*, 2019; Lee *et al.*, 2019). In addition, the low level of accuracy will negatively impact customer experience (Brickwood *et al.*, 2020). If the data is inaccurately recorded and presented by WHT for senior citizens, it will affect their experience with WHT and result in some frustration that senior citizens believe their efforts are not recognised (Brickwood *et al.*, 2020).

"*And I would go do my exercise class and they would make us work so hard, and I would read the thing that night and it'd be such a limited number of steps for the amount of effort that I'd put into it (Female, 73 years)"*(Brickwood *et al.*, 2020, p. 8).

The frustration caused by inaccuracy may lead to the result that senior citizens would lose interest in continuously using WHT (Nguyen *et al.*, 2017; Kononova *et al.*, 2019; Brickwood *et al.*, 2020; Lee *et al.*, 2020).

"*And I did lose interest when it wasn't working [band wouldn't always record steps on treadmill]* (Female,74 years)*"* (Brickwood *et al.*, 2020, p. 8).

2.4.4.2 Perceived Risk

The perceived risk is defined as the degree to which users believe the technology may bring unanticipated risks, such as safety risks, functionality risks, and privacy violations (Chatterjee and Price, 2009). Nguyen *et al.* (2017) examined the adoption of WHT for female senior citizens who are breast cancer survivors. The participants in this research presented their concerns about WHT, especially for breast cancer survivors. Lymphoedema is one of the most common side effects of treatment for breast cancer that has undergone lymph node dissection or radiation therapy, usually in the arms and hands. The participants stated they were concerned about the discomfort of wearing WHT caused by lymphoedema. In addition, some participant proposed their concern that the electromagnetic radiation of WHT may adversely affect their treatment (radiation therapy) and stimulate the cancer tissues, which may affect their physical health.

Another perceived risk is the privacy of personal health information. Privacy was a significant barrier for senior citizens in adopting WHT(Gao, Li and Luo, 2015). However, in selected studies, participants did not have excessive concerns about the privacy of WHT. Lee *et al.* (2020) investigated the data privacy of WHT for senior citizens; they noted that the majority of participants realised the sensitivity of personal health information. However, they did not consider sharing personal health information would violate their privacy and be comfortable with sharing personal health information with some agencies. To be more specific, participants believed that the number of steps, sleeping time, physical activities and physical information (such as heart rate and blood pressure) are not private (Puri *et al.*, 2017).

"*I mean privacy—I would not like somebody to be able to go into my bank account or into personal details like that. But privacy; how I live or what I do, that's not a—not bothering me. No.* [Paula]" (Puri *et al.*, 2017, p. 10).

"It's *like the information you have about your salary, how much you pay for your house, how much you pay for rent, how much you paid for your car, whether you had sex last night or anticipate having it next year [laughs] you know, all that stuff…I can share anything in my life and I don't get the feeling* *that I shouldn't be sharing that with somebody* [Greg]" (Puri *et al.*, 2017, p. 10).

Puri *et al.* (2017) explained that the diminished sense of privacy may be caused by the widespread sharing of data in other areas of life and the lack of understanding of privacy risks and implications. In addition, Wang *et al.* (2019) analysed the sustainable consumption of WHT in ageing in place for senior citizens; they noted that privacy is not the major concern in adopting WHT. However, if the information from WHT would be linked to healthcare online communities, senior citizens presented their concern of privacy which may be relevant to fraud.

2.4.5 People Dimension

Peers, families and physicians play an essential role in the sustainable consumption of WHT for senior citizens. The opinions of these people are essential for senior citizens in the sustainable consumption of WHT. Relatedness encouragement and social competition contribute to sustainable consumption of WHT for senior citizens (L. Li *et al.,* 2019). However, social competition is seen as an effective method only for short-term customers and early adopters (Kononova *et al.*, 2019).

"*I would say one of the things that I did, my kids had gotten some wearables, and so we had a little contest. That encouraged me, instead of having the red line or something like that. It was like, "Oh, so how many did you do today?" It was a non-threatening way of getting everybody to see what they did, so, "You only did so many steps today? What's going on with you?* [Female participant, former user]" (Kononova *et al.*, 2019, p. 8).

Nevertheless, L. Li *et al.* (2019) noted that social competition is seen as a double-edged sword of sustainable consumption of WHT, as social competition may increase the engagement of WHT to benefit from sustainable consumption. However, personal characteristic is another impact factor in this process, as social competition only works for the people who enjoy it. For long-term adopters, the essential point of using WHT to monitor is to do activities with their relatedness or to compete with themselves (Kononova *et al.*, 2019; L. Li *et al.*, 2019).

Besides, senior citizens tend to sustainably adopt WHT when they get suggestions or encouragement from their relatedness and physicians (Brickwood *et al.*, 2020). The customer experience would be enhanced by the support from physicians (Brickwood *et al.*, 2020).

"*I felt it was doing me a whole heap of good, like somebody was always looking over my shoulder and keeping me (on track).* (Male, 71 years)" (Brickwood *et al.*, 2020, p. 9).

"*It encouraged me. I don't know that it kept me on track, but I was really chuffed when I got a good, oh well, a very good [report].* (Female, 79 years)" (Brickwood *et al.*, 2020, p. 9).

"I thought it was great [the text messages]. I mean, yeah okay I knew when I didn't do my steps, but it sort of prompted me – well I'll do better tomorrow. (Female,69 years)" (Brickwood *et al.*, 2020, p. 9).

Senior citizens would like to sustainably adopt WHT when they firmly realized that most of the important people think they should sustainably adopt it (Ku, Lai and Hsieh, 2020). However, this behaviour comes more from perceived pressure rather than self-driven willingness (Ku, Lai and Hsieh, 2020). It is also mentioned in Brickwood *et al.* (2020)'s research that senior citizens would feel guilty when they did not use WHT or maintain activity levels after obtaining support and reminders from physicians. Moreover, senior citizens do not always want to get support from others, due to the following reasons: 1) senior citizens do not want to reveal their lack of knowledge; 2) senior citizens do not want to bother others; 3) senior citizens prefer to keep their problems to themselves due to the generational attitude of self-sufficiency (Kim and Choudhury, 2020).

2.5 Summary

This chapter is aimed to offer a comprehensive review of sustainable consumption of WHT for senior citizens.

Section 2.1 delineates the concepts of sustainable consumption. A research gap is pinpointed within sustainable consumption, specifically in contexts where participants and products do not align with "green" principles. The section also grapples with the broader objectives of sustainable consumption, such as improving life quality.

Section 2.2 delves into the definition and evolution of the customer experience paradigm. Additionally, the leadership dynamics of WHT are dissected from three cardinal dimensions, highlighting design, technological, and brand leadership within the WHT sector.

In section 2.3, the author reviewed the origin of WHT and the definition of WHT. In addition, the development and the adoption of WHT were reviewed in this section.

In section 2.4, the literature focused on sustainable consumption of WHT for senior citizens. Seventeen core empirical studies were selected, based on the selection criteria. The prevailing theories within these studies were thoroughly reviewed, and their evolution was discussed. Concluding this section, the principal influencing factors from the chosen studies were categorised under three dimensions: design, technology, and people.

Thus, the research gap in sustainable consumption of WHT for senior citizens could be identified as:

- A noticeable lack of studies that centre on the sustainable consumption of WHT, especially considering senior citizens unfamiliar with IT and new technologies.
- An absence of literature that addresses the sustainable consumption of WHT for senior citizens from technology leadership, design leadership and brand leadership standpoints.
- While some studies have probed the positive correlation between customer experience and sustainable consumption, empirical explorations specific to the WHT domain are scant.
- Despite various firms offering WHTs, the significance of brand influence remains largely untouched in this academic area.

In response to these gaps, this study would develop a research framework based on affordance theory to analyse the sustainable consumption of WHT for senior citizens. Furthermore, by adopting affordance theory and integrating design, technology and brand leadership, this study could provide a holistic view of how these aspects collectively shape the affordances of WHT. Moreover, this integrated approach enables a nuanced understanding of how technology leadership, design leadership and brand leadership impact customer experience of using WHT and sustainable consumption of WHT among senior citizens.

Chapter 3. Methodology

This chapter sets out the methodological foundation for this thesis; there are two parts are included in this chapter:

- An overview of research paradigms and rationale for a pragmatic approach is selected in this thesis.
- Research strategies of selecting qualitative and quantitative research to answer the research questions.

3.1 Research Paradigms

Researchers have historically employed a variety of distinct strategies to investigate and generate novel phenomena and knowledge. Two primary paradigms, positivism and interpretivism, have significantly shaped these investigative processes. Furthermore, these paradigms play a pivotal role in guiding the methodologies for data collection and analysis (Willig, 2013).

3.1.1 Positivism

Positivism is commonly equated with the 'scientific method'. It posits that reality remains constant and objective; repeatable observations can glean knowledge about this unchanging reality (Levin, 2008). Positivists seek to validate widespread explanations by formulating and testing theories and hypotheses, often relying on numerical and statistical methodologies (Crotty, 1988). Data procured through this lens prove effective in verifying predefined hypotheses. Moreover, this approach underscores the importance of maintaining an objective distance between the researcher and the subject under examination (Charmaz, 2006).

While this method has firmly established its relevance in physical and natural sciences, its complete appropriateness for social sciences remains a topic of debate (Hirschheim, 1985). In IS research field, many researchers have kept calling for a more pluralistic attitude toward IS research methodologies (e.g., Kuhn, 1970; Bjørn-Andersen, 1985; Remenyi and Williams, 1996). The essence of IS research is that dealing with the interaction between people and technology, it squarely aligns with the social sciences (Hirschheim, 1985). Therefore, this inappropriateness of the positivist paradigm for the domain could lead to some of the challenges encountered in IS research, such as the apparent inconsistency of results.

3.1.2 Interpretivism

Interpretivists believe that while reality is extant and measurable, the influence that researchers bring to their subjects is inescapable. They state that the interpretations of reality can be multiple, but it also can be changed due to the differences in time and place. Moreover, these interpretations intrinsically form a component of the scientific knowledge under investigation (Madill *et al*., 2000).

Instead of predicting causality, the interpretive approach seeks to fathom and interpret the motivations, meanings, reasons, and other subjective experiences rooted in specific temporal and contextual confines of human behaviour and social dynamics. This philosophical stance often relies heavily on naturalistic methods such as interviews, observations, or the analysis of extant texts (Lincoln, Lynham and Guba, 2011).

A central point of contention surrounding the interpretive approach hinges on its inherently subjective nature. The potential for researcher bias might compromise the broader applicability of study findings, given that data may be profoundly shaped by individual perspectives and convictions (McEvoy and Richards, 2006).

3.1.3 Pragmatism

Pragmatists believe that the most important parts of selecting adopted methods are the limitations and opportunities of the research context

(Silverman, 1993). It emphasizes the importance of using a pragmatic approach in responding to the strengths and weaknesses each approach can offer in answering the research question instead of agonizing over the contradictory contrasts that multiple paradigms show (Patton, 2002).

Pragmatism is often equated with 'mixed methods', a strategy that melds quantitative and qualitative methodologies (Creswell, 2017). The objective behind employing this mixed approach is to gain a more profound comprehension of phenomena than might be possible using only one method. That is to say, the pragmatism approach refers to combining two or more different methods that produce both quantitative and qualitative data in a single research project (Johnson and Onwuegbuzie, 2004).

In many cases, an amalgamation of quantitative and qualitative techniques is perceived as the most efficacious strategy (Olsen, 2002). The quantitative approach could be utilized to make accurate comparisons and build credible descriptions, while the qualitative approach is helpful in clarifying the complex concepts and relationships which cannot be captured by predetermined categories or standardized quantitative measures (McEvoy and Richards, 2006).

Therefore, this research will align with positivist research paradigms. Moreover, a qualitative survey will be employed to refine the research factors within the framework and to establish the research hypotheses. Conversely, a quantitative survey will be deployed to assess these hypotheses and to present the study's results.

3.2 Research Strategy

There are several different strategies for selecting an approach in qualitative methods based on diverse applicability and purpose, such as:

- Participant observation: collecting data on naturally occurring behaviours in participants' usual contexts.
- Interviews: obtaining data from individuals based on their personal perspectives and experiences.
- Focus groups: collecting data (information) on a broad range of issues that interest the cultural groups or subgroups represented in the group.

In this study, the research aim is to obtain the personal experiences and perspectives of senior citizens who would make their consumption of WHTs sustainable. Qualitative interviews were regarded as the most suitable approach to be utilise. These interviews not only allow for an in-depth understanding of the perspectives of senior citizens on WHT but also offer valuable insights that can be used to fine-tune the research model with pertinent influencing factors.

Subsequent to the qualitative phase, a quantitative questionnaire will be employed. This strategy is deemed most suitable for statistically analysing data obtained from a vast number of participants. Thus, a quantitative survey will be conducted following the qualitative interviews and the necessary modifications to the research model.

3.2.1 Qualitative Survey-Interview

The qualitative interview is a valuable tool that allows researchers to delve into ideas and concepts that are not directly observable, capturing participants' perspectives (Patton, 2002). Such interviews are fundamental to interpretivist research, excelling at shedding light on the dynamic interplay of participants' actions, beliefs, and thoughts. The interview is regarded as a form of conversation that is *"initiated by the interviewer for the specific purpose of obtaining research-relevant information and focused on content specified* *research objectives of systematic description, prediction or explanation"* (Cohen, 1989, p. 307).

Interviews can take various forms, such as semi-structured interview and unstructured interview. The semi-structured interview, while centred on pre-determined topics, retains flexibility, permitting exploration of unexpected or unanticipated issues during discussions (Smith, 2019). Unstructured interviews give participants with increased flexibility, allowing them to concentrate on aspects that they consider relevant to the main topic.

In this thesis, a semi-structured interview was adopted to process the data collection. The interview questions are broad, which is aimed to extend the question or include additional interview questions when the unanticipated or interesting concepts appear. Another advantage of the semi-structured interview is to easily build up a rapport with participants through an appropriate interaction. However, it's paramount that these discussions remain nonthreatening and non-judgmental, ensuring that the gathered data genuinely mirrors the participants' perspectives (Smith and Shinebourne, 2012).

3.2.1.1 Quality in Qualitative Research

It is hard to assess the quality of qualitative research due to the differences in epistemological, philosophical, and methodological perspectives. Besides, the traditional assessing principles of generalisability, validity and reliability widely utilised in positivist research are argued for the availability and efficiency of applying in qualitative interpretative approach (Dixon-Woods *et al.*, 2004). Yardley (2000) proposed some broad principles for assessing the quality of qualitative research, such as sensitivity to context, commitment and rigour, transparency and coherence, and impact and importance. Meyrick (2006) developed a six-stepped framework to investigate the rigour or quality of qualitative research based on credibility and trustworthiness. In this thesis, Meyrick's framework (shown in Table 12) will be adopted in qualitative research.

Elements	**Identification**
Researcher theoretical stance	A clear researcher's theoretical stance in the study is a good research's guarantee.
Methods	The set research aims, objective and questions and methods should be guided by a body of literature review.
Sampling	Sufficient details of sampling technology and participants' information are needed.
Data collection	Sufficient detail of data collecting process
Analysis	Sufficient information of how the conclusion is generated from data.
Results and conclusions	Sufficient information of results and conclusion conducted process.
	Provide the transcripts or conclusions back to the participants or an independent audit to build up the strength of conclusions and verifying the trustworthiness and credibility of the findings.

Table 12 Meyrick's Six-Stepped Framework

3.2.1.2 Qualitative Interview Participants

The qualitative approach differs from the quantitative approach due to the different aims. Qualitative research aims to identify qualitative similarities or other patterns in a data set rather than quantitative quantities. Hence, an appropriate selection of participants based on the research features, including context, nature of the topic, and data quality, is considered more important than the number of participants (Sandelowski, 2000).

As mentioned in Chapter 1, the ageing population is a severe challenge for both developed countries and some developing countries. Take the UK and

China as examples; in 2014, there were 16.2 million ageing people over 60 years old in the UK, and it is estimated to increase from 14.9 to 21.9 million ageing people between 2014 and 2039 (Government Office for Science, 2016). China's population aged 60 and over was about 190 million in 2020, which is 13.5% of the total population in China. Compared with the 6th national census data in 2010, the ageing population has increased by 4.63% (National Bureau of Statistics of China, 2021a). According to the Office for National Statistics (2019), 65.78% (equivalent to 5.7 million) of British individuals aged 65 and over reported suffering from long-term health conditions in 2019. Additionally, over 68.18% (about 18 million) of the ageing population in China has chronic diseases.

In summary, the increasing number of ageing people, the demand for 'ageing in place' and the unbalanced requirement of the nursing home show the importance of monitoring the health condition of ageing people to manage their health at home. The ageing people who are over 60 years old are considered as the most appropriate participants in this research.

3.2.2 Quantitative Survey

The questionnaire refers to "Structured schedules used to elicit predominantly quantitative information, using direct questions, from informants, either by self-completion or via interview" (McColl *et al.*, 2001, p. 3).

A quantitative questionnaire aims to transfer the information into meaningful numbers (e.g., counts, averages, rates) relevant to the population of interest. Dillman (1991) described these population-related numbers as attributes (what people are), behaviours and events (what people do), beliefs or knowledge (what people trust), attitudes or reasons, etc. (people say about what they want or how they feel). According to the scores of participants' answers to survey questions that are processed by summarising or statistical tests, the inferences of the underlying population can be made from the samples. Questionnaires can be administered through various methods, including face-to-face interactions, online platforms, mobile phone applications, or via postal services.

3.2.2.1 Quality in Quantitative Questionnaire

The primary objective of a quantitative questionnaire is to procure information that is valid, reliable, unbiased, and discerning.

Validity is regarded as the accuracy extent of the measured concept in a quantitative questionnaire. Validity could be categorised into three primary classifications (Heale and Twycross, 2015):

- Content validity: all facets of a construct are comprehensively and accurately measured.
- Construct validity: the questionnaire measures the construct it is intended to measure.
- Criterion validity: correlation or relevance of the questionnaire compared to other instruments measuring the same variable.

Reliability can be thought of as the accuracy of questionnaire research. The same result should be as repeatable as possible when the other research tool is utilised in the same condition to process the investigation (Heale and Twycross, 2015). Additionally, efforts should be made to minimise bias throughout the questionnaire research process.

A notable limitation of questionnaire research is the constraint it imposes on the depth of responses. Unlike semi-structured interviews, questionnaires offer less flexibility to participants due to their pre-set response formats, potentially hindering the capture of nuanced insights or deeper meanings in responses. However, this shortcoming can be mitigated by allocating a dedicated space for participants to elucidate their answers or provide further insightful information (Oppenheim, 2000).

This chapter provides an overview of the research methodology and strategies employed. For this study, a pragmatic approach has been chosen as the guiding research methodology, utilising a mixed-methods approach that combines qualitative interviews and quantitative questionnaires. Detailed explanations of the practical elements of each research method will be provided in subsequent chapters.

Chapter 4. Qualitative Research and Results

The primary objective of qualitative research is to address the complexities related to deepening our comprehension of the significance and experience aspects of human existence and social contexts (Fossey *et al.*, 2002). It has proven efficacious in understanding individuals' subjective healthcare experiences, cultural and political factors within healthcare, and interactions between participants and associated practitioners (National Health and Medical Research, 1994; Davidson *et al.*, 1996). Furthermore, qualitative research is particularly advantageous for knowledge development in obscure or complex research areas within healthcare (Fossey *et al.*, 2002).

Interviewing is the most prevalent method for data collection in qualitative research (Taylor and Holloway, 2005). Structured, unstructured and semi-structured are three main fundamental categories of qualitative interview research (Gill *et al.*, 2008). A structured interview operates akin to a verbal questionnaire, presenting a set of preordained questions with minimal variation and scant opportunity for probing deeper into the implicit connotations conveyed by the interviewees (Gill *et al.*, 2008). In contrast, unstructured interview research is predominantly employed to explore subjects in profound depth, to venture into uncharted territories, or to uncover novel dimensions within a familiar topic (Agarwal and Tanniru, 1990). In unstructured interview research, participants are encouraged to express their viewpoints more freely (Chauhan, 2022). However, in empirical research, the range of responses and the effectiveness of employing unstructured interviews remains largely unexplored (Levashina *et al.*, 2014).

In qualitative research, semi-structured interviews are widely recognised as the most popular interviewing method (Crabtree and DiCicco-Bloom, 2006). Furthermore, in the context of healthcare research, semi-structured interviews are frequently favoured due to their provision of a 'discussion guide' for participants. This is particularly beneficial when discussing healthcare matters (Gill *et al.*, 2008). The semi-structured interview method's efficacy in establishing reciprocity between the interviewer and participant is one of its key merits (Galletta, 2013), enabling the interviewer to generate new questions in response to participant feedback (Rubin and Rubin, 2012; Polit and Beck, 2020).

In this study, the author devised a semi-structured interview based on the established framework and extant knowledge of WHTs for older adults. Concurrently, participants were furnished with interview guidelines that encapsulated the central research themes of this study. The purpose of these guidelines was to provide a consistent framework for participants, ensuring the retrieval of analogous data from each individual. This approach fostered a deeper exploration of the research domain, guiding the direction of participants' discussions (Holloway and Galvin, 2016).

4.1 Objective

As highlighted in the previous chapter, there exists a notable absence of robust research on the sustainable consumption of WHT among senior citizens, particularly in developing countries. This issue was discussed and confirmed in Chapter 2's literature review. Hence, to investigate this research gap and refine the research framework, a qualitative research approach employing semi-structured interviews, was adopted in 2022.

The objectives of this study centred on exploring the sustainable consumption of WHT by older adults in China, specifically from the perspectives of design leadership, technology leadership, and brand leadership. Concurrently, this study aimed to provide direction for modifying the research framework, ensuring comprehensive coverage of all critical impact factors associated with senior citizens' sustainable use of WHTs.

4.2 Methodology

Semi-structured interviews are often perceived as a straightforward method of data collection (Wengraf, 2001). When preparing for semi-structured interviews, a central concern is the depth of information collected (Kallio *et al.*, 2016). However, the need for in-depth information can prompt ethical debates over collecting data beyond what is required for the study (Gibbs *et al.*, 2007). Conversely, the user-friendliness of the semi-structured interview method, considering its potential to yield rich and detailed data, has also been called into question (Gibbs *et al.*, 2007). Consequently, it is imperative to meticulously conduct and report qualitative studies (Cleary, Horsfall and Hayter, 2014). Kallio *et al.* (2016) argued that a well-constructed qualitative semi-structured interview guide can enhance the trustworthiness of qualitative research, proposing a five-phase method for developing such a guide:

1. Determining the prerequisites for conducting semi-structured interviews.
2. Locating and employing prior knowledge.
3. Crafting a preliminary semi-structured interview guide.
4. Undertaking a pilot test of the semi-structured interview guide.
5. Refining the overall semi-structured interview guide.

This study adhered to this five-phase method in developing the semi-structured interview guidelines. Initially, the research was deemed suitable for semi-structured interviews due to its focus on understanding individuals' perspectives (Barriball and While, 1993) and attitudes toward complex or sensitive problems (Barriball and While, 1993; Åstedt-Kurki and Heikkinen, 1994). Moreover, semi-structured interviews should be predicated on an extensive literature review (Turner III and Hagstrom-Schmidt, 2022) and a predetermined framework (Barriball and While, 1993). In the preceding chapters, the literature was reviewed, and the framework was introduced, thereby providing a comprehensive background for conducting semi-structured interviews.

A preliminary semi-structured interview guide was developed for data collection, drawing on prior knowledge to shape its structure, logic, and coherence (Kallio *et al.*, 2016). Semi-structured interviews typically incorporate two levels of questioning: main queries and follow-up questions (Kallio *et al.*, 2016). The main questions address the research subject and critical points, encouraging participants to express their views and experiences (Kallio *et al.*, 2016). Follow-up questions are designed to deepen the participants' understanding, enabling the extraction of more specific and detailed information (Turner, 2010). These secondary questions lend fluency and accuracy to the interview (Whiting, 2008).

A pilot test is instrumental for refining semi-structured interview guidelines, enabling the examination of the coverage and relevance of the initial guide (Kallio *et al.*, 2016). Common pilot test methods for semi-structured interview guides include internal testing, expert assessment, and field testing (Barriball and While, 1993; Turner, 2010). This study incorporated internal and field testing. Internal testing involves the assessment of the initial interview guide in collaboration with the study team's investigators (Chenail, 2011). In this case, Prof. Suraksha Gupta and the author conducted internal testing of the preliminary interview guide, enabling the resolution of ambiguities and the elimination of inappropriate leading questions. Field testing was undertaken to evaluate the draft interview guide with prospective study participants (Kallio *et al.*, 2016). This process, simulating real interview situations, led to reorganising and adjusting the question order and format, thereby enhancing the guide's relevance (Chenail, 2011).

Finally, a comprehensive semi-structured interview guide was produced (refer to Appendices 1 and 2). The aim was to deliver a logical, polished, and transparent guide for data collection. The arrangement of the interview questions is provided in Appendix 3.

4.2.1 Data Collection

Aligned with the research objectives, this study carried out 20 semi-structured interviews with senior citizens aged over 60 years, all of whom had experience using WHT. Snowball sampling, also known as referral sampling, is a technique for selecting subjects within a network or chain, as outlined by Sekaran and Bougie (2016). This approach involves identifying subjects based on the specific criteria necessary for the research. The initial respondents are then encouraged to recommend additional individuals from the same population to be part of the sample, a strategy described by Malhotra *et al.* (2006). This process is repeated, with each respondent referring new subjects, until the target number of respondents is achieved. This method of recruitment enables the author to connect with interviewees who use WHT for long-term. Before conducting the interviews, a preliminary understanding of potential interviewees will be carried out to determine whether their use of the product aligns with the sustainable consumption of WHT. This entails assessing whether they have been using the same specific WHT product for a long period and whether they hope to achieve an enhancement in personal wellbeing through the use of this product. Conducted in August 2022, these interviews ranged from 20 to 50 minutes in duration and were carried out via voice call online, a format akin to telephone interviews. The telephone interview method is versatile for data collection, allowing interviewees to feel more comfortable sharing their experiences (Novick, 2008).

The traditional gold standard for qualitative interviews is in-person interviews, with alternative methods often perceived as less (McCoyd and Kerson, 2006). Owing to scholarly tradition and the clear benefits of face-to-face interaction where participants live, work, or relax, in-person interviewing is typically preferred (Johnson, Scheitle and Ecklund, 2021). In-person interviews offer a natural conversational context, an excellent basis for rapport building, and ample opportunity to notice visual and emotional cues (Irvine, Drew and Sainsbury, 2013). Nonetheless, some researchers advocate for a broader acceptance of alternative data collection modes (Holt, 2010; Cachia and Millward, 2011; Johnson, Scheitle and Ecklund, 2021).

Telephone interviews offer several practical advantages (Johnson, Scheitle and Ecklund, 2021). They afford greater scheduling flexibility, reduce travel costs, and save time for researchers. Additionally, methodological benefits include providing a quiet, private, and comfortable environment for participants (Sturges and Hanrahan, 2004), potentially leading to the collection of richer information. Moreover, some participants may prefer remote participation due to their personal circumstances. While the lack of nonverbal cues is often cited as a disadvantage of telephone interviews, Cachia and Millward (2011) argue that this can often be naturally compensated for with additional verbal cues; specialised probing questions can also address this perceived shortcoming. Rather than viewing the telephone interview as a ‘second-best choice’, it can be a more advantageous mode depending on the particular circumstances of the study (Holt, 2010, p. 120).

This study was conducted during the COVID-19 pandemic, with all participants being senior citizens, a demographic notably vulnerable to COVID-19. Furthermore, international travel was severely impacted by COVID-19 prevention measures implemented globally. As such, this study selected telephone interviews as the qualitative interview method, considering the prevailing conditions. A robust interview guide was developed to ensure accuracy and appropriateness, and interview questions were meticulously adjusted to suit a telephone interview format (Novick, 2008).

The gold standard for qualitative interviews remains the face-to-face approach, with alternative methodologies often perceived as less efficacious (McCoyd and Kerson, 2006). Due to scholarly history and the obvious benefits of meeting a participant face-to-face where they live, work, or play, in-person interviewing mode is considered preferable (Johnson, Scheitle and Ecklund, 2021). Meanwhile, the in-person interview can be regarded as a mode with several advantages as it can offer the most natural conversational context, the most significant basis for developing rapport, and the best opportunity to notice visual and emotional indicators (Irvine, Drew and Sainsbury, 2013). Nevertheless, some scholars advocate broadening the acceptance of alternative modes of interview data collection (Holt, 2010; Cachia and Millward, 2011; Johnson, Scheitle and Ecklund, 2021).

Conducting telephone interviews has some practical advantages (Johnson, Scheitle and Ecklund, 2021). For instance, the schedule of interviews can be more flexible; besides, it can reduce the cost of travel and save time for researchers. Besides, some methodological advantages of telephone interview are pointed out as it can provide a quiet, private and comfortable interviewing environment for participants (Sturges and Hanrahan, 2004). In this environment, researchers may get richer information from participants. Furthermore, some participants may prefer a remote method of taking part in an interview due to their personal situations. The most challenging point of telephone interviews is the weakness of obtaining nonverbal cues. However, Cachia and Millward (2011) stated that the loss of nonverbal cues can often be naturally replaced with additional verbal cues; besides, special probing interview questions can also fix this perceived disadvantage. Telephone interview should not be seen as a 'second-best choice'; it can be a more favourable mode, according to the different situations of the study (Holt, 2010, p. 120).

This study was conducted during the COVID-19 pandemic, with all participants being senior citizens, a demographic notably vulnerable to COVID-19. Furthermore, international travel was severely impacted by COVID-19 prevention measures implemented globally. As such, this study selected telephone interviews as the qualitative interview method, considering the prevailing conditions. A rigorous interview guide was devised for precision and suitability, with questions meticulously tailored to fit the telephone interview format.

4.2.2 Profile of Respondents

The participants in this study were all above 65 years of age and had experience with WHT. Each participant was selected from China, the world's largest developing country, grappling with the significant challenge of an ageing population (Liu *et al.*, 2021). Since the onset of the 21st century, alongside accelerated economic transformation and social transition, the population structure in China has undergone substantial changes. Over the last decade, the number of senior citizens aged over 60 has grown from 167 to 264 million; by 2050, the elderly population in China is projected to exceed 400 million, accounting for over 30% of the total population (Lu and Liu, 2019). This demographic transition exerts significant pressure on elderly social support systems, intensifies healthcare demand, and hastens the escalation of medical expenses (Katz *et al.*, 1963; Yi *et al.*, 2002). Therefore, strategies to alleviate the burden of an ageing population require exploration, and China offers a significant sample for this analysis.

In this study, the average age of respondents was 66.6 years. The participant pool consisted of 12 male and 8 female respondents, with the average duration of use of WHT being 2.85 years (see Table 13 for respondent details).

Participants	Age	Gender	Duration of use (year)
1	67	M	4
2	68	F	4
3	65	F	0.5
4	67	M	5
5	65	F	1
6	68	M	3
7	65	M	2
8	65	M	3
9	66	M	2
10	67	M	3
11	65	F	2
12	67	M	3
13	65	M	4
14	65	F	4
15	67	F	2
16	67	F	3
17	68	M	3
18	70	M	5
19	65	M	2
20	70	F	2
Average	66.6	M=12 (60%) F=8 (40%)	2.875

Table 13 Profile of Respondents

4.2.3 Reliability and Validity

In this study, the sample size was determined by saturation. According to Glaser and Strauss (2017), the sample size of a study should be determined at the end of the study, rather than being set at the beginning. Ensuring that the sample size is large enough to cover most of the issues under investigation, but not so large that data becomes repetitive, is crucial (Mason, 2010). Thus, the sample size of this study was determined by the saturation as when little new information was revealed after gathering the fresh data; the author concluded that the saturation point had been achieved.

The credibility of this study was upheld by employing well-established research methods. The research framework, qualitative interview guidance, and interview questions were developed and refined based on earlier research conducted for this study.

Transferability was facilitated by the transparent disclosure of information such as the profiles, number, and location of the participants. In addition, details about the data collection method and the timeline for data collection were disclosed in this thesis to further ensure transferability (Shenton, 2004).

In order to ensure dependability and confirmability, the specifics of the research design, sample size, data collection, and data analysis methods were clearly articulated in this study, allowing readers to thoroughly review the research process (Sandelowski, 1986; Koch, 1994).

4.2.4 Data Analysis

The qualitative research in this study aimed to gain deeper insights into the sustainable consumption of WHT by senior citizens. Attaining an in-depth understanding of the senior citizen demographic was crucial for refining the framework and addressing the research questions. Therefore, it was imperative to conduct qualitative interviews, given that the qualitative approach prioritises comprehension (Ghauri, Grønhaug and Strange, 2020).

Interview recordings were transcribed and translated into English to facilitate a more profound understanding of the data obtained. Coding, a crucial process in qualitative social research data, aids researchers in classifying or categorising individual data points (Babbie, 2004). In this study, the author adhered to the three stages of the coding method proposed by Strauss (1987) and Neuman (2007).

Data collection and analysis procedural

The semi-structured interview process encompasses several research procedures. These include transferring data into a computer, abstracting, configuring, identifying, coding, and emphasising critical themes in responses (Alam, 2020). Audio recording was utilised to document the interviews, with permission to record sought from respondents at the interview's commencement. Once the conversations were systematically gathered and recorded, they were transcribed from Chinese to English. Broad concepts of explanation, accuracy, and actual significance were formulated before data coding. Respondent selection commenced from the initial contact, with interviews initiated upon respondents meeting the screening criteria. The conversations were then transcribed, evaluated, and cross-checked. Following analysis, the data was coded, categorised, and themes were developed. Ultimately, findings and discussions were presented. The data collection and analysis process in this qualitative research is depicted in Figure 10.

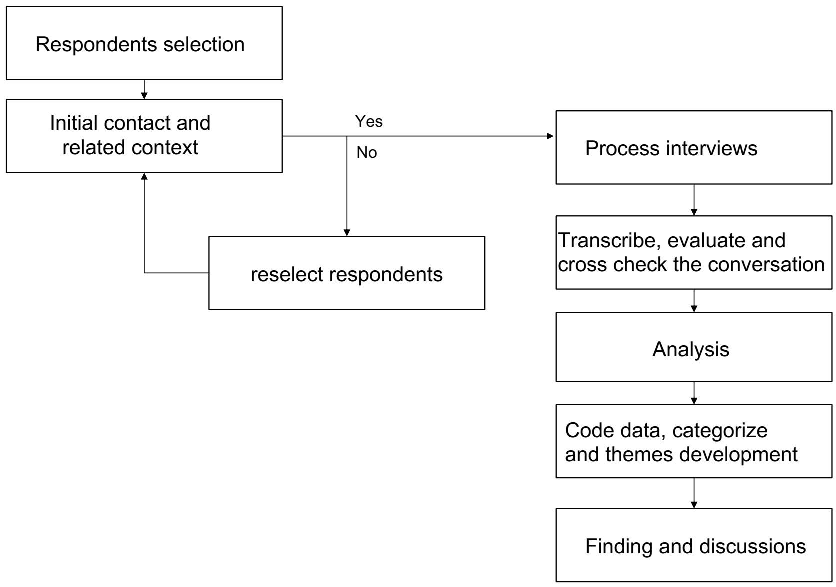


Figure 10 Data Collection and Analysis Process (Adjusted from Alam, 2020)

Data coding is an intermediary process between data collection and analysis (Saldaña, 2021). It should not merely be regarded as a data analysis and interpretation technique, but as a tool that enables researchers to connect data to ideas and relationships within the study, utilising all available data (McEvoy and Richards, 2006). Following the approach to qualitative research analysis proposed by Renner and Taylor-Powell (2003), this study employed three stages in analysing qualitative research data:

1) Interpretation of findings and discussions.
2) Theme creation involves crafting main themes, generating primary codes, capturing codes, developing and refining sub-themes, and grouping sub-themes.
3) Interpretation of findings and discussions.

NVivo QSR 12.0 software was employed to facilitate coding. NVivo is a Qualitative Data Analysis (QDA) computer software package developed by

QSR International (Hilal and Alabri, 2013). It proves advantageous in analysing a substantial amount of textual data in qualitative research. NVivo allows researchers to construct codes, themes, and categories (Joffe and Yardley, 2003) , thereby assisting researchers in understanding research problems (Jackson and Bazeley, 2019). The procedures involved in using the NVivo software program in this study are illustrated in Figure 11.

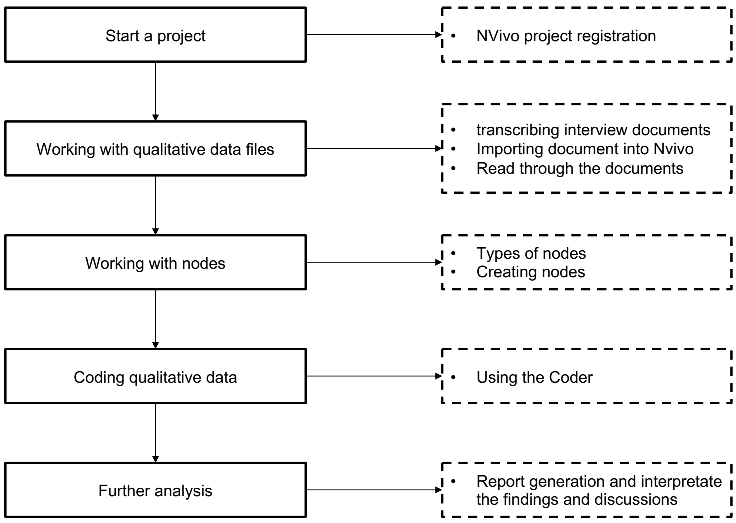


Figure 11 Data Analysis Procedural in Applying Nvivo Software (Adjusted from Jackson and Bazeley, 2019)

NVivo project registration: the first step was to create a project that includes the documents, coding data and associated information that can help researchers investigate.

Working with qualitative data files: the recorded interviews (electronic sound files) had been transcribed and stored in text-based forms. These files were imported into NVivo and read through by the author to understand the documents better.

Working with the nodes: in this study, three main themes named design leadership, technology leadership and brand leadership were set as nodes (main themes) in this study based on the research framework and design of the interview questions. In addition, there are two types of nodes: tree nodes and free nodes (Jackson and Bazeley, 2019). As a semi-structured interview qualitative research, the tree node is appropriate to be adopted to set the main themes in this study. Thus, four sub-nodes in each node were set as sub-themes in this study.

Coding qualitative data: the relevant texts were highlighted as codes to identify the nodes. After coding a chunk of data under the nodes, these codes were categorized into appropriate sub-nodes under the nodes.

Further analysis: in this step, based on the generation report, the codes were utilized to answer the research questions and support the findings in this study.

4.3 Results of Qualitative Research

Coding is seen as an 'integral part of data analysis' (Neuman, 2007, p. 480); the descriptive or inferential data obtained during a study project is given significance by codes, which are tags and labels. (Miles and Huberman, 1994). The coding method has been introduced in the previous section. In the following section, the responses from participants were coded and quoted to produce insights on the sustainable consumption of WHTs. The codebook is shown in Appendix 3 and the nodes compared by the number of coding references is shown in Appendix 4.

4.3.1 Design Leadership

4.3.1.1 Wearability

Wearability offered by WHT represents the most immediate perception for participants. The attribute of being lightweight was consistently highlighted when participants described their WHTs as comfortable. Additionally, waterproofing emerged as another frequently mentioned feature. Given that some participants habitually wear their devices throughout the day, it is pivotal that these devices meet their daily requirements, encompassing activities such as hand washing, household chores, and exercising.

I find it comfortable and wearable; it's great. The strap is waterproof, so I can even wear it in the shower (Participant 1, female).

I am basically satisfied with the wearability. Because this device is lightweight. It will not impact me during the sleep time (Participant 2, female).

Yes, I think it is comfortable. I retired; I do want to hold my smartphone in my hand all the time. The WHT is lightweight and waterproof. If I go swimming, I do not need to take it off. That is really good. (Participant 3, male).

Conversely, the waterproof feature of WHTs also had its downsides in terms of wearability. Specifically, this feature occasionally led to skin irritation on the wrist, particularly during the summer months.

I wear it frequently, but in summer, I feel it is a little bit sweaty to wear it (Participant 4, female).

Not really. The strap is not breathable, it irritates my wrist skin in summer. I prefer to wear it in other seasons, but not in summer (Participant 5, female).

Besides, some WHTs are designed to measure blood pressure. This feature offers added convenience for participants keen on health monitoring. However, the recurrent issue of wrist irritation continues to be a concern for users.

But my WHT strap has an inflatable bladder for measuring blood pressure. So, in summer, I feel a little sweaty wearing it. But it is not a big deal. It is waterproof. What I need to do is just take it off and rinse it with water. It does not take too long (Participant 6, male).

Take this new series as an example, it has the function of measuring blood pressure, but this function is equipped with an inflatable cloth strip, which is a little sweaty to wear in summer. Because it is made of silicone material on the outside and cloth on the inside, it can be replaced if it is broken. However, this cloth strip for measuring blood pressure cannot be felt when wearing it in winter. When the weather becomes hot, it will make me feel stuffy when wearing it or wearing for a long time (Participant 7, female).

Wearability influences the sustained use of WHTs among senior citizens. Superior wearability increases participants' intentions to continue using the devices. However, some participants are only partially tolerant of the discomfort associated with wear, with a few even discontinuing its use altogether.

4.3.1.2 Interaction

The interaction of WHTs in this study will be examined from both hardware and software perspectives. In terms of hardware, battery capacity and screen size emerged as the most frequently mentioned attributes during the interviews. Several participants expressed a desire for WHTs to offer enhanced battery performance and more user-friendly charging methods.

I just think the battery capability needs to be improved. I find it cumbersome to charge every three to five days. It would be better if the

WHT could be charged once a month or half a month (Participant 8, male).

It needs to be charged with a special base. If I travel and forget to bring that base, I cannot charge it and use it. If it can be the same with the smartphone, I mean, can be charged via a cable, it would be better (Participant 9, female).

Several participants expressed satisfaction with the battery capacity of their WHTs, feeling that it adequately met their needs.

Screen size was another frequently discussed point in the realm of hardware. Presbyopia was another key word used by respondents when describing their experience of using WHTs. All the participants in this study are senior citizens; the small screens of commonly available WHTs pose a challenge, making it difficult for those with presbyopia to discern content clearly.

Actually, at my age, presbyopia is a normal thing, so I think the screen size is a little bit small, but it does not matter. I can make the font bigger (Participant 10, female).

The screen size is a little bit small. You know, presbyopia is common in our age group. It is a little bit hard to see the number (monitoring results) clearly without wearing reading glasses. But it is not a big deal as well. Because it is a WHT which should be worn on the wrist, bigger size is maybe more inconvenient for me (Participant 6, female).

For the software aspect of WHTs, interaction always happens in the operation system. The complex operation system of WHTs brought troubles for senior citizens. Age emerges as a pivotal factor in this regard, with many participants expressing their difficulty in navigating WHT operating systems, particularly when compared to younger generations. Furthermore, some functions (i.e., ECG monitor) can only be used when the WHTs are connected to the smartphone. It makes senior citizens abandon the use these more complex functions in favour of some simple and automatic functions (i.e., step account and heart rate monitoring). However, this weak using experience finally led to the misalignment of the purpose of using WHTs for senior citizens to monitor health conditions.

> *I would say I cannot easily understand how to operate the WHT. To be honest, I have some confusions. The WHT has a lot of functions. However, many functions need to be connected to a smartphone before they can be used. It is hard for senior citizens to skilfully use these functions. I know this device can do ECG, but as I said, it is hard to operate (Participant 11, male).*

> *I am old, setting menu is difficult for me (Participant 12, female)*

> *I cannot easily understand how to operate it. I am old, it is hard for me. There are several operations, very complex (Participant 13, female)*

> *For young people, they are more familiar with IT, we are not. Young people can get necessary information about updating system easily, but we cannot. It would be helpful if the WHT could provide reminders, like sending a notification directly through the device, about these updates. The point is many functions cannot be used without upgrading the system (Participant 14, male).*

The same issues also happened to the participants who claimed the operation system was easy and convenient. They believed they could efficiently operate the system and use the WHTs, but nearly all participants did not try all the health-related functions.

I would say basic functions, I can totally understand how to operate it. Complex functions, I do not think I have to use them (Participant 1, female).

I would say that I totally understand how to operate the basic functions. Perhaps, I am too lazy to study other complicated functions. But for me, the basic functions are enough (Participant 10, female).

I think I can easily understand how to operate it. But you know, I am old. It is impossible for me to use every function. So, I just picked some useful functions to use. It is hard to accept all the newest things for people in my age (Participant 3, male).

4.3.1.3 Perceived Ease of Learning and Use

Perceived ease of learning and use have traditionally been regarded as significant barriers for senior citizens in adopting WHTs. However, the participants in this qualitative interview-based research did not report experiencing difficulties related to the perceived ease of learning and using WHTs. On the contrary, participants acknowledged the importance of user manuals and the support received from their families. Some participants received WHTs as gifts from their families, allowing them to benefit from informal training in WHT usage provided by their relatives.

Installation is difficult for me; my daughter helps me in this process. But after that, I think I can use it easily (Participant 12, female).

I think it is easy to learn. I can learn it through reading the manual. It also provides another method of learning. If the WHT is connected with a smartphone via Bluetooth, there is a visual introduction in the related App. I just follow it, everything is done (Participant 6, male).

Moreover, with the proliferation of the Internet and the emergence of short-form video hosting services, it has become increasingly convenient for senior citizens to access information related to learning and using WHTs online.

Besides, if I meet some problems, I will check it online and see some videos to figure out my problem. Reading manual makes me feel tired, I think the video is more visualized. There are many introductory videos online, it can be easily found, so I can easily learn from them and operate my device (Participant 9, female).

In addition, the average age of participants in this interview research is 66.6 years old. Their careers overlap with China's information development stage (Information Office of the State Council of the People's Republic of China, 2010). Thus, using Internet-related technology is not seen as a big challenge for them.

I think this device is easy to learn and use…I did not spend too much time in learning using it. I used to be an accountant; I am familiar with operating computer. So, I think maybe I can learn it faster than other people because of that (Participant 12, female).

I think it is easy to learn. I think if you use a smartphone, then you can use it well. Maybe it would be harder for the people who are around 80, but at my age (65+), nothing is hard (Participant 1, female).

4.3.1.4 Functional Value

The most mentioned functional value in the interviews is health-related benefits. A considerable number of senior citizens grapple with chronic illnesses, and the adoption of WHTs offers them a means to monitor their health status conveniently, anytime and anywhere. Nearly all the participants mentioned that monitoring heart rate was their most frequent and valuable function. The participants with heart disease paid much more attention to this function. It was the primary cue that triggered them to purchase and consume WHTs sustainably. In addition, the outcomes of monitoring health situations (i.e., heart situation and sleep monitoring) and the reminders encourage them to keep using the WHTs.

> *I really love the sleep monitor functions. Every morning, when I wake up, the first thing I want to do is check my sleep score. If I feel bad for my heart, I want to get my heart rate checked right away. These functions make me want to continuously use this device. I feel pity if the device is out of power; because I cannot monitor my sleep and check the score when I get up (Participant 12, female).*

> *I would say I cannot leave it. I have some heart and cardiovascular problems. The heart monitor can help me to check my health situation. Besides, the step counting can help me to check the exercise situation. I check the result (step counting) so that I can know have I met my own standards. If not, I would like to take more walks (Participant 15, female).*

> *In my opinion, the most valuable function is monitoring heart rate. The normal heart rate is around 60. Sometimes, I suddenly feel uncomfortable in my heart, I check it and find my heart rate has reached 80. If the heart rate is around 90, that means I need to take the pills and*

have a rest. If the device can provide more functions in health, I would be happier to purchase and use (Participant 9, female).

I have a favourite function. That function provides me a score of my health. If I get 100 points 7 days in a row, it means I'm healthy. This score will be automatically reset after 7 days, and the calculation will start again. The first thing I do every day when I wake up is to check my sleep monitoring last night. It shows the situations of my light sleep and deep sleep. I like this function (Participant 1, female).

Similarly, the measurement of blood pressure through WHTs garnered significant interest among participants dealing with hypertension. However, for those participants who considered themselves to be in good health, they struggled to perceive the health-related functional benefits offered by WHTs.

I use this device to monitor how much I run, how many calories I burn and what is my heart rate. I focus on these data and functions (Participant 11, male).

To be honest, the most valuable function for me is not a health-related function, because I think I am healthy. I usually use it as a watch. I am healthy, I did not get many alarms on health aspect from WHT, so I am not attracted to health-related functions (Participant 5, female).

4.3.2 Technology Leadership

4.3.2.1 Effectiveness

Accuracy and trustworthiness emerged as paramount considerations when participants expressed their views on the effectiveness of WHTs. Almost all the participants confirmed the accuracy and trustworthiness of WHTs. However, they also highlighted a dilemma inherent to WHTs concerning measurements, as the results obtained can only serve as reference points. For instance, when considering blood pressure measurement, some participants noted the existence of an error gap between WHTs and traditional sphygmomanometers.

> *I do not think its results are in high-level standard. For example, blood pressure monitor, the results are not 100% accurate. There is still a gap between it and a sphygmomanometer. The inaccuracy is caused by device (Participant 7, male).*

> *I think these differences are caused by technology. The current development of electronic devices has not yet reached the level of fully accurate measurement. Besides, there are several factors that will impact the accuracy, such as usage method and using time. There is a gap between professional medical equipment and WHT (Participant 8, male).*

> *It's relatively accurate. I have a blood pressure monitor. I compared the result between it and the WHT. The error is about 5. But I asked my doctor about this issue. The error of the electronic blood pressure monitors and mercury blood pressure monitor is normal within 10. But I think the most important thing is the trend, instead of the specific number. So, I think it is accurate, I can also accept the error (Participant 6, male)*

Several participants displayed a greater inclination toward the WHTs' ability to reflect their genuine health status rather than fixating on precise numerical results. All participants consistently engaged in comparisons of monitoring outcomes between WHTs and professional-grade monitoring equipment. This inclination might stem from their perception of WHTs as supplementary tools, with the primary allure residing in their capacity for real-time health monitoring, as opposed to achieving pinpoint accuracy in measurements.

I think it is trustworthy. But it can only be a reference value, not a standard. Unless you monitor some data at any time, you have to go to the hospital to make this kind of inspection at any time, and you can know whether his data is accurate or not. But sometimes we don't have this condition, but it can be a general feeling or a general reference. But I don't have high blood pressure, so I don't monitor my blood pressure either (Participant 4, female).

I had an ECG test in hospital. Doctor told me I have sinus arrhythmia. This device also told me I have it. This actually surprised me at that time. After that, I think this device is accurate and trustworthy. I also compared the data between the WHT and blood pressure metre. They are similar. So, the technology is amazing; small device, but accurate data (Participant 10, female).

I think it is kind of accurate. But I cannot say it is 100% accurate and trustworthy, because it is worn on the wrist. It is in a reasonable range. For instance, if I ride very fast, the heart rate can reach 110 to 120. The normal heart rate is around 70 to 80. This is indeed within the normal range (Participant 3, male).

Participants expressed a strong preference for comparing results obtained from professional health monitoring equipment with those from WHTs. They firmly believed that the attainment of relatively accurate results played a pivotal role in their ability to effectively monitor their health conditions. Consequently, ensuring a high level of effectiveness becomes imperative in enhancing the overall customer experience for senior citizens using WHTs.

4.3.2.2 Perceived Risk

In this study, perceived risk was categorised into physical risk and data risk. Based on the interviews, the type of data governed the perceived data risk. As WHTs generate health-related data, all participants conveyed a lack of concern regarding the security of this information. Some indicated that their personal health data was of little significance to them. In essence, unlike personal financial information, they believed that a breach of their health data would not pose any tangible risk to them.

> *Personal health data is not that private, I do not really care about it. It does not involve my financial information, so I do not worry about the privacy and risk. (Participant 15, female).*

> *Data privacy, to be honest, in China it is depends on the vendors. If they want to "steal" your data, but there are not some policies to protect these data; worry is meaningless. Actually, it happens all around world, not only in China. The information of national leaders can be leaked.* P*ersonal health data is not that private, I do not really care about it (Participant 4, male).*

> *This data is health information; this information also has little value in confidentiality. It's not a particularly private thing either (Participant 2, male).*

> The reluctant acceptance of reality causes the other ignoration of data risk, as data leakage is normal. Some participants mentioned their experiences of data leakage. *Nowadays, data leakage is too normal, I do not think this data can leak much information. It can not cause any risk if these data are leaked (Participant 14, male).*

Conversely, reassurance from family members, coupled with the trustworthiness of vendors and companies, alleviated participants' concerns regarding data risks.

> *I trust this brand (Participant 8, male).*

> *My confidence in it comes from the vendor. I do really trust in this organisation (Participant 16, male).*

Device-related risks did not particularly concern the participants either; they believed the risk of electromagnetic radiation to be within an acceptable threshold. Furthermore, the reputation of the brand served as a validation of the device's quality.

> *I'm not worried about electrocution (Participant 9, female).*

> *I do not think there is any risk of it. Maybe it has radiation, but I think it is acceptable (Participant 6, male).*

4.3.2.3 Real-time Process

The real-time processing has enhanced the customer experience of using WHTs for participants. The immediacy of results has motivated participants to continue using the devices. Additionally, the instant reminders provided by WHTs have proven beneficial for participants in monitoring their health conditions.

> *Real-time process means a lot for me. As I said, the sleep monitor. When I wake up every day, I want to know my sleep score as soon as possible. If the score is high, I will be very happy. If the score is not high, I will try to adjust it. Good sleep means a healthy body. In addition, the heart rate monitor is another factor that makes me want to continuously use this*

device. As I said, I have a heart problem. If the real-time process of heart rate tells me my heart is in a good situation, I will feel relieved. If I do not know it or I cannot know it, I have to go to the hospital to monitor ECG. The device in the hospital is very heavy and I have to wear it for 24 hours (Participant 12, female).

It helps me identify health issues, which is beneficial for me. If I receive regular health reminders, I would likely use it more often to monitor my health. Such features would encourage long-term use. If this device were to break, I'd be inclined to purchase a new one Participant 2, male).

The real-time processing feature of the WHT is a significant advantage for me. I use it out of necessity to understand my current health situation. I value the immediate results and frequently check them, finding them beneficial (Participant 6, male).

4.3.2.4 AI-based Usage Monitoring

Participants perceived AI-based usage monitoring as a trend in scientific advancement. Some believed that AI, being a manifestation of technological progress, could offer them advantages in usage monitoring. Additionally, AI has the potential to facilitate their ease of use with WHTs.

I'm not opposed to AI; I see it as the future trend. If there are devices with AI-driven usage monitoring or enhanced functions for blood sugar and blood pressure tracking, I'd be inclined to purchase the latest model (Participant 2, female).

I accept this science developing trend, you know, we generation get older and older, our children are not in the same city as us, this type of device should be helpful (Participant 17, female).

Conversely, some interviewees expressed scepticism regarding the capabilities of AI. While open to adopting related functions, they harboured reservations about AI's ability to accurately and comprehensively capture and analyse data.

> *I have mixed feelings about trusting AI. While it offers intelligent analysis, it often provides a general reference rather than a precise evaluation tailored to every individual. If AI were completely accurate, there might not be a need for hospitals (Participant 4, female).*

While participants placed greater trust in recommendations from human physicians regarding their health, they viewed AI-based suggestions more as supplementary references.

> *I trust the doctor more. AI does not have a comprehensive diagnosis for me. I prefer humans to check my health situation (Participant 13, female).*

> *AI is not human. It can just remind people from some aspects. I think it can be seen as a reference (Participant 18, male).*

4.3.3 Brand Leadership

4.3.3.1 Brand attitude

Products from a consistent brand are perceived as more accessible, leading participants to be more inclined to use associated products. For senior citizens, an operating system designed within a familiar framework offers an intuitive means to embrace and integrate new technologies. Additionally, a positive sentiment towards the brand can bolster the company's ability to retain customers, encouraging consistent purchases from the same brand. In contrast, senior citizens often find it challenging to discern the merits among competing products. Hence, a favourable brand attitude serves as an implicit endorsement of product quality.

I think this brand is good. All the products of this brand have good and unified operating systems. They are "humane", clear, simple and useful (Participant 11, male).

My smartphone is also of this brand. It is easier to transfer data between the WHT and smartphone. So far, they work well. They all have their own advantages. But for me, I prefer the products of the same brand when I choose the WHT (Participant 9, female).

I use this brand of mobile phone; I am used to their system. Thus I feel comfortable using this system. I am familiar with this system, so I use it. I think it is a usage habit (Participant 10, female).

Conversely, market size can exert a lateral influence on customers' attitude to a brand. The popularity of a product often signals its quality, as endorsed by a broader customer base. Within this study, participants indicated that their attitudes towards the brand of WHTs were influenced by market size. The consumption patterns and sustained consumption of WHTs associated with a single brand can shape their perceptions of that brand. Moreover, a brand's leadership position in the market lends additional credibility to its WHTs, making them appear more trustworthy.

This brand is good. Because everyone used it, it perhaps means it is a good brand (Participant 19, female).

I do really trust the organization. In my opinion, bigger companies are better and more reliable (Participant 16, female).

I think it is a famous brand all over the world. In contrast, the price of its product is high. This brand is the biggest one within the domestic brands. I think the big brand is more trustworthy (Participant 6, female).

4.3.3.2 Perceived Quality

Analogous to brand attitude, the perceived quality of the product (WHTs) was also validated by market size for participants in this study. Importantly, perceived quality extends beyond just the product to encompass services. After-sales service can enhance senior citizens' confidence in both the brand and its products. The quality of follow-up services can influence the overall user experience. Indeed, the quality of these services can be a determinant affecting the sustained consumption of products among senior citizens.

The quality of service and product are good. My WHT has been used for several years, it still works well (Participant 15, female).

The recognition is relatively high, so many people use it. Perhaps I am already preconceived. I think of this brand when I need to buy a product, and I do not really want to know about other brands (Participant 14, male).

I think the quality of service is very good. This brand has a service where the customers can renew their screen protector in store for free. I might know about and purchase other products during this period. The service attitude is good as well. If the quality of service is not good, I think I may not go to the store again (Participant 9, female).

4.3.3.3 Brand Prestige

Participants in this study viewed brand prestige as a testament to quality and user experience. Similarly, a significant market size suggested that the brand has garnered approval from a majority of customers. Concurrently, high visibility is indicative of elevated brand prestige.

I think this company has good public praise; I have heard quite a lot of good impressions of it from my friends. Besides, nearly all my friends are using products from this brand. I have no specific story I can talk about it, but just because of word of mouths; it makes me trust this brand (Participant 4, female).

It has a good reputation. some of my friends are using the products from this brand, I think it does have a good word of mouth (Participant 11, male).

This company has a good reputation. Nearly all my friends use this brand of products. If it is not good, why do so many people choose it (Participant 12, female)?

Furthermore, the personalities of brand leaders, particularly those of brand founders, play a crucial role in enhancing brand prestige. In an environment where products increasingly become homogenised, the distinctive personas of these leaders can serve as a significant draw for customers. In this research, participants frequently referenced Zhengfei Ren and Wanzhou Meng, the prominent figures of Huawei. They contended that these leaders heightened their awareness of Huawei's brand prestige, guiding their consumption behaviour towards endorsing a domestic brand. Additionally, Huawei's strategic approach amidst the 'Chip War' between the USA and China further solidified this perception for several participants.

I think it has a good reputation. I would say it is the TOP brand in China. I love the spirits and strategies of this brand. It can take precautions *during the 'Chip War' between China and the USA. It has a national spirit, like its slogan, Chinese achievement (Participant 14, female).*

I think this brand has a good reputation. I am Chinese, I love my country, and I support domestic brands. In addition, due to the 'Chip war' and the 'Wanzhou Meng incident', I know much more about this brand. I think several Chinese people know much more about it as well (Participant 18, female).

I would say that the USA helps me to learn more about this brand. Before the 'Chip war', I only knew that Huawei was a mobile phone brand ... Due to the 'Chip War', I know much more about Huawei. Besides, this company has great development, such as designing their own operation system and chips. I think this brand has a great reputation. It has great business, and it is trustworthy. I am Chinese, I want to support a domestic brand. There are several Chinese brands, but few brands can be as excellent as Huawei. This brand figures out some technologic problems for China. In addition, I am also attracted by the founder of this brand. He started from scratch and turned the company into a multinational company with world-leading 5G technology. He is fantastic. If I don't trust such a company, what company should I trust? (Participant 6, male)

4.3.3.4 Customer-oriented Behaviour

Some participants mentioned that their engagement with staff was minimal during both the purchase and post-purchase stages, with family members frequently stepping in to bridge the communication gap. Conversely, those who interacted directly with staff felt that customer-oriented behaviour could shape their inclination towards the sustainable consumption of WHTs.

I do not have too many connections with their staff. Because my daughter bought this device for me. But if the attitude of their staff is not good, I will not want to use their product for long-term and I will not choose this brand if I want to buy new products (Participant 12, female).

Some participants conveyed their inclination towards sustainable consumption, which was influenced by customer-oriented behaviours. Superior service quality would positively shape their emotions and overall customer experiences. Such a positive impression of the brand would subsequently influence their willingness to continue using the WHTs.

Their attitude can certainly impact my long-term adoption. If they have a bad attitude, they also make a mess in my office (another experience of purchasing computer from same brand). Then I will definitely think that their corporate culture will be very poor, and their product quality will not be much better. I would not like to continuously use its products and select this brand anymore (Participant 14, male).

Their service attitude will impact me in the long-term. There are two attractive points for me in adopting its products for the long term, one is scientific technology behind its products, another one is the staff attitude (Participant 11, male).

Their service attitude is excellent. One-to-one service from the moment you walk in. They also provide tea and cakes for free. I will be impacted by their service attitude. The attitude directly affects whether I choose it next time and whether I will keep using this product or not (Participant 9, female).

4.3.3.5 Social Support

Based on the qualitative research, the brand of origin emerged as a significant factor influencing the sustainable consumption of WHTs among senior citizens. This origin offers an intangible user experience from a psychological standpoint. Profound patriotic education, especially prevalent among senior citizens in China, instils the notion that supporting domestic brands is paramount. This evokes a sense of pride in purchasing and using domestic products, further enhancing their consumer experiences fuelled by such emotions. Moreover, the brand of origin often acts as a seal of quality assurance for both products and services, thereby bolstering the confidence of senior citizens in the support these products provide.

> *The incident involving Wanzhou Meng garnered significant attention. She was detained and faced extradition proceedings in Canada. Upon winning her case and returning to China, a large number of Chinese citizens followed her return via live broadcast. In some respects, the attention to her case went beyond her role as a corporate leader, reflecting a form of national sentiment or complex (Participant 9, female).*

> *I am Chinese, I love my country, and I support domestic brands. In addition, due to the 'Chip war' and the 'Wanzhou Meng incident', I know much more about this brand. I think several Chinese people know much more about it as well (Participant 18, male).*

> *Few years ago, some foreign brands were more popular. But within a couple of years, domestic brands have had great development. In my opinion, we should support domestic brands (Participant 6, male).*

From the qualitative research, participants highlighted the pivotal role of facilitative support in bridging the gap between their customer experience of using WHTs and their sustained consumption of these technologies. Several participants recounted challenges in installing and updating the operating system. However, family support enabled them to address these issues, ensuring the continuous, long-term use of the WHTs. Furthermore, while participants voiced concerns regarding monitoring results, viewing them primarily as reference, the actual user experience of WHTs for senior citizens remained unaffected. Nevertheless, there was a clear desire expressed by participants to receive recommendations from qualified physicians to assist in monitoring their health conditions.

> *Setting up and installation are challenging for me, so my daughter assists with that part. However, once it's set up, I find it relatively easy to use. Being older, navigating through settings and menus can be difficult (Participant 12, female).*

> *It has a 'ask doctor' function. But I am healthy, I do not use this function quite frequently. sometimes, I would browse some notices from the doctor. From this aspect, I think talking to a doctor via WHT has some development in China; it is helpful, but I cannot say I am totally trust it (Participant 7, male).*

Chapter 5. Research Model and Hypotheses Formulation

This research model (shown in figure was developed based on the literature review and the exploratory research. The qualitative research underscored the relevance and robustness of this study. Participants emphasised that the sustainable consumption of WHTs significantly benefits their health monitoring and enhances their quality of life. Moreover, the qualitative data procured from this study proves instrumental in refining and evolving the fundamental framework. The qualitative results provided support for the concepts proposed in the original study framework, particularly emphasising significant variables within the realms of design leadership, technology leadership, and brand leadership. In the following section, the impact factors will be discussed.

5.1 Design Leadership

The term 'design' is widely employed across various domains, including product design, fashion design, interaction design, and system design. Design is regarded as the changes based on the user, using context and the direction (to whom or to what) (Gloppen, 2009). It is essential to distinguish between design management and design leadership. Design management is a term that has been adopted to describe what was formerly known as design project management. On the contrary, design leadership concentrates on the organisational aspect. It refers to a higher level of strategic thinking about how design may be employed within an organisation to achieve corporate objectives (Gloppen, 2009). Muenjohn *et al.* (2015) defined design leadership in a specific aspect as a type of leadership that promotes and sustains the development of innovative design solutions. Based on the results of the qualitative study, participants mentioned that WHTs demonstrating design leadership, characterized by a higher level of wearability, thoughtful interactive design, easier operating systems, and valuable functions, would enhance their user experience and promote sustainable consumption of WHT. Thus, in design leadership, it is essential to provide a suitable design solution for seniors to promote and maintain the adoption of WHT. Therefore, this hypothesis is set as:

H1: Design leadership has a positive relationship with the customer experience of using WHT.

A. Wearability

Wearability was introduced by Gemeperle *et al.* (1998) to characterise the extent to which products are tailored to suit the human form. With the development of wearable technology, the current definition of wearability is concentrated on the interaction between the shape of the device and the user's body (Dunne and Smyth, 2007). Dunne, Profita and Zeagler (2014) extend the definition of wearability as the physical ability to mount a device on the body or the physical and mental comfort of the wearer. Overall, a product with high wearability is hoped not aggressively to divert the user's attention away from their task. The issue of low-level wearability, such as discomfort, unsuitable shape, and embarrassment, would reduce the users' acceptance and use intention. Besides, Park and Jayaraman (2009) suggested that users are also concerned about skin irritation or allergies and unwanted radiation or infection when they use wearable healthcare devices. Based on the literature review part, a large number of researchers noted that their participants complained about the low level of WHT. According to the qualitative study, the wearability of WHT is a primary factor in participants' immediate perception of these devices. Participants consistently emphasized the importance of being lightweight for comfort in their WHTs. Similar with findings of previous studies, some participants are only partially tolerant of the discomfort associated with wear. Thus, this hypothesis is set as:

H1a: Wearability has a positive relationship with the customer experience of using WHT.

B. Interactivity

Interactivity is loosely defined and conceptualised differently (Downes & McMillan, 2000; Walther *et al.*, 2005). Scholars tend to define and conceptualise interactivity differently according to their approach. For instance, Bucy (2004) believed that interaction can be found in user perceptions, communication settings, and technology; according to the locus of interactivity, Bucy (2004) defined interactivity as subjective experience, messages exchanged, and/or interface (media) features. In this framework, interactivity is considered differently; based on the function of wearable healthcare, it asks for the ability to provide a range of services with little involvement of user interaction. Participants in qualitative study mentioned that the battery capability, interaction with operation system and connection with smartphone also related to their customer experience and sustainable consumption of WHT. Hence, interactivity in this research is defined as the feedback of information via the interface between customers and wearable devices (Windasari and Lin, 2021).

For the traditional window Icon Menu Pinter metaphor, the primary task is the interaction with the computer. However, the users of wearable technology are frequently distracted by surroundings; this phenomenon asks the design of wearable technology to change the understanding of the operation in a different way (Clarke *et al.*, 2002). Thus, the operation of wearable devices should provide services for the user with little involvement in user interaction. In addition, this limited amount of user participation must be consistent with the user's values, beliefs, and requirements (Meng, Choi and Kim, 2011). To be more specific, the wearable device should also be performed with a minimal cognitive effort of the user, i.e., a simple and intuitive interface (Lukowicz, Kirstein and Tröster, 2004). Thus, this hypothesis is set as:

H1b: Interactivity has a positive relationship with the customer experience of using WHT.

C. Perceived ease of learning & use

In this research, the perceived ease of learning and use is defined as the degree to which a person believes that learning and using a particular system would result in reduced effort. In TAM, perceived ease of use is included as a factor and defined as "*the degree to which a person believes that using a particular system would result in reduced effort*" (Davis, 1989). Perceived ease of use would influence perceived usefulness and intention of use in TAM (Davis, 1985). Perceived ease of learning and use results from the perceived ease of use (Renaud and Van Biljon, 2008). The experimenting and exploration stage directly impacts the ultimate conclusion perceived ease of use; this corresponds to Roger's complexity innovation attribute (Rogers, Singhal and Quinlan, 2014). Seniors often hesitate to accept new technology, whether they believe it is valid or not (Kim *et al.*, 2016). Many senior citizens perceive that it is too difficult to learn new technology, and some of them even suspect their capability to learn new technology. Hence, difficulty in learning to use new technology (Brewster and Dunlop, 2004), as well as fear of failure (Arning and Ziefle, 2007), are determining factors for senior citizens in accepting and adopting new technology. Therefore, the distinction between 'perceived ease of use' and 'perceived ease of learning and use' should arise. For instance, when seniors observe the operational process of new technology is accessible to young people, they might think that this technology is accessible for the young generation, rather than it is easy for them to learn. The 'ease of learning and using' is a concern for senior citizens (Kim and Choudhury, 2020); however, some researchers stated that their participants do not think the WHT is difficult for them. Participants in qualitative study shared similar opinion about perceived ease of learning and use of WHT. Therefore, it is essential to investigate the relationship between perceived ease of use and learning and customer experience. Thus, this hypothesis is set as:

H1c: Perceived ease of learning & use has a positive relationship with the customer experience of using WHT.

D. Functional value

Functional value is one of the critical determinants of customer purchase behaviour. It refers to the perceived ability of a product or service to have a functional, practical or physical purpose (Sheth, Newman and Gross, 1991). For the customer, the functional value is seen as a technique for determining the degree of physical activity and a tool for raising it (Paluch and Tuzovic, 2019). Functional value is based on the accuracy and reliability of wearable healthcare devices. These premises make customers believe that adopting wearable healthcare devices can help them to keep healthy and improve their quality of life. In summary, the existence of functional value depends on whether the product can realise the benefits that customers expect from it (Dastan, 2016). Based on findings from the qualitative study, a significant number of participants indicated that the valuable functions of WHTs are a major factor in their sustained use. For some, certain functions have become essential daily tasks, further embedding these devices into their routine. Thus, this hypothesis is set as:

H1d: Functional value has a positive relationship with the customer experience of using WHT.

5.2 Technology Leadership

Technology leadership aims to develop, direct, manage, and apply information technology (IT) in organisational procedures as a 'functionally oriented' leadership paradigm (Dexter, 2011). This term is frequently utilised in education research (e.g., Flanagan and Jacobsen, 2003; Anderson and Dexter, 2005). They discussed the method of IT integrated with education and the role of technology leadership. Similarly, with the high-speed development of IT, more technologies have been utilised in WHT. Understanding customers' viewpoints on technology and thoroughly investigating its efficacy in augmenting their overall experience is paramount. Participants in the qualitative study emphasized that technological advancements have not only markedly improved their customer experience but have also substantially alleviated the complexities associated with managing their health conditions. These insights highlight the transformative impact of technology in both enhancing user engagement and offering significant relief in the day-to-day management of personal health, thereby underscoring the critical role of innovative solutions in the realm of healthcare. Thus, this hypothesis is set as:

H2: Technology leadership has a positive relationship with the customer experience of using WHT.

A. Effectiveness

For WHT, effectiveness refers to the ability to obtain data that can provide reliable and acceptable quality and accuracy as that obtained by a regular healthcare system (adjusted from Park and Jayaraman, 2009). WHT is adopted in a real-life context; systems may experience a variety of unexpected issues, such as high bio-signals noise, measurement errors and weak contact of the sensor with skin (Meng, Choi and Kim, 2011). However, the accuracy and reliability of WHT are concerns for customers when they adopt it (Shin *et al.*, 2019; Sprogis, Currey and Considine, 2019; Wulfovich *et al.*, 2019; Hathaliya and Tanwar, 2020). From the qualitative study, it emerged that participants initially had reservations about the effectiveness of WHT. The majority of them indicated that they had actively compared the measurements from their WHTs with the outcomes from conventional healthcare measurement tools. This behavior underscores the significance of the effectiveness of WHT in enhancing the customer experience, emphasizing the critical role of high-level technology leadership in building trust and reliability in these innovative health solutions. Thus, this hypothesis is set as:

H2a: Effectiveness has a positive relationship with the customer experience of using WHT.

B. Perceived risk

Senior citizens have not widely accepted WHT. One of the concerns for senior citizens is Perceived risk (J. Li *et al.*, 2019). The perceived risk is defined as the degree to which users believe the technology may bring unanticipated risks, such as safety risks, functionality risks, and privacy violations (Chatterjee and Price, 2009). Some participants of qualitative study expressed their concern about personal financial information. Generally, senior citizens' concern of perceived risk is that WHT will not function as expected. However, senior citizens might also consider the more profound perceived risk (Marakhimov and Joo, 2017). Specifically, when utilising WHT, senior citizens might also worry about potential hazards such as radiation exposure, electric shocks, or invasive features (Valdastri *et al.*, 2004; J. Li *et al.*, 2019). Besides, what cannot be ignored is the concern of senior citizens about the safety risks caused by perceived risks. The feedback from the qualitative study participants suggests a nuanced view of WHTs. While there were some shared concerns about the effectiveness of these devices, there was also a prevailing sentiment that products demonstrating technology leadership are likely to meet a high standard in safety requirements. This indicates a belief among users that technological advancement and leadership in the field could be synonymous with enhanced safety and reliability in WHTs. Thus, this hypothesis is set as:

H2b: Perceived risk has a negative relationship with the customer experience of using WHT.

C. Real-time process

Real-time process refers to the ability to transmit and process the obtained data in real-time (Meng, Choi and Kim, 2011). There are a variety of benefits of real-time transmission and processing of the data obtained by WHT, and it can promote the customer's acceptance. Compared with the traditional method (monitored by professionals), this concise and efficient method can directly provide the monitoring results for senior citizens. Besides, the transmission of obtained data to physicians or hospitals can ensure the security and safety of data (Meng, Choi and Kim, 2011). It may provide senior citizens with a better customer experience than traditional healthcare technology. In the qualitative study, participants offered real-life examples showing that real-time notifications from their devices significantly enhance their customer experience. The prompt alerts serve as appropriate reminders, contributing to the establishment of better healthcare management habits for the users. Thus, this hypothesis is set as:

H2c: Real-time process has a positive relationship with the customer experience of using WHT.

D. Artificial intelligence (AI) based usage monitoring

AI presents a tremendous potential ability to analyse skin lesions, pathology slides, and electrocardiograms (Lakhani and Sundaram, 2017; Haenssle *et al.*, 2018; Topol, 2019). In treatment strategies for sepsis in intensive care, AI outperforms better than humans (Komorowski *et al.*, 2018). The responses provided by chatbots were preferable to those given by physicians, as they were consistently rated higher in terms of quality and empathy (Ayers *et al.*, 2023). However, the success of such therapies outside of hospitals in the real world is still uncertain and will be determined by patients' engagement, uptake, and adherence to these interventions (Tran, Riveros and Ravaud, 2019). AI-based usage monitoring refers to the technology which combines AI and wearable biometric monitoring devices to benefit in informing diagnosis, predicting patient outcomes, and better treatment (Hinton, 2018; Komorowski *et al.*, 2018; Fagherazzi and Ravaud, 2019; Tran, Riveros and Ravaud, 2019). During the qualitative study, participants expressed a common concern. The majority acknowledged the potential benefits of AI in managing their health, yet they also indicated a reluctance to rely on it completely, suggesting a measured trust in the technology. Based on the current dilemma, it is essential to understand the view of AI-based usage monitoring of WHT to investigate if the involvement of AI can improve the customer experience and adopt the AI-enabled WHT. Thus, this hypothesis is set as:

H2d: AI-based usage monitoring has a positive relationship with the customer experience of using WHT.

5.3 Brand Leadership

A services brand is vitally a guarantee of the nature of a future experience with a service provided by an organisation (Berry and Seltman, 2007). On the contrary, the customer experience with the organisation also promotes brand awareness and meaning (Berry, 2000). Customer experience within an organisation refers to the cumulative experience interactive between the customer and the organisation. Non-customers would build their impression through the organisation and word-of-mouth. Generally, brand leadership is defined as the ongoing process by which a brand achieves excellence (Aaker, 1996). In the past 20 years, its definition has gradually developed to include the ability to increase organisational competitiveness (Gehlhar *et al.*, 2009), influence customer purchasing decision making (Keller, 2012) and achieve success (Aaker and Joachimsthaler, 2000).

The Theory of Planned Behaviour (TPB) suggests that behaviour is driven by intentions, which are in turn influenced by attitudes towards the behaviour, subjective norms, and perceived behavioural control (Bosnjak *et al*., 2020). Attitude towards the Behaviour involves how favourably or unfavourably consumers feel about adopting new technologies (Ajzen, 2020). Brand leadership can significantly influence this attitude. A brand perceived as a leader in innovation and quality can foster positive attitudes towards the technology it offers. Consumers might associate the brand's products with high standards, reliability, and prestige, making them more inclined to adopt the technology. Subjective Norms are the perceived social pressures to perform or not perform the behaviour (Ajzen, 2020). Consumption sustainability plays a role here. As societal awareness of environmental issues increases, consumers may feel a social pressure to adopt technologies that are more sustainable. Brands that emphasize their commitment to sustainability can influence these norms, pushing consumers towards technologies that are seen as more eco-friendly or responsible. Perceived Behavioural Control refers to the perceived ease or difficulty of performing the behaviour (Ajzen, 2020). It is influenced by past experience and anticipated obstacles. Both brand leadership and consumption sustainability can impact this. A leading brand might be perceived as offering more user-friendly, accessible technology, thereby increasing perceived behavioural control. Similarly, if sustainable technology is seen as more accessible or comparable in cost and functionality to less sustainable options, it can increase the consumer's perceived control over adopting such technologies.

For the healthcare industry, brand leadership is one of the vital competencies. Different from other services, healthcare is a service that is highly individualised; brands for healthcare services can infuse unique meaning to customers. Besides, brand leadership plays an integral role in the healthcare organisation; due to the particularity of the doctor-patient relationship, the buyer entirely surrenders to the vendor (Berry and Bendapudi, 2007). As a result, healthcare providers with brand leadership will promote customer trust in intangible performance (Beckham, 2000; Berry, 2000). In summary, customer experience and brand leadership are mutually reinforcing. Organisations with brand leadership make customers get the guarantee that these organisations can provide excellent services and a good customer experience for them. The customers who obtain high-quality services and customer experience would trust the brand leadership of the organisation more. Thus, this hypothesis is set as:

H3: Brand leadership has a positive relationship with the customer experience of using WHT.

A. Brand attitude

The brand attitude is defined as an affective reaction to a brand; this attitude could be positive or negative (Burton *et al.*, 1998). When individuals hold a positive attitude toward an entity, they tend to trust this entity and the performance of their service (Rotter, 1980; Kemp, Jillapalli and Becerra, 2014). It is worth noticing that the attitude is not only caused by the functions of products, but also by the experience and symbolic performances of the brand (Brakus, Schmitt and Zarantonello, 2009). As mentioned by senior citizens in qualitative study, an operating system that is designed within a recognizable and familiar framework can provide an intuitive pathway to adopting and incorporating new technologies into their lives. Furthermore, favourable perceptions of a brand can strengthen the company's customer retention, fostering brand loyalty and encouraging repeat purchases. Thus, this hypothesis is set as:

H3a: Brand attitude has a positive relationship with the customer experience of using WHT.

B. Perceived quality

Perceived quality refers to a consumer's subjective assessment of the overall excellence of a product when referring to competing products (Zeithaml, 1988). The definition of perceived service quality is similar to perceived quality as a customer's assessment or impression of an entity's overall superiority or excellence (Bitner and Hubbert, 1994). A high level of perceived quality will improve the customer's trust in the brand (Netemeyer *et al.*, 2004). However, in the healthcare industry, it is difficult for the customer to accurately assess service quality. Consequently, 'functional' quality typically emerges as the primary quality dimension assessed by customers (Babakus *et al.*, 1991). According to the result of qualitative study, perceived quality is not limited to the product itself but also includes the services associated with it. For senior citizens, after-sales service is critical in reinforcing their trust in a brand and its offerings. The calibre of customer support and follow-up services significantly impacts the overall user experience. In fact, the quality of these services can be a key factor influencing the long-term adoption and continuous use of products within this demographic. Thus, this hypothesis is set as: perceived quality has a positive relationship with the customer experience of using WHT.

H3b: Perceived quality has a positive relationship with the customer experience of using WHT.

C. Brand prestige

Brand prestige is defined as a brand's high-status positioning (EM Steenkamp, Batra and Alden, 2003). The core criteria for creating a high-status positioning for a brand are the unique competency, quality and performance of a product or service (Lichtenstein, Ridgway and Netemeyer, 1993). In addition, when the product includes services, brand prestige and reputation are essential. This is often due to the absence of readily evaluable search attributes within the product (Herbig and Milewicz, 1995). Additionally, customers may be inclined to perceive brands with elevated prestige and a strong reputation as more dependable and credible (EM Steenkamp, Batra and Alden, 2003). This represents another facet of customer assurance, as offerings from esteemed organisations are often presumed to exhibit commendable performance. Study participants regarded brand prestige as an indication of quality and a superior user experience. Likewise, a sizable market presence was perceived as evidence that the brand has earned widespread customer endorsement. Additionally, prominent brand visibility was seen as a marker of enhanced brand prestige. Thus, this hypothesis is set as:

H3c: Brand prestige has a positive relationship with the customer experience of using WHT.

D. Customer-oriented behaviour

Customer-oriented behaviour refers to the behaviour oriented by a set of beliefs that prioritises the customer's needs. In service organisations, employees play a pivotal role in shaping and reinforcing the brand's significance and credibility (Berry, 2000). Hence, the manifestation of customer-oriented behaviour by employees is of considerable importance to organisations (Kim *et al.*, 2004). Besides, the emotions of employees, especially those on the service frontline, play a vital role in enhancing the customer experience. Such employees often serve as the primary point of contact, transmitting their attitudes and sentiments to consumers (Umasuthan, Park and Ryu, 2017). Several participants noted that their interaction with staff was limited during the purchasing process and after the sale, often relying on family members to facilitate communication. On the other hand, participants who had direct interactions with staff reported that customer-focused service played a role in influencing their willingness to continue using WHT over time. This difference therefore needs to be examined, and this hypothesis is set as:

H3d: Customer-oriented behaviour has a positive relationship with the customer experience of using WHT.

E. Brand of origin

The brand of origin refers to "*as the place, region or country to which the brand is perceived to belong by its target consumers*" (Thakor, 1996, p. 27). Brand of origin offers an intangible, psychological dimension to the customer experience of using WHTs. Profound patriotic education, particularly prevalent among senior citizens in China, instils the idea that supporting domestic brands is of significant importance. This engenders a sense of pride in purchasing and utilising domestic products, enhancing their consumer experiences anchored by this sentiment. For a significant number of participants, this particular component offered reassurance, enhancing their level of confidence in achieving a favourable user experience using WHTs. A notable sentiment was the participants' inclination to endorse domestic brands, deriving a sense of satisfaction from this act. Consequently, this hypothesis is set as:

H3e: Brand of origin has a positive relationship with the customer experience of using WHT.

5.4 Customer Experience

Due to the operation of WHT, the primary support provided by related organizations and firms is through the phone or the Internet. Therefore, in this research, the author selected the concept of online customer experience as the foundation to formulate the hypothesis concerning customer experience and sustainable consumption.

The customer experience is shaped when interacting with the organization (Carbone and Haeckel, 1994). They defined the customer experience as "*the take-away impression formed by people's encounter with products, services and businesses*" (Carbone and Haeckel, 1994, p. 9). This 'take-away' impression is a perception left in customers' minds after interacting with products, environment and staff rather than a response expressed by the customer (Rose, Hair and Clark, 2011). It is essential to distinguish between customer experience and customer satisfaction. Customer satisfaction should measure "*the culmination of a series of customer experiences or, one could say, the net result of the good ones minus the bad ones*" (Meyer and Schwager, 2007, p. 2).

In addition, a satisfied customer experience will lead to the re-purchase intention in the online customer experience framework(Rose, Hair and Clark, 2011). Based on the online customer experience framework (Rose, Hair and Clark, 2011), sustainable consumption can be seen as a 're-purchase' behaviour in this research. Participants shared the view that an enhanced customer experience would bolster their intention to use WHT over the long term. Thus, this hypothesis is set as:

H4: Customer experience has a positive relationship with sustainable consumption of using WHT.

5.5 Moderators

A moderator effect occurs when a third independent variable changes the connection between two dependent and independent variables. The connection between the dependent and independent variables can be altered by a moderator.

5.5.1 Moderators at Customer Level

A. Efficacy of self-health management

Self-efficacy is a crucial concept of the Social Cognitive Theory, and it is widely investigated in social behaviour science (Bandura, 2005). Self-efficacy refers to "person's *perception or belief of their ability to perform a certain behaviour or control a certain situation*" (Xie, Yadav and Jo, 2021, p. 331). Self-efficacy is widely accepted as a moderator of changing health behaviour (Strecher *et al.*, 1986; RGN and RGN, 2002). Efficacy of self-health management can be seen as a belief or confidence in one's own competence to plan and implement activities to preserve and manage one's health and sickness (Xie, Yadav and Jo, 2021, p. 331). However, senior citizens are regarded as lacking self-efficacy in adopting new technology (Kim and Choudhury, 2020). There is less research that utilized 'senior citizen's efficacy of self-health management' as a moderator when a senior citizen has understood the usage of WHT. This was also found in qualitative research, while senior citizens can personalize and self-monitor their physical condition through the adoption of healthcare wearables, whether they are competent to utilize the obtained information and long-term adopt the WHT still needs to be investigated. Thus, this hypothesis is set as:

Ha: The efficacy of self-health management has a positive impact on the relationship between customer experience and sustainable consumption of using WHT by senior citizens.

B. Perceived vulnerability & C. perceived severity

Perceived vulnerability refers to the perception that one's health is threatened (Johnston and Warkentin, 2010). When a person perceives a high likelihood of a threat to their health, that person adopts new health information technologies to reduce or avoid the threat. (Prentice-Dunn and Rogers, 1986). In the WHT research field, perceived severity is the judgement of an individual's perceived health risk if they do not adopt WHT (Johnston and Warkentin, 2010). Several studies noted that users tend to assume WHT when the threat to their health is severe (Sun *et al.*, 2013; Gao, Li and Luo, 2015). Gao, Li and Luo (2015) claimed that perceived vulnerability and severity would impact a user's attitude toward adopting WHT. Almost all participants indicated that their initial motivation for using WHT stemmed from concerns about their personal health conditions. Thus, these hypotheses are set:

Hb: Perceived vulnerability has a positive impact on the relationship between customer experience and sustainable consumption of using WHT by senior citizens.

Hc: Perceived severity has a positive impact on the relationship between customer experience and sustainable consumption of using WHT by senior citizens.

F. Facilitating support

The definition of facilitating support in this framework is based on Plumridge *et al*. (2012)'s definition, described as individuals capable of offering pertinent information, advice, and guidance. There is a large number of senior citizens acquire their WHTs through family members rather than selecting them independently (Chu, Chen and Wang, 2019). Hence, it becomes imperative for families and other relevant individuals to assist seniors in comprehending the 'terms' associated with using WHTs (Peng *et al*., 2016). Engaging with these individuals also proves advantageous for senior citizens in heightening their health awareness, subsequently fostering long-term adoption of WHTs (Peng *et al*., 2016). Senior citizens frequently encounter challenges in system operation and updates, and this facilitative support proves invaluable in addressing these issues, ensuring the sustained use of WHTs. Thus, this hypothesis is set as:

Hf: Facilitating support has a positive impact on the relationship between customer experience and sustainable consumption of WHT by senior citizens.

5.5.2 Moderators at Corporate Level

D. Government regulation policy

WHT pertains to the collection, processing, storage, and dissemination of vast quantities of data, including cloud-based data accessible by third-party organisations (Escobar-Linero *et al.*, 2023). It is important to note that the paramount challenge lies in safeguarding data privacy (Kapoor *et al.*, 2020). Given the sensitive and confidential nature of personal healthcare data, it is crucial for all stakeholders, including users, vendors, and relevant departments, to strike a balance between the benefits of WHT and the ethical management of personal healthcare data (Bouderhem, 2023).

Several studies have pointed to the importance of government regulatory policy in the adoption of WHT. Li *et al.* (2014) stated that while a wearable device acts as a data collector, medical professionals should dispense medical decisions and treatments, irrespective of the circumstances. Therefore, the government or related organizations should publish the related policy and industry standard of wearable devices to make devices that can provide necessary data and contribute to improving the effectiveness of medical activities(Sun *et al.*, 2016). Banerjee, Hemphill and Longstreet (2018) recommended that the government should create a 'watchdog' unit to identify and monitor types of new data which can be caught via wearable technology. Participants in qualitative study conveyed that if data security is assured and there is financial support for the use of WHT, such as coverage under national insurance, they are more likely to use WHT for the long term. However, the qualitative study in this thesis revealed a stark reality: senior citizens exhibit a lack of awareness regarding the protection of their privacy. Some participants did not perceive personal health data as private, reasoning that it is associated with their financial information, thereby demonstrating a disconcerting leniency towards their health data. Additionally, participants articulated a sense of pessimism and helplessness concerning privacy, stemming from widespread personal information leaks (e.g., home addresses, private phone numbers). The prevalence of fraudulent calls has eroded these participants' confidence, leading them to abandon efforts to protect their personal data. This has resulted in the relinquishment of certain internet-reliant features for personal information security, as highlighted by participants. Consequently, the abandonment of these advanced functions has rendered long-term WHT adoption less appealing to senior citizens. Therefore, the importance of governmental regulatory policies should be emphasised and investigated to determine whether authoritative governmental interventions can continually enhance user trust in the protected use of WHT, thereby increasing the intention for sustainable consumption. Furthermore, beyond protecting users, the sustainable use of these devices also contributes to achieving net-zero goals and environmental protection.

Thus, this hypothesis is set as:

Hd: Government regulation policy has a positive impact on the relationship between customer experience and sustainable consumption of using WHT by senior citizens.

E. Disclosure policy

In the realm of corporate strategy, the implementation of transparent and responsible disclosure policies is paramount in shaping a positive corporate image (Platonova *et al.*, 2018). Such strategies not only enhance public perception of the company and its offerings but also cultivate long-term cooperation based on trust in its products and services. For senior citizens, in particular, the demonstration of corporate responsibility assumes heightened significance due to their generally limited familiarity with WHT.

The qualitative study in this thesis sheds light on this perspective, revealing that senior citizens place considerable value on a brand's proactive approach to managing negative information. This stance, characterized by courageous and positive responses to adverse situations, significantly bolsters their trust in the enterprise and its products. Additionally, the disclosure of salaries for high-tech talent within these companies has been noted to further reinforce senior citizens' perceptions of the company’s research prowess and product superiority, thereby enhancing their long-term usage intentions.

The detrimental effects of negative information on a company's reputation and market share have been well-documented (Wrigley, Salmon and Park, 2003). Adverse events such as product failures, negative rumours, and unethical behaviour negatively impact both the company’s standing and the public's behaviour towards it (Cialdini and James, 2009). Conversely, Fennis and Stroebe (2014) posit that a transparent self-disclosure policy positively influences consumer choice behaviour. Participants in the study also noted that a company's forthright handling of issues and transparent communication with the public, without any attempt at concealment, significantly boosts their comfort and trust in the product. This, in turn, fosters a long-term usage intention.

Interestingly, Fennis and Stroebe (2014) also observed that the disclosure policies of companies already enjoying a positive reputation do not adversely affect customer perceptions. Building on these insights, this hypothesis is set as:

He: Disclosure policy has a positive impact on the relationship between customer experience and sustainable consumption of using WHT by senior citizens.

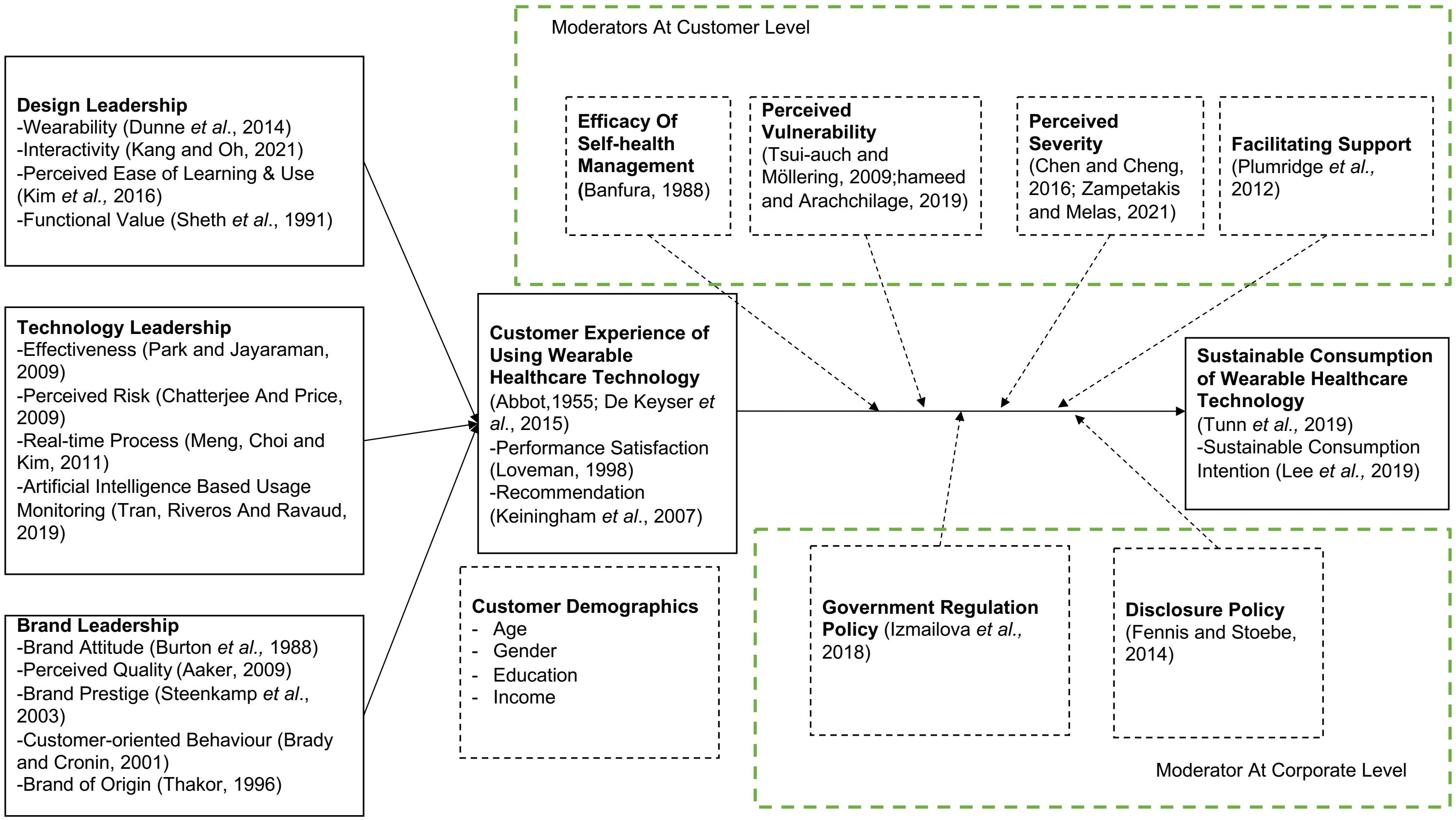


Figure 12 Framework of Sustainable Consumption of WHT for Senior Citizens

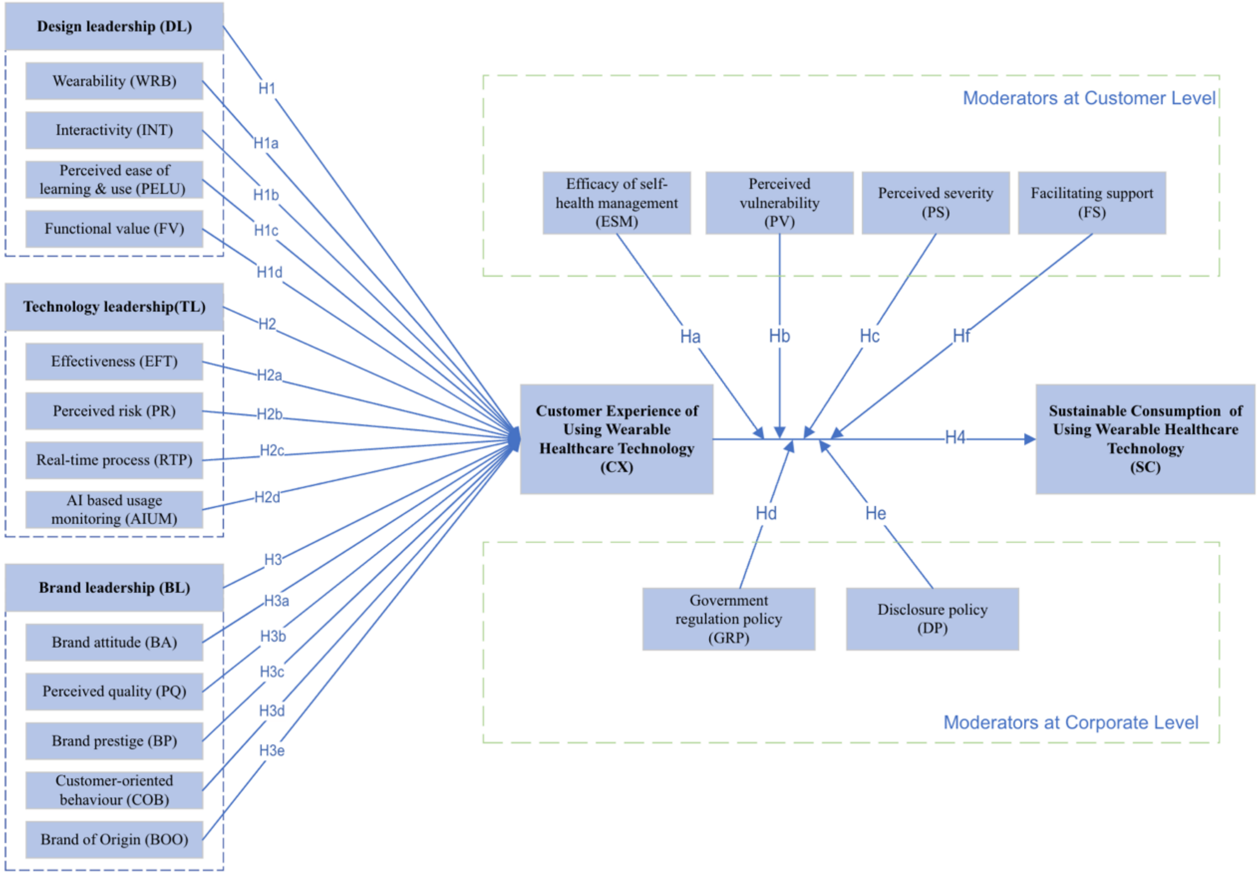


Figure 13 Framework with Hypotheses

In summary, all the tested hypotheses are:

H1: Design leadership has a positive relationship with the customer experience of using WHT.

H1a: Wearability has a positive relationship with the customer experience of using WHT.

H1b: Interactivity has a positive relationship with the customer experience of using WHT.

H1c: Perceived ease of learning and use has a positive relationship with the customer experience of using WHT.

H1d: Functional value has a positive relationship with the customer experience of using WHT.

H2: Technology leadership has a positive relationship with the customer experience of using WHT.

H2a: Effectiveness has a positive relationship with the customer experience of using WHT.

H2b: Perceived risk has a negative relationship with the customer experience of using WHT.

H2c: Real-time process has a positive relationship with the customer experience of using WHT.

H2d: AI-based usage monitoring has a positive relationship with the customer experience of using WHT.

H3: Brand leadership has a positive relationship with the customer experience of using WHT.

H3a: Brand attitude has a positive relationship with the customer experience of using WHT.

H3b: Perceived quality has a positive relationship with the customer experience of using WHT.

H3c: Brand prestige has a positive relationship with the customer experience of using WHT.

H3d: Customer-oriented behaviour has a positive relationship with the customer experience of using WHT.

H3e: Brand of origin has a positive relationship with the customer experience of using WHT.

H4: Customer experience has a positive relationship with sustainable consumption of WHT.

Ha: The efficacy of self-health management has a positive impact on the relationship between customer experience of using WHT and sustainable consumption of WHT by senior citizens.

Hb: Perceived vulnerability has a positive impact on the relationship between customer experience and sustainable consumption of WHT by senior citizens.

Hc: Perceived severity has a positive impact on the relationship between customer experience and sustainable consumption of WHT by senior citizens.

Hd: Government regulation policy has a positive impact on the relationship between customer experience and sustainable consumption of WHT by senior citizens.

He: Disclosure policy has a positive impact on the relationship between customer experience and sustainable consumption of WHT by senior citizens.

Hf: Facilitating support has a positive impact on the relationship between customer experience and sustainable consumption of WHT by senior citizens.

Chapter 6. Quantitative Study and Results

This chapter presents an analytical approach to assess and gauge the validity, reliability, and relevance of the research framework utilised in this study. The chapter is divided into six sections. Section 6.1 and Section 6.2 outline the objectives and methodology of the quantitative research, respectively. Section 6.3 explains the quantitative pilot test, including the questionnaire translation, demographic profile, and measurement validation. The pilot study aided in assessing the reliability and validity of the scales used, paving the way for the development of the final questionnaire employed in the main survey. Section 6.4 details the data screening process in the main survey, delineating the methods used to identify and eliminate missing values and outliers, assess multicollinearity, and evaluate factor loadings. Section 6.5 presents the outcomes of the main survey data analysis, encompassing demographic information, reliability and validity measurements, results of the structural model, and the explanation of moderation. Finally, Section 6.6 provides a conclusion for this chapter.

6.1 Objective

Quantitative research aims to evaluate and measure the hypotheses within the framework of sustainable consumption of WHT for senior citizens in China. The study intends to understand the characteristics, intentions, and behaviours of this population through a representative sample, thereby generalising the findings (Babbie, 2004). Specifically, in this context, inferences can be made regarding the factors influencing sustainable consumption behavioural intentions.

6.2 Methodology

While qualitative research often faces criticism for being susceptible to subjective influence introduced by the researchers, quantitative research is considered a potential countermeasure against such influence (Neuman, 2007). Moreover, quantitative research can expedite data collection and analysis, yielding more accurate measurements of variables (Neuman, 2007). With the aid of computer software, quantitative research can process vast amounts of data collected from large sample sizes (Payne and Williams, 2011). Nevertheless, quantitative research also has its limitations. These include the inability to adequately explain unmeasurable social phenomena, potential bias in assumptions about the objectivity of social entities, inadequate attention to subjective human experiences and interactions with social entities, an inability to encompass all the relevant factors that affect social phenomena, and a lack of comprehensive understanding of social phenomena unveiled in the findings, often due to constraints imposed by various factors (Neuman, 2007).

Therefore, this study utilised a mixed-method approach to analyse the sustainable consumption of WHT for senior citizens, striving to balance the limitations of both qualitative and quantitative research. Quantitative methods can produce reliable findings based on measurable data and instruments, offering valuable numerical evidence for researchers seeking to understand and improve the subject under study (Payne and Williams, 2011). In this study, quantitative research lends reliability to the findings. It enables generalisability, facilitating a more in-depth understanding of the factors impacting sustainable consumption of WHT among senior citizens in China.

6.2.1 Population and Sampling

The population in this study is defined as *"the entire group of people, events, or things of interest that the researcher wishes to investigate"* (Sekaran and Bougie, 2016, p. 236). In contrast, a sample is a selected subset of this population (Sekaran and Bougie, 2016). According to Bryman *et al*. (2007), researchers select a specific number of samples from the entire population and use these samples to draw conclusions that can be applied to the larger population (Bell, Bryman and Harley, 2022). The target population of this study consists of Chinese senior citizens who have previously consumed WHT, encompassing both current and former users. The study's sample was restricted to individuals who have used WHT and voluntarily responded to the survey questionnaires.

Two sampling methods are commonly used in social science research: probability sampling and non-probability sampling. Probability sampling involves selecting samples where each case's likelihood of being chosen from the larger population is known and never zero (Saunders *et al.*, 2015). Conversely, non-probability sampling involves selecting samples with unknown probability of each chosen case (Saunders *et al.*, 2015). In contrast to non-probability sampling, probability sampling requires more significant resources as it involves selecting participants randomly from the entire population. Therefore, probability samples are considered to be more representative compared to non-probability samples (Doherty, 1994).

Due to its cost and time efficiency compared to probability sampling, this study utilised a non-probability sampling method. Furthermore, the large population size made probability sampling impractical, particularly when considering the logistical difficulties in reaching the senior citizen population in China. Hence, non-probability sampling was chosen to address this challenge.

6.2.2 Instrument Development

For a research study to achieve its goals, it is crucial to use an instrument that is accurate, complete, and relevant (Sekaran and Bougie, 2016). To ensure content validity, the survey instrument in this study was developed based on existing literature. The measurement of indicators for constructs in this study is shown in Table 14. In the construct of design leadership, the scale items were adapted from various sources (Davis, 1989; McNamara *et al.*, 2016; Yang *et al.*, 2016; Ryan, Edney and Maher, 2019; Jeng, Pai and Yeh, 2022). The scale items for the technology leadership constructs are successively adapted from Marakhimov and Joo (2017), Talukder *et al.* (2020), Jeng, Pai and Yeh (2022), and Tran, Riveros and Ravaud (2019). The scale items for the brand leadership constructs are successively adapted from Venkatesh *et al.* (2003), Talukder *et al.* (2020), Kim *et al.* (2019), Kemp, Jillapalli and Becerra (2014), and Götze and Brunner (2020). The scale items for the customer experience of using WHT constructs are successively adapted from Rahman *et al.* (2022). The scale items for the moderators are successively adapted from Sun *et al.* (2013), Chu, Chen and Wang (2019), Beh *et al.* (2021), Peng *et al.* (2022), and Fennis and Stroebe (2014). In the construct of sustainable consumption of WHT, the scale items are successively adapted from Windasari, Lin and Kato-Lin (2021), and Lee and Lee (2020).

All measurement items in this study were previously validated in earlier research and were slightly modified to fit the specific context of sustainable consumption of WHT. In addition, a pilot study was conducted to test the validity and reliability of the measuring instruments that will be used to test the hypotheses in this research.

6.2.3 Scale Used

This research employed a seven-point Likert scale to measure each item, with responses ranging from 1 (strongly disagree) to 7 (strongly agree). The Likert scale was chosen for its popularity, simplicity, and practicality, as researchers commonly use it for data collection (Viswanathan, Sudman and Johnson, 2004). Additionally, a significant body of literature in the IS research field supports the use of this scale (Venkatesh *et al.*, 2003; Venkatesh, Thong and Xu, 2012; Vanapalli *et al.*, 2021). Demographic information was also collected through nominal scales, including factors such as gender, age, education, occupation, and income (See Appendix 6 and Appendix 7).

6.2.4 Data Collection

A questionnaire survey is a research methodology utilised for data collection, involving the use of a predetermined set of questions designed to provide relevant evidence in relation to the study objectives (Del Greco and Walop, 1987). It is an effective and cost-efficient method for accurately measuring the necessary variables from a chosen sample (Wong, Ong and Kuek, 2012).

Constructs	Item		Measurement items	References
Customer Demographics	Gender		**My gender is**: ☐ Male ☐ Female ☐ Other	-
	Age		**My age group is:**☐ 60-65 ☐ 66-70 ☐ 71-75 ☐ 76- 80 ☐ over 80	-
	Education		**My education background is:**	-
			☐ Junior high school or lower ☐ Senior high school ☐ College or equivalent ☐ Bachelor's degree ☐ Master or higher degree	
	Income		**My salary is (Yuan/ monthly):**	-
			☐ <1000 ☐ 1001-3000 ☐3001-5000 ☐ 5001-8000 ☐ over 8000	
			The following items will be evaluated on a seven-point Likert scale (where 1 - strongly disagree and 7 - strongly agree).	
			☐ Strongly disagree ☐ Disagree ☐ Somewhat disagree ☐ Neither agree nor disagree ☐ Somewhat agree ☐ Agree ☐ Strongly agree	
Design leadership	Wearability	WRB1	I feel comfortable using WHT during the day	Adapted from McNamara *et al.* (2016) Ryan,
		WRB2	I feel comfortable using WHT during the night	

Constructs	Item		Measurement items	References
		WRB3	I did not experience any uncomfortable symptoms while wearing the WHT, such as itchiness, skin allergy, or burning sensation	Edney and Maher (2019)
	Interactivity	INT1	The health data is displayed quickly on WHT	Jeng, Pai and Yeh (2022)
		INT2	I am able to freely select the functions I want to use on WHT	
		INT3	I can quickly search for the required health information through WHT	
	Perceived ease of learning and use	PELU1	It is easy to learn and use the WHT	(Davis, 1989)Jeng, Pai and Yeh (2022)
		PELU2	WHT provides clear instructions to help me unlock useful and hidden functions	
		PELU3	I would not have to spend too much time learning and using WHT	Davis (1989)
	Functional value	FV1	The functions on WHT perform stably	Adapted from Yang *et al.* (2016)
		FV2	I believe using WHT could effectively improve my health by helping me monitor my health situation.	
		FV3	The functions on WHT are handy	
Technology leadership	Effectiveness	EFT1	I believe that the quality of data obtained by WHT can be considered as trustworthy as data obtained through the conventional healthcare system (e.g., Sphygmomanometer)	Marakhimov and Joo (2017)

Constructs	Item		Measurement items	References
		EFT2	The data displayed on WHT are accurate and correct	
		EFT3	The health information I received from WHT is complete	
	Perceived risk	PR1	I am concerned about the potential leak of personal data when using WHT	Talukder *et al.* (2020)
		PR2	I am concerned about the potential risks to my physical health (e.g., electromagnetic radiation or skin burns) from using WHT	
		PR3	If I used WHT, I may feel psychologically uncomfortable (e.g., anxious and stressed caused by monitoring)	
	Real-time process	RTP1	I think the real-time process of WHT can help me get the data I need at any time	Jeng, Pai and Yeh (2022)
		RTP2	The real time process helps me to better monitor my health at all times by sending me real-time alerts (e.g., heart rate changes, sedentary reminder)	
		PTR3	I am happy to receive and check the information provided by the real-time processing technology in WHT	
	Artificial intelligence-	AIUM1	I use AI (a virtual assistant that can perform actions via voice queries, e.g., Siri in Apple products) to assist me in using WHT to monitor my health	Adapted from Tran, Riveros

Constructs	Item		Measurement items	References
	based usage monitoring	AIUM2	I believe that AI is useful in helping me use WHT to monitor my health.	and Ravaud (2019)
		AIUM3	I believe that AI can recognize potential risks of disease by analysing various data sources	
Brand leadership	Brand attitude	BA1	My attitude toward this brand is good	Adapted from Venkatesh *et al.*, (2003)
		BA2	I am satisfied with the brand of WHT I am using	
	Perceived quality	PQ1	The quality of this brand's WHT is reliable	Adapted from Talukder *et al.* (2020)
		PQ2	The quality of this brand's WHT is good	
		PQ3	The quality of this brand's WHT is acceptable	
	Brand prestige	BP1	I think the brand of WHT I am using is prestigious	Kim *et al.*, (2019)
		BP2	I think the brand of WHT I am using has high status	
		BP3	I think this brand's WHT is very upscale	
	Customer-oriented behaviour	COB1	I think the brand employees I've encountered are friendly	Adapted from Kemp, Jillapalli and Becerra, (2014)
		COB2	I think the brand employees I've encountered are capable of promptly assisting me in resolving problems according to my needs (e.g., pre-purchase introduction and after-sales service)	

Constructs		Item	Measurement items	References
		COB3	I think the brand employees I've encountered are able to think from my perspective.	
	Brand of origin	BOO1	I think the origin of the brand is important to my consumption experience	Adapted from Götze and Brunner (2020)
		BOO2	It is important to me to purchase domestic products to support the national economy	
		BOO3	Whenever possible, I prefer to purchase domestic brands	
Customer experience of using wearable healthcare technology	Performance satisfaction	PSAT1	The WHT I am using always meets my requirements	Adapted from Rahman *et al.*, (2022)
		PSAT2	I am satisfied with the performance of the WHT I am using	
		PSAT3	The performance of the WHT makes me feel that my choice is wise	
	Recommenda tion	REC1	I encourage other people to use WHT	
		REC2	I will recommend WHT to other people if they ask my advice about WHT	
		REC3	I say positive things about WHT to other people	
		ESM1	It is easy for me to self-manage my health conditions by using WHT	Sun *et al.* (2013)

Constructs	Item		Measurement items	References
Moderator at customer level	Efficacy of self-health management	ESM2	I have the capability to use wearable devices to self-monitor my physical conditions	
		ESM3	I am able to use WHT to self-manage my health conditions without much effort	
	Perceived vulnerability	PV1	I am at risk of suffering from chronic diseases	Sun *et al.* (2013)
		PV2	I am likely to suffer from chronic diseases	
		PV3	It is possible for me to suffer chronic diseases	
	Perceived severity	PS1	If I suffered the chronic disease, it would be severe	Sun *et al.* (2013)
		PS2	If I suffered the chronic disease, it would be serious	
		PS3	If I suffered the chronic disease, it would be significant	
	Facilitating support	FS1	When I have difficulty using WHT, I can seek help from others (e.g., family, friends, or staff)	Adapted from Chu, Chen and Wang (2019) and Beh *et al.* (2021)
		FS2	I was encouraged by relatives to use the WHT (e.g., purchasing equipment for me, supervising my usage)	
Moderator at corporate level	Government regulation policy	GRP1	I hope that the relevant government departments can issue more detailed specifications and requirements for WHT to ensure my rights and interests when using it	Adapted from Peng *et al.* (2022)

Constructs	Item		Measurement items	References
		GRP2	If the relevant governmental bodies implement more comprehensive policies and regulations pertaining to WHT, it would strengthen my long-term inclination to utilize it.	
	Disclosure policy	DP1	When I have had a good experience with the WHT I use, negative disclosures about the brand in the media will not affect my long-term adoption intention	Adapted from Fennis and Stroebe (2014)
		DP2	When I have a good experience with WHT I use, the brand's self-disclosure of negative information does not affect my long-term adoption intention	
		DP3	When I have had a good experience with the WHT I use, the negative information about this brand does not affect my long-term adoption intention	
Sustainable consumption of wearable healthcare technology	Sustainable consumption intention	SC1	I will continue to use WHT	Windasari, Lin and Kato-Lin, (2021) Lee and Lee (2020)
		SC2	I will continue to use WHT frequently	
		SC3	I am willing to use WHT in the future	

Table 14 Indicators for Constructs

Pinsonneault and Kraemer (1993) stated that there are three criteria to ascertain the appropriateness of employing a questionnaire survey as a data collection method.

1) A measurable research topic that requires a quantitative methodology,
2) The use of a pre-designed and structured instrument during the data collection phase to ensure accuracy and consistency.
3) The research aims to obtain generalizable findings from a sample of the target population that can be applied to the entire population.

In this investigation, the research subject is quantifiable, with the objective of gauging the relationship between the hypotheses and variables. As delineated in the literature review chapter, sustainable consumption of WHT among senior citizens emerges as a quantifiable theme, appropriately measurable using numerical instruments. It is necessary to formulate hypotheses to examine the determinants influencing senior citizens to long-term adopt WHT for health monitoring. In addition, the instrument was pre-designed, structured and developed from the research, ensuring accuracy and consistency. Finally, the participant of this research is the senior citizens; it was also proved in the previous chapter that the participant has a certain degree of representation in senior citizens in China.

The chosen approach for this study was an online questionnaire survey due to its cost-effectiveness and ability to efficiently collect data from a large sample size across different geographic areas (De Vaus and de Vaus, 2013), benefiting both the researchers and participants. Additionally, it is beneficial in addressing the constraints of space and time during data collection (Lefever, Dal and Matthíasdóttir, 2007). This study was carried out during the COVID-19 pandemic, so direct face-to-face interactions with participants proved difficult. This was particularly the case as all participants, senior citizens, were at an elevated risk of contracting the virus. Hence, an online survey was a suitable approach to prevent unnecessary risk.

6.2.5 Data Analysis Process

The data analysis process in this study contains model construction and validation. Model construction refers to analysing the pilot test based on 100 samples. The main test has a sample size of 647 to assess the validation of the model in this study. These two tests will collect data separately, as each respondent can only participate in one of the tests (pilot test or main test).

The first step is to process a preliminary analysis of the pilot test. In the preliminary analysis, the SPSS 26 (Statistical Package for the Social Sciences, version 26) was employed to process the data screening and to investigate the frequency of demographics (i.e., gender, age group, educational background, and salary). In addition, the reliability and validity of the measurement were assessed with SmartPLS4 (Ringle, Wende and Becker, 2022). Finally, the questionnaire was modified, and the final version used in the main study was determined. SmartPLS4 (Ringle, Wende and Becker, 2022) was used to analyse the measurement model and structural model in this study. Specifically, the reliability and validity of the measurements, as well as the proposed research model, were examined using SmartPLS4 (Ringle, Wende and Becker, 2022).

The Partial Least Squares Structural Equation Modelling (PLS-SEM) approach is adopted in the assessment of model construction and validation. Structural equation modelling (SEM) is a statistical method utilised in marketing and management research to examine the cause-and-effect relationships between latent constructs or unobserved variables (Fornell, 1985; Hair, Ringle and Sarstedt, 2011). SEM has become a quasi-standard in marketing research (Hair *et al.*, 2012). Covariance-based structural equation modelling (CB-SEM) analysis (software: LISREL, AMOS, and EQS, etc.), and the variance-based structural equation modelling (PLS-SEM) analysis (software: SmartPLS, PLS-Graph and VisualPLS) are the two approaches in SEM research (Urbach and Ahlemann, 2010).

Hair *et al*. (2012) stated that if the research aim is to predict significant target constructs or recognise essential driver constructs, particularly in an exploratory or extension of a current structural theory, PLS-SEM is the preferred technique. Conversely, when the research objective is theory testing, confirmation, or comparisons, CB-SEM is the more appropriate method to use. This study is not aimed at testing theories in the context of sustainable consumption of WHT for senior citizens in China. On the contrary, an innovative model based on existing theories is developed and utilised in this study. Furthermore, this study aims to predict the key factors that can impact the customer experience of using WHT and sustainable consumption of WHT for senior citizens. Hence, PLS-SEM is a suitable approach to use instead of CB-SEM.

Besides, PLS-SEM is also a valuable method for handling complex models that involve a significant number of constructs and indicators. (Hair *et al.*, 2012). Due to the presence of 23 constructs (including 19 first-order constructs and 4 second-order constructs) and 67 indicators, as well as the complex mediation relationship among the constructs, the most suitable approach for analysing the research model in this study is PLS-SEM. Additionally, one advantage of PLS-SEM is that it does not require the input data to be normally distributed, making it a preferred method for this study.

6.2.6 The PLS Path Modelling Method

In the previous section, it has been approved that the PLS-SEM is a suitable approach for this study. A latent variable refers to "*the hypothetical construct built by a researcher in order to understand a research topic"*(Bentler, 1980, p. 420); the latent variable can also be regarded as a construct. A latent variable is not directly measurable due to its hypothetical and unobservable nature. Nevertheless, using an appropriate model, researchers can estimate it through observable and measurable indicator variables. This enables researchers to analyse a variety of theoretical constructs, such as benefits, satisfaction, perceptions, and intentions, to investigate their relationships. Therefore, a research model can be created by incorporating latent variables to aid in the use of unmeasurable theoretical constructs (Urbach and Ahlemann, 2010).

In this study, there are 19 latent variables (shown in figure 14), which are wearability (WRB), interactivity (INT), perceived ease of learning and using (PELU), functional value (FV), effectiveness (EFT), perceived risk (PR), real-time process (RTP), artificial intelligence-based usage monitoring (AIUM), brand attitude (BA), perceived quality (PQ), brand prestige (BP), customer-oriented behaviour (COB), brand of origin (BOO), performance satisfaction (PSAT), recommendation (REC), efficacy of self-health management (ESM), perceived vulnerability (PV), perceived severity (PS), facilitating support (FS), government regulation policy (GRP), disclosure policy (DP), sustainable consumption (SC). There are two sets of models in PLS-SEM: the measurement and structural models (Hair, 2006). The measurement model (shown in Figure 14) displays the connections between the latent variables represented by blue circles and the measurement items represented by yellow squares. In contrast, the structural model (shown in Figure 15) only comprises the latent variables depicted by blue circles and the arrows that link them. The primary objective of this research is to examine the connections (hypotheses) between the latent variables within the structural model. In the structural model, the observable variables, also referred to as manifest variables, indicators, or measurement items, consist of specific items that represent questions presented in questionnaires or surveys. These items are measurable and used to estimate the underlying construct of the latent variable. In this study, a seven-point Likert scale from '1' (strongly disagree) to '7' (strongly agree) was utilised to measure the responses of latent variables. Hence, 67 observable variables (yellow squares) are utilised to estimate the latent variable in the measurement model. The details of each observable variable are displayed in Table 14.

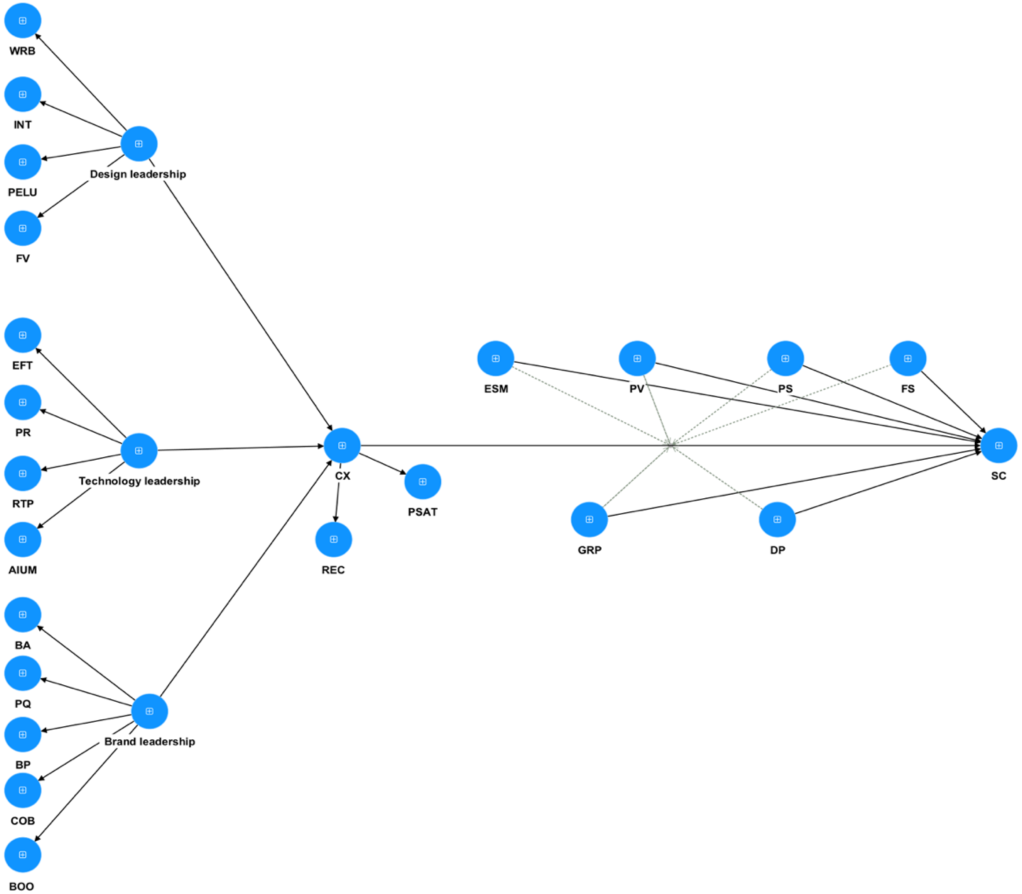


Figure 14 The Structural Model (Second Order) in SmartPLS4

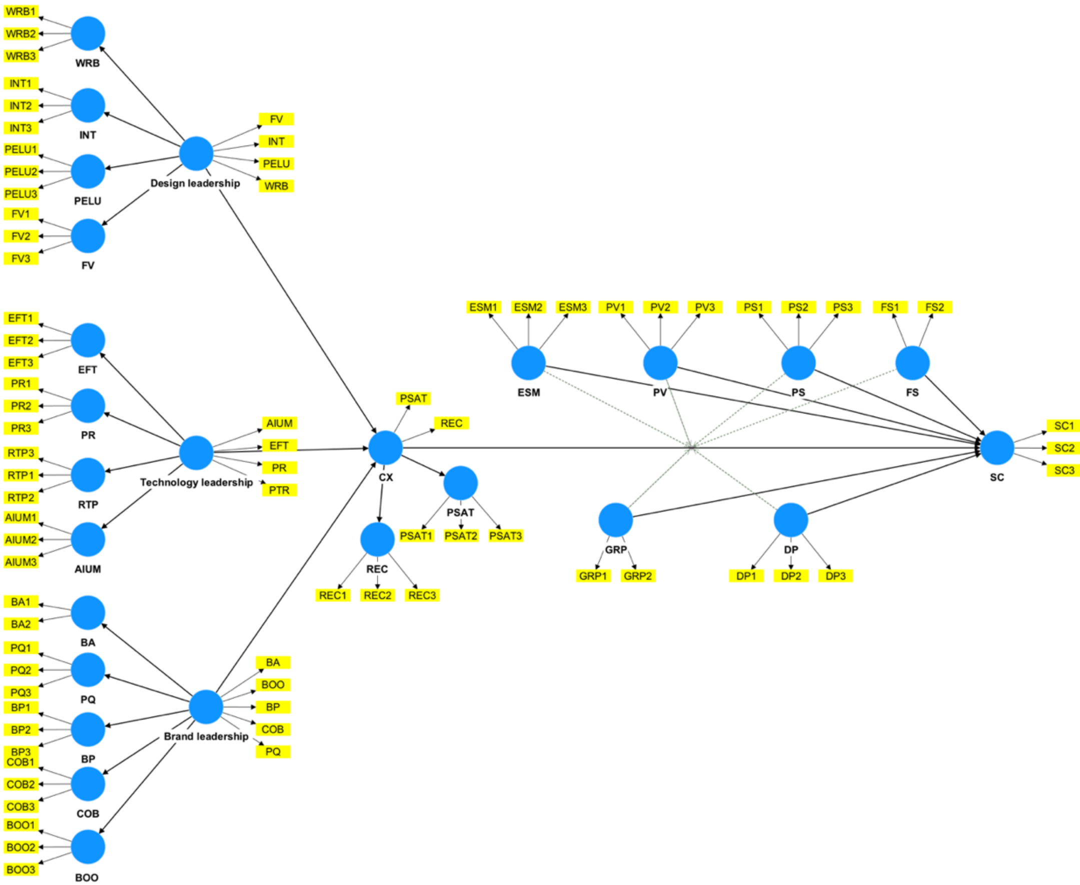


Figure 15 The Measurement Model (Second Order) and Structural Model in SmartPLS4

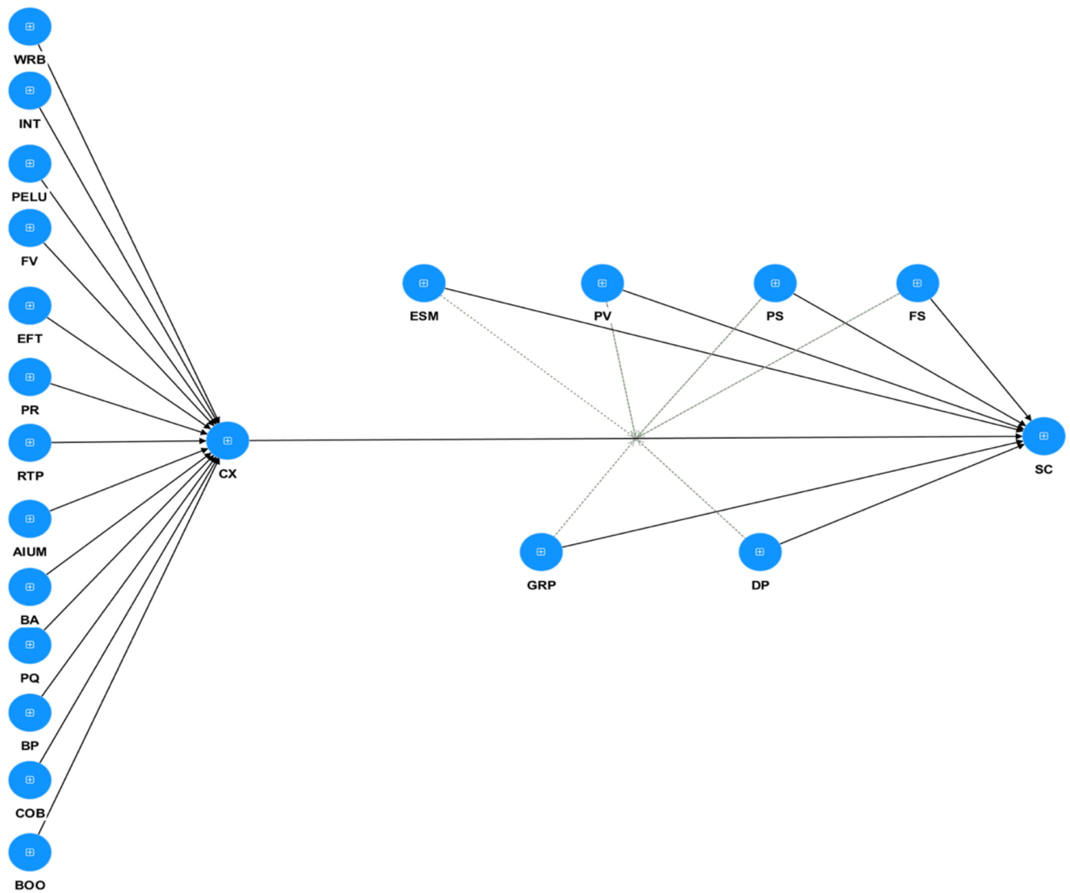


Figure 16 The Structural Model (First Order) in SmartPLS4

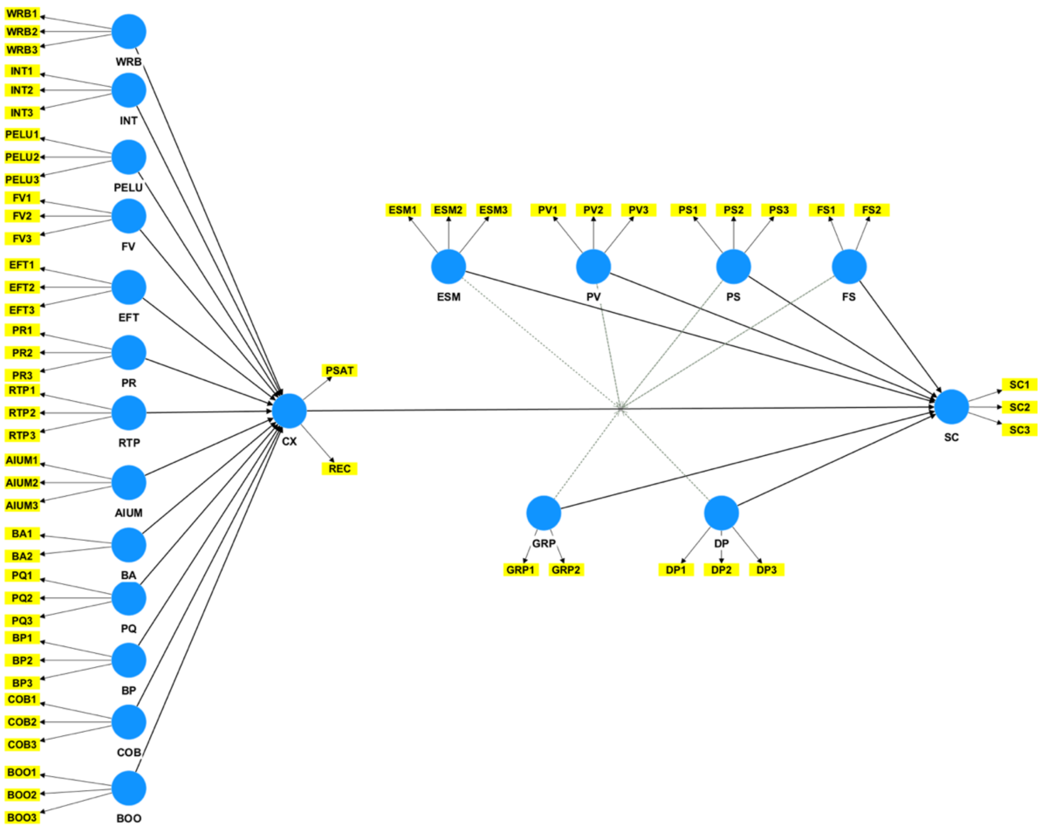


Figure 17 The Measurement Model (First Order) and Structural Model in SmartPLS4

6.3 Quantitative Pilot Test

6.3.1 Translation of Pilot Test

For this study, the questionnaire was designed in English and underwent a rigorous content validity assessment by a group of PhD students with a background in Business research and the supervisory team. The questionnaire was initially translated from English to Chinese by a marketing doctoral candidate. Subsequently, another professional translator with TEM-8 certification and a master's degree in English Language and Literature translated the Chinese version back into English. This iterative process, with the identification, discussion and revision of issues along the way, ensures the accuracy of the translation. In addition, a senior citizen reviewed all the questions to confirm their generation could understand the expression. After the adjustments mentioned above, all of the translated items were readily understandable to the participants and effectively conveyed the intended meaning of the original items. The finalized versions of the questionnaire are presented in Appendices 6 and 7, where the former contains the English rendition, and the latter comprises the Chinese translation.

6.3.2 Preliminary Analysis

The pilot study serves as an essential preliminary phase in research, aiding the researcher in enhancing the quality and efficiency of the principal study (Hazzi and Maldaon, 2015). In this study, a pilot study is utilised to evaluate the reliability and validity of all the measurements of constructs. A pilot online survey was conducted for fourteen days, specifically from March 1st to March 14th, 2023, resulting in a total of 108 surveys being collected from participants in China. To ensure the validity of the collected data, specific criteria were established for the questionnaire. Firstly, all questions in the questionnaire must be answered. If a question is left unanswered, the respondent will be unable to proceed to the next step, and subsequently, their questionnaire will not be collected. Secondly, if ten or more questions were answered with the same response, the questionnaire would be deemed invalid and excluded from the final dataset. For example, if a questionnaire had ten or more questions answered with '7' (strongly agree), it would be considered invalid and not included in the following analysis.

6.3.2.1 Pilot Study Demographic Profile

This section provides a detailed description of the demographic characteristics of the respondents who participated in the pilot test. A total of 100 valid surveys were collected from participants in China. Table 15 presents a summary of the participants' demographic information, which includes their gender, age group, education background and salary (Yuan/month).

		Frequency	Percent
Gender	Male	52	52.0%
	Female	48	48.0%
	Total	100	100.0%
Age group	60-65	41	41.0%
	66-70	36	36.0%
	71-75	10	10.0%
	76-80	9	9.0%
	Over 80	4	4.0%
	Total	100	100.0%
Education background	Junior high school or lower	10	10.0%
	Senior high school	30	30.0%
	College or equivalent	39	39.0%
	Bachelor’s degree	15	15.0%
	Master or higher degree	6	6.0%
	Total	100	100.0%
Salary	<1000	7	7.0%
	1001-3000	13	13.0%
	3001-5000	39	39.0%
	5001-8000	34	34.0%
	Over 8001	7	7.0%
	Total	100	100.0%

Table 15 Frequencies of the Pilot Survey Sample Demographic (N=100)

Under the gender category, the table shows that 52 participants (52%) were male, and 48 participants (48%) were female, making the total number of participants 100.

The age group category provides information on the age group distribution of the participants. The largest age group comprised individuals aged 60-65, constituting 41% of the total respondents. The second-largest age group was individuals aged 66-70, accounting for 36% of the respondents. The age group of 76-80 accounts for 9% of the total, while the age group of 71-75 accounts for 10% of the total. The age group of individuals aged over 80 had the lowest number of respondents, with only 3.1% of the total.

The education background category shows the educational qualifications of the participants. The majority of respondents (39%) had a college or equivalent education. Respondents with a senior high school education background accounted for the second large percentage of respondents at 30%. The percentage of respondents with a bachelor's degree was 15%. In contrast, only 10% of the respondents had a junior high school or lower education background. Respondents with a master's or higher degree accounted for the smallest percentage of respondents at 6%.

Finally, the salary category indicates the participants' monthly income in yuan. Respondents with a salary range of 3001-5000 accounted for the majority at 39%, followed by those in the 5001-8000 range at 34%. Those with a range of 1001-3000 accounted for 13% of respondents, while only 7% reported a salary range of less than 1000. Additionally, 7% of respondents reported a salary range of over 8001.

6.3.2.2 Measurement Validation

Before progressing to the main survey, it is essential and imperative to evaluate the reliability and validity of the measurements. Consequently, these aspects were scrutinised in the pilot survey.

Construct	Item	Loadings	Construct	Item	Loadings
Design leadership			**Technology leadership**		
wearability	WRB1	0.944	Effectiveness	EFT1	0.919
	WTB2	0.898		EFT2	0.850
	WTB3	0.891		EFT3	0.901
Interactivity	INT1	0.917	perceived risk	PR1	0.917
	INT2	0.894		PR2	0.844
	INT3	0.892		PR3	0.818
Perceived ease of learning and using	PELU1	0.923	Real-time process	RTP1	0.907
	PELU2	0.906		RTP2	0.822
	PELU3	0.889		PTR3	0.867
Functional value	FV1	0.937	AI-based usage monitoring	AIUM1	0.875
	FV2	0.892		AIUM2	0.856
	FV3	0.899		AIUM3	0.845
Brand leadership			**Moderator at corporate level**		
Brand attitude	BA1	0.933	Government regulation policy	GRP1	0.853
	BA2	0.926		GRP2	0.991
Perceived quality	PQ1	0.859	Disclosure policy	DP1	0.905
	PQ2	0.894		DP2	0.860
	PQ3	0.881		DP3	0.757
Brand prestige	BP1	0.922	**Moderator at customer level**		
	BP2	0.892	Efficacy of self-health management	ESM1	0.917
	BP3	0.894		ESM2	0.924
Customer-oriented behaviour	COB1	0.878		ESM3	0.688
	COB2	0.822	Perceived vulnerability	PV1	0.865
	COB3	0.873		PV2	0.649
Brand of origin	BOO1	0.917		PV3	0.949
	BOO2	0.875	Perceived severity	PS1	0.928
	BOO3	0.850		PS2	0.724
Customer Experience of WHT				PS3	0.886
Performance satisfaction	PSAT1	0.946	Facilitating support	FS1	0.867
	PSAT2	0.861		FS2	0.964
	PSAT3	0.858	**Sustainable consumption of using WHT**		
Recommenda-tion	REC1	0.916	Sustainable consumption intention	SC1	0.916
	REC2	0.849		SC2	0.861
	REC3	0.823		SC3	0.869

Table 16 Factor Loadings

Reliability

Reliability is a measure of the consistency of a construct, so it is important to assess the reliability of the constructs in the measurement model (Chin, 1998). Hair (2006) and Awang (2015) provided a standard to ensure the reliability of the measurement, as indicator loading estimates should be 0.5 or higher, and ideally 0.7 or higher. Table 16 shows that all the indicator loading values exceed the recommended threshold.

The Cronbach's alpha value is regarded as the most recommended threshold to assess the data reliability for researchers (Rosnow and Rosenthal, 2013). The Cronbach's alpha value should be higher than 0.70 to ensure the reliability of the research constructs (Hair, 2006). The composite reliability (CR) method is also utilized to evaluate the reliability of measurement. Hair (2006) recommended that the value of CR should be higher than 0.70 to ensure the measurement is considered acceptable in further investigation. The values of Cronbach's alpha and CR of this survey are shown in Table 17; all the values are higher than 0.70. Thus, all the remaining measurements are reliable.

	Cronbach's alpha	Composite reliability
AI-based usage monitoring	0.822	0.894
Brand attitude	0.842	0.927
Brand of origin	0.856	0.912
Brand prestige	0.886	0.930
Customer-oriented behaviour	0.820	0.893
Effectiveness	0.869	0.920
Functional value	0.896	0.935
Interactivity	0.884	0.928
Perceived ease of learning and use	0.891	0.932
Perceived quality	0.852	0.910
Perceived risk	0.824	0.895
Real-time process	0.833	0.900
Wearability	0.898	0.936
Customer experience of using WHT	0.878	0.908
Performance satisfaction	0.867	0.919
Recommendation	0.828	0.898
Sustainable consumption of using WHT	0.858	0.913
Disclose policy	0.798	0.880
Efficacy of self-health management	0.835	0.885
Facilitating support	0.825	0.913
Government regulation policy	0.873	0.921
Perceived severity	0.814	0.886
Perceived vulnerability	0.827	0.867

Table 17 Results of Cronbach's Alpha and Composite Reliability

Validity

Convergent validity assesses the degree to which multiple measures of a single construct correlate, while discriminant validity gauges the extent to which distinct constructs do not correlate. Therefore, it is crucial to evaluate both the convergent and discriminant validity of the constructs within the measurement model. (Hair, 2006).

For the assessment of convergent validity, an average variance extracted (AVE) value exceeding 0.50 is deemed acceptable (Hair, 2006). To evaluate discriminant validity, we verified if the square roots of the AVE for each construct surpassed the correlation values between any two constructs (Henseler, Ringle and Sinkovics, 2009). As shown in Table 18, the square root of the AVE for each variable is presented on the diagonal (highlighted in bold). These figures exceed their respective correlation coefficients, confirming that the measurement model satisfies the criteria for discriminant validity (Fornell and Larcker, 1981). Besides, the factor loadings should be larger than the corresponding cross-loading to confirm the discriminant validity (Chin, 1998). According to Table 19, the factor loadings (highlighted in blue) are greater than their cross-loadings. Hence, the model measurement presented well in discriminant validity. Furthermore, the heterotrait–monotrait ratio (HTMT) is also utilized to measure discriminant validity (Henseler, Ringle and Sarstedt, 2015). As shown in Table 20, all HTMT values were below the threshold value of 0.90, and the discriminant validity of the measurement model is confirmed.

	AVE	AIUM	BA	BOO	BP	COB	DP	EFT	ESM	FS	FV	GRP	INT	PELU	PQ	PR	PS	PSAT	PV	RTP	REC	SC	WRB
AIUM	0.737	**0.859**																					
BA	0.864	0.082	**0.929**																				
BOO	0.776	0.176	0.674	**0.881**																			
BP	0.815	0.120	0.720	0.523	**0.903**																		
COB	0.736	0.115	0.631	0.626	0.675	**0.858**																	
DP	0.793	0.040	-0.090	-0.008	-0.189	-0.180	**0.843**																
EFT	0.828	0.618	0.148	0.148	0.152	0.231	-0.088	**0.890**															
ESM	0.812	0.077	0.024	0.138	0.065	0.039	0.086	-0.008	**0.850**														
FS	0.821	0.141	-0.006	-0.097	0.033	0.105	-0.167	0.204	0.098	**0.917**													
FV	0.771	-0.016	0.148	0.179	0.202	0.264	0.045	0.041	0.085	-0.016	**0.910**												
GRP	0.741	-0.040	-0.063	-0.143	-0.038	0.030	0.165	-0.191	0.089	0.034	-0.026	**0.925**											
INT	0.750	0.001	0.242	0.253	0.324	0.280	-0.032	0.193	0.008	-0.044	0.643	-0.013	**0.901**										
PELU	0.831	-0.107	0.143	0.077	0.135	0.187	-0.031	-0.008	0.044	-0.078	0.610	0.078	0.613	**0.906**									
PQ	0.791	0.076	0.670	0.612	0.561	0.490	0.004	0.076	0.089	-0.094	0.293	-0.059	0.215	0.204	**0.878**								
PR	0.746	0.394	0.191	0.179	0.185	0.336	-0.157	0.648	0.068	0.098	-0.001	-0.156	0.164	0.058	0.082	**0.861**							
PS	0.778	0.112	0.102	0.117	0.097	0.070	-0.189	0.032	0.072	-0.044	0.065	0.081	0.083	0.049	-0.077	-0.095	**0.850**						
PSAT	0.711	0.097	0.082	0.177	0.122	0.148	-0.010	0.148	0.017	0.055	-0.046	-0.240	-0.149	-0.143	0.093	0.001	0.056	**0.889**					
PV	0.723	0.009	-0.046	-0.134	-0.125	-0.055	-0.313	0.217	0.003	0.063	0.017	-0.259	-0.013	-0.058	0.035	0.220	0.038	0.025	**0.831**				
RTP	0.840	0.446	0.144	0.088	0.110	0.189	0.076	0.680	-0.029	0.153	-0.042	-0.028	0.094	-0.047	0.073	0.563	-0.106	0.066	0.129	**0.866**			
REC	0.855	0.046	0.069	0.048	0.147	0.082	-0.056	0.167	-0.058	0.111	-0.096	-0.112	-0.054	-0.049	0.135	0.084	0.015	0.621	0.029	0.150	**0.864**		
SC	0.723	-0.001	-0.098	0.026	-0.085	0.021	-0.242	0.086	0.148	0.050	0.063	-0.082	0.037	0.126	-0.089	0.052	0.125	-0.040	0.221	-0.029	-0.014	**0.882**	
WRB	0.690	-0.044	0.246	0.261	0.265	0.269	-0.010	0.055	0.074	-0.033	0.657	0.025	0.685	0.712	0.394	0.059	0.108	-0.075	0.067	0.079	0.035	0.113	0.911

Note: AIUM=AI-based usage monitoring; BA=Brand attitude; BOO=Brand of origin; BP=Brand prestige; COB=Customer-oriented behaviour; EFT=Effectiveness; FV=Functional value; INT=Interactivity; PELU=Perceived ease of learning and use; PQ=Perceived quality; PR=Perceived risk; RTP=Real-time process; WRB=Wearability; PSAT=Perceived satisfaction; REC=Recommendation; SC=Sustainable consumption of using WHT; DP=Disclose policy; ESM=Efficacy of self-health management; FS=Facilitating support; GRP=Government regulation policy; PS=Perceived severity; PV=Perceived vulnerability

Table 18 Results of Validity - Ave and Correlation of Constructs

	AIUM	BA	BOO	BP	COB	DP	EFT	ESM	FS	FV	GRP	INT	PELU	PQ	PR	PS	PSAT	PV	REC	RTP	SC	WRB
AIUM1	0.875	0.038	0.191	-0.008	0.021	0.064	0.529	0.062	0.048	-0.007	-0.045	-0.005	-0.101	0.012	0.337	0.042	0.051	-0.012	-0.042	0.338	0.060	-0.118
AIUM2	0.856	0.103	0.130	0.165	0.153	0.084	0.597	0.038	0.144	0.023	-0.064	0.069	-0.051	0.092	0.379	0.088	0.059	0.020	0.044	0.436	-0.047	0.034
AIUM3	0.845	0.067	0.132	0.148	0.117	-0.055	0.453	0.103	0.172	-0.064	0.011	-0.074	-0.130	0.090	0.292	0.164	0.145	0.014	0.120	0.371	-0.013	-0.036
BA1	0.067	0.933	0.659	0.674	0.568	-0.049	0.137	0.036	-0.084	0.161	-0.066	0.250	0.170	0.670	0.162	0.149	0.076	-0.049	0.059	0.134	-0.089	0.261
BA2	0.086	0.926	0.591	0.664	0.607	-0.121	0.138	0.007	0.075	0.113	-0.052	0.199	0.094	0.573	0.193	0.038	0.076	-0.035	0.068	0.134	-0.093	0.195
BOO1	0.147	0.586	0.917	0.474	0.593	0.038	0.126	0.099	-0.044	0.130	-0.112	0.196	0.036	0.568	0.146	0.068	0.160	-0.160	0.121	0.146	-0.038	0.244
BOO2	0.116	0.571	0.875	0.440	0.519	-0.100	0.090	0.149	-0.037	0.108	-0.154	0.228	0.078	0.498	0.127	0.122	0.174	-0.093	0.046	0.071	0.140	0.168
BOO3	0.200	0.624	0.850	0.468	0.540	0.035	0.172	0.119	-0.175	0.234	-0.113	0.248	0.092	0.550	0.200	0.120	0.135	-0.098	-0.043	0.013	-0.026	0.275
BP1	0.055	0.652	0.462	0.922	0.557	-0.218	0.083	0.006	0.045	0.110	-0.120	0.223	-0.005	0.468	0.087	0.087	0.129	-0.143	0.149	0.017	-0.074	0.142
BP2	0.083	0.661	0.441	0.892	0.625	-0.174	0.123	0.042	0.052	0.254	-0.016	0.340	0.239	0.519	0.126	0.125	0.114	-0.116	0.090	0.099	-0.031	0.318
BP3	0.183	0.637	0.513	0.894	0.643	-0.121	0.202	0.124	-0.007	0.182	0.028	0.312	0.128	0.531	0.282	0.053	0.087	-0.081	0.159	0.178	-0.124	0.253
COB1	0.010	0.550	0.502	0.612	0.878	-0.185	0.174	0.063	0.150	0.200	0.054	0.265	0.247	0.411	0.248	0.015	0.136	-0.076	0.075	0.152	0.075	0.244
COB2	0.154	0.507	0.572	0.536	0.822	-0.063	0.185	-0.055	0.164	0.165	0.011	0.135	0.043	0.389	0.262	0.023	0.148	-0.099	0.062	0.188	-0.119	0.131
COB3	0.132	0.567	0.540	0.587	0.873	-0.209	0.234	0.088	-0.037	0.309	0.013	0.315	0.187	0.458	0.351	0.138	0.098	0.030	0.074	0.147	0.091	0.310
DP1	0.050	-0.081	0.008	-0.164	-0.167	0.905	-0.090	0.096	-0.175	0.067	0.241	-0.020	-0.039	0.036	-0.227	-0.163	-0.008	-0.401	0.017	0.062	-0.206	0.022
DP2	0.060	0.009	0.080	-0.054	-0.103	0.860	-0.125	0.110	-0.164	0.062	0.077	0.047	-0.005	0.062	-0.070	-0.092	0.000	-0.182	-0.063	0.018	-0.235	0.016
DP3	-0.024	-0.196	-0.152	-0.311	-0.207	0.757	0.019	-0.011	-0.066	-0.035	0.104	-0.146	-0.040	-0.123	-0.108	-0.257	-0.022	-0.215	-0.107	0.136	-0.161	-0.083
EFT1	0.592	0.089	0.103	0.056	0.176	-0.078	0.919	-0.006	0.283	0.036	-0.080	0.159	0.000	0.012	0.589	-0.006	0.128	0.171	0.122	0.629	0.107	0.066
EFT2	0.452	0.187	0.110	0.194	0.257	-0.054	0.850	-0.091	0.137	0.064	-0.193	0.150	0.029	0.099	0.544	-0.025	0.143	0.195	0.182	0.562	-0.046	0.070
EFT3	0.597	0.125	0.180	0.163	0.192	-0.101	0.901	0.067	0.121	0.012	-0.240	0.204	-0.045	0.098	0.597	0.111	0.126	0.215	0.145	0.623	0.156	0.013
ESM1	0.055	0.103	0.166	0.078	0.075	0.093	-0.002	0.917	0.094	0.033	0.050	-0.035	0.022	0.138	0.061	0.066	0.062	-0.009	0.018	-0.012	0.123	0.061
ESM2	0.104	-0.060	0.085	0.032	-0.003	0.047	-0.010	0.924	0.086	0.100	0.093	0.024	0.055	0.020	0.081	0.066	-0.010	0.028	-0.105	-0.036	0.160	0.070
ESM3	-0.048	0.113	0.155	0.110	0.073	0.165	-0.010	0.688	0.074	0.122	0.124	0.080	0.022	0.156	-0.036	0.056	-0.037	-0.073	-0.053	-0.031	0.034	0.074

	AIUM	BA	BOO	BP	COB	DP	EFT	ESM	FS	FV	GRP	INT	PELU	PQ	PR	PS	PSAT	PV	REC	RTP	SC	WRB
FS1	0.163	0.007	0.007	0.059	0.090	-0.134	0.231	0.125	0.867	-0.012	0.089	-0.010	-0.121	-0.025	0.062	-0.018	0.088	0.024	0.125	0.147	0.030	-0.009
FS2	0.114	-0.013	-0.142	0.015	0.102	-0.167	0.168	0.073	0.964	-0.016	0.000	-0.057	-0.047	-0.121	0.106	-0.053	0.032	0.077	0.092	0.139	0.055	-0.043
FV1	-0.024	0.160	0.157	0.215	0.281	0.081	0.034	0.089	0.008	0.937	-0.008	0.542	0.527	0.287	0.021	0.075	0.002	0.078	-0.079	-0.052	0.051	0.591
FV2	-0.017	0.095	0.132	0.165	0.224	0.006	0.067	0.001	-0.021	0.892	0.019	0.663	0.622	0.203	0.022	0.099	-0.114	-0.019	-0.108	0.029	0.123	0.586
FV3	-0.002	0.151	0.202	0.173	0.215	0.038	0.008	0.148	-0.029	0.899	-0.085	0.544	0.511	0.312	-0.048	0.000	-0.008	-0.010	-0.073	-0.096	-0.006	0.615
GRP1	0.005	-0.076	-0.059	-0.084	0.066	0.221	-0.130	0.001	0.042	-0.019	0.853	-0.053	0.046	0.012	-0.196	0.077	-0.214	-0.283	-0.042	0.046	-0.024	0.090
GRP2	-0.050	-0.057	-0.158	-0.025	0.020	0.143	-0.197	0.107	0.030	-0.027	0.991	-0.002	0.083	-0.075	-0.138	0.078	-0.235	-0.241	-0.125	-0.046	-0.094	0.007
INT1	-0.001	0.252	0.259	0.288	0.278	-0.037	0.268	-0.035	-0.043	0.479	-0.025	0.917	0.525	0.215	0.243	0.100	-0.149	0.058	-0.073	0.201	0.033	0.613
INT2	-0.134	0.139	0.140	0.259	0.159	-0.065	0.053	-0.037	-0.117	0.601	-0.038	0.894	0.541	0.108	0.083	0.010	-0.127	-0.076	-0.068	-0.032	0.083	0.592
INT3	0.129	0.262	0.284	0.326	0.317	0.012	0.202	0.087	0.037	0.651	0.024	0.892	0.587	0.256	0.122	0.113	-0.129	-0.015	-0.008	0.090	-0.013	0.643
PELC1	-0.178	0.157	0.071	0.129	0.189	0.009	-0.010	0.039	-0.088	0.557	0.143	0.561	0.923	0.176	0.054	0.045	-0.158	-0.027	-0.092	-0.065	0.104	0.670
PELC2	-0.071	0.128	0.037	0.079	0.145	-0.026	-0.051	0.072	-0.006	0.544	-0.002	0.533	0.906	0.142	0.060	0.010	-0.052	-0.023	-0.049	-0.015	0.110	0.593
PELC3	-0.040	0.103	0.100	0.157	0.174	-0.067	0.039	0.008	-0.116	0.558	0.068	0.571	0.889	0.236	0.043	0.077	-0.176	-0.107	0.007	-0.047	0.129	0.671
PQ1	0.023	0.517	0.525	0.465	0.354	0.044	0.030	0.170	-0.098	0.134	-0.039	0.099	0.067	0.859	0.077	-0.083	0.158	0.045	0.211	0.057	-0.035	0.247
PQ2	0.096	0.618	0.599	0.517	0.474	-0.004	0.080	0.070	-0.067	0.305	-0.071	0.250	0.189	0.894	0.061	-0.105	0.076	-0.005	0.133	0.077	-0.111	0.377
PQ3	0.077	0.624	0.486	0.494	0.455	-0.025	0.088	0.003	-0.087	0.321	-0.044	0.209	0.274	0.881	0.080	-0.014	0.017	0.055	0.018	0.057	-0.085	0.407
PR1	0.387	0.148	0.159	0.153	0.273	-0.227	0.663	0.029	0.133	-0.020	-0.140	0.132	0.042	0.073	0.917	-0.056	0.039	0.227	0.131	0.499	0.090	0.054
PR2	0.328	0.197	0.201	0.201	0.349	-0.063	0.500	0.027	-0.013	0.033	-0.083	0.177	0.049	0.036	0.844	-0.042	0.032	0.133	0.025	0.457	-0.024	0.049
PR3	0.296	0.153	0.104	0.125	0.249	-0.103	0.497	0.126	0.124	-0.012	-0.179	0.116	0.059	0.103	0.818	-0.153	-0.075	0.203	0.052	0.499	0.061	0.049
PS1	0.162	0.101	0.121	0.131	0.056	-0.142	0.046	0.055	-0.034	-0.014	0.054	-0.013	-0.020	-0.107	-0.102	0.928	0.059	0.049	0.015	-0.072	0.118	-0.001
PS2	-0.048	0.130	0.101	0.073	0.085	-0.184	-0.083	0.016	-0.016	0.057	0.069	0.023	0.078	-0.078	-0.134	0.724	-0.007	-0.010	-0.016	-0.080	0.062	0.098
PS3	0.108	0.055	0.083	0.045	0.053	-0.176	0.065	0.094	-0.052	0.122	0.086	0.178	0.085	-0.025	-0.038	0.886	0.066	0.040	0.026	-0.117	0.124	0.182
PSAT1	0.130	0.049	0.135	0.097	0.135	-0.016	0.171	0.054	0.149	-0.018	-0.219	-0.157	-0.097	0.066	0.035	0.058	0.946	0.014	0.610	0.109	0.006	-0.073

	AIUM	BA	BOO	BP	COB	DP	EFT	ESM	FS	FV	GRP	INT	PELU	PQ	PR	PS	PSAT	PV	REC	RTP	SC	WRB
PSAT2	0.007	0.019	0.146	0.103	0.094	0.005	-0.014	0.011	0.016	-0.071	-0.210	-0.174	-0.198	0.066	-0.090	0.008	0.861	0.018	0.565	-0.057	-0.073	-0.057
PSAT3	0.120	0.157	0.197	0.127	0.168	-0.017	0.240	-0.025	-0.032	-0.036	-0.212	-0.062	-0.089	0.120	0.059	0.084	0.858	0.035	0.476	0.125	-0.045	-0.069
PV1	-0.062	-0.008	-0.061	-0.103	0.056	-0.237	0.106	0.030	0.092	0.072	-0.189	-0.015	0.001	0.088	0.205	0.045	0.016	0.865	0.103	0.097	0.135	0.148
PV2	0.047	0.101	0.132	-0.026	0.008	-0.075	0.106	0.017	-0.063	0.080	-0.211	-0.049	-0.022	0.220	0.127	0.075	-0.002	0.649	0.106	0.057	0.032	0.164
PV3	0.040	-0.077	-0.183	-0.129	-0.113	-0.331	0.254	-0.014	0.053	-0.023	-0.259	-0.005	-0.085	-0.022	0.203	0.024	0.028	0.949	-0.025	0.134	0.254	0.001
REC1	0.018	0.016	0.041	0.042	-0.005	-0.061	0.131	-0.076	0.071	-0.072	-0.140	-0.102	-0.052	0.133	0.037	-0.053	0.560	-0.035	0.916	0.160	-0.015	0.055
REC2	0.081	0.069	0.127	0.163	0.160	-0.016	0.242	0.067	0.037	-0.061	-0.048	0.013	0.029	0.116	0.120	0.060	0.531	0.120	0.849	0.147	0.035	0.072
REC3	0.020	0.098	-0.045	0.184	0.063	-0.068	0.059	-0.141	0.183	-0.117	-0.099	-0.048	-0.106	0.099	0.063	0.037	0.518	-0.008	0.823	0.079	-0.057	-0.041
RTP1	0.349	0.138	0.096	0.066	0.167	0.116	0.588	-0.086	0.147	-0.006	-0.009	0.111	0.011	0.088	0.513	-0.192	0.074	0.110	0.140	0.907	-0.048	0.090
RTP2	0.331	0.101	0.066	0.106	0.122	0.004	0.522	0.029	0.050	-0.029	-0.044	0.078	-0.046	0.073	0.453	-0.026	0.070	0.098	0.105	0.822	-0.007	0.103
RTP3	0.471	0.133	0.066	0.113	0.196	0.071	0.649	-0.015	0.189	-0.072	-0.023	0.057	-0.086	0.031	0.495	-0.053	0.030	0.125	0.142	0.867	-0.020	0.017
SC1	0.050	-0.104	0.046	-0.075	0.031	-0.203	0.103	0.165	-0.022	0.040	-0.051	0.077	0.160	-0.086	0.078	0.187	-0.058	0.166	-0.033	-0.064	0.916	0.134
SC2	0.081	-0.157	-0.024	-0.153	-0.032	-0.176	0.110	0.075	0.125	0.015	-0.069	0.019	0.091	-0.148	-0.001	0.053	-0.035	0.140	-0.020	-0.028	0.861	0.047
SC3	-0.115	-0.015	0.036	-0.016	0.044	-0.253	0.023	0.137	0.050	0.103	-0.097	0.000	0.078	-0.020	0.050	0.078	-0.013	0.267	0.014	0.014	0.869	0.105
WRB1	-0.048	0.246	0.224	0.317	0.266	0.039	0.055	0.059	-0.016	0.608	0.016	0.651	0.636	0.410	0.049	0.083	-0.023	0.094	0.141	0.086	0.124	0.944
WRB2	-0.019	0.237	0.253	0.250	0.283	-0.115	0.048	0.081	0.010	0.569	0.023	0.605	0.635	0.325	0.087	0.133	-0.008	0.041	0.073	0.061	0.156	0.898
WRB3	-0.052	0.191	0.236	0.155	0.186	0.046	0.047	0.063	-0.085	0.617	0.029	0.615	0.677	0.341	0.025	0.081	-0.173	0.047	-0.120	0.067	0.030	0.891

Note: AIUM=AI-based usage monitoring; BA=Brand attitude; BOO=Brand of origin; BP=Brand prestige; COB=Customer-oriented behaviour; EFT=Effectiveness; FV=Functional value; INT=Interactivity; PELU=Perceived ease of learning and use; PQ=Perceived quality; PR=Perceived risk; RTP=Real-time process; WRB=Wearability; PSAT=Performance satisfaction; REC=Recommendation; SC=Sustainable consumption of WHT; DP=Disclose policy; ESM=Efficacy of self-health management; FS=Facilitating support; GRP=Government regulation policy; PS=Perceived severity; PV=Perceived vulnerability.

Table 19 Results of Validity - Cross Loadings

	AIUM	BA	BOO	BP	COB	DP	EFT	ESM	FS	FV	GRP	INT	PELU	PQ	PR	PS	PSAT	PV	RTP	REC	SC	WRB
AIUM																						
BA	0.097																					
BOO	0.209	0.793																				
BP	0.173	0.833	0.600																			
COB	0.167	0.760	0.748	0.790																		
DP	0.094	0.156	0.155	0.259	0.230																	
EFT	0.722	0.176	0.170	0.175	0.277	0.112																
ESM	0.108	0.126	0.185	0.107	0.111	0.161	0.080															
FS	0.183	0.103	0.139	0.053	0.173	0.193	0.253	0.132														
FV	0.050	0.171	0.205	0.227	0.306	0.077	0.053	0.130	0.023													
GRP	0.041	0.082	0.140	0.086	0.063	0.236	0.201	0.101	0.067	0.054												
INT	0.136	0.279	0.291	0.364	0.325	0.105	0.220	0.089	0.083	0.717	0.048											
PELU	0.142	0.164	0.091	0.164	0.216	0.075	0.056	0.045	0.116	0.681	0.092	0.688										
PQ	0.093	0.787	0.715	0.644	0.582	0.118	0.099	0.160	0.116	0.332	0.058	0.243	0.230									
PR	0.473	0.232	0.213	0.215	0.410	0.190	0.760	0.092	0.123	0.046	0.210	0.195	0.068	0.099								
PS	0.160	0.137	0.144	0.115	0.101	0.257	0.098	0.081	0.069	0.093	0.100	0.120	0.094	0.108	0.134							
PSAT	0.137	0.101	0.208	0.140	0.177	0.027	0.203	0.061	0.106	0.073	0.275	0.169	0.162	0.129	0.107	0.075						
PV	0.072	0.086	0.172	0.119	0.098	0.320	0.213	0.075	0.087	0.091	0.300	0.070	0.068	0.160	0.250	0.069	0.047					
RTP	0.533	0.171	0.107	0.140	0.227	0.121	0.795	0.077	0.182	0.088	0.058	0.148	0.076	0.092	0.680	0.126	0.128	0.133				
REC	0.101	0.084	0.114	0.175	0.114	0.099	0.198	0.127	0.147	0.112	0.126	0.086	0.103	0.173	0.105	0.075	0.731	0.137	0.180			
SC	0.111	0.126	0.093	0.116	0.134	0.283	0.138	0.145	0.088	0.086	0.086	0.058	0.142	0.118	0.092	0.142	0.069	0.208	0.060	0.060		
WRB	0.094	0.282	0.297	0.295	0.311	0.106	0.064	0.091	0.045	0.732	0.058	0.767	0.796	0.447	0.069	0.134	0.091	0.154	0.100	0.142	0.127	

Note: AIUM=AI-based usage monitoring; BA=Brand attitude; BOO=Brand of origin; BP=Brand prestige; COB=Customer-oriented behaviour; EFT=Effectiveness; FV=Functional value; INT=Interactivity; PELU=Perceived ease of learning and use; PQ=Perceived quality; PR=Perceived risk; RTP=Real-time process; WRB=Wearability; PSAT=Performance satisfaction; REC=Recommendation; SC=Sustainable consumption of WHT; DP=Disclose policy; ESM=Efficacy of self-health management; FS=Facilitating support; GRP=Government regulation policy; PS=Perceived severity; PV=Perceived vulnerability.

Table 20 HTMT Ratio

6.3.3 Questionnaire Revision

Based on the reliability and validity assessment of all constructs in the research model, all measurements of indicators exceeded the recommended threshold. However, Hair (2006) suggests that indicator loading value estimates should be 0.5 or higher, and ideally 0.7 or higher. The indicator loading values of PV2 (0.649) and ESM3 (0.688) were higher than 0.50 but lower than 0.70. Therefore, these two items were revised to ensure the higher quality of the questionnaire.

For PV2, the three questions in the PV construct express varying levels of risk: 'at risk', 'likely', and 'possible'. However, when translated into Chinese, there is no clear distinction between these levels of risk in English. As a result, the Chinese versions of the three questions about PV in the questionnaire were modified to clarify the sequential reduction in the degree of risk.

Similarly, the series of ESM questions in the questionnaire express varying levels of self-efficacy in health management. These levels include 'easy', 'have capability to', and 'be able to'. However, the expression of these levels in English does not translate into a clear distinction of extent in Chinese. As a result, the Chinese versions of the ESM questions were modified to clarify the sequential reduction in degree and differentiate the levels of self-efficacy expressed in each question.

6.4 Results of Main Quantitative Survey Analysis

6.4.1 Main Quantitative Survey Data Screening

The primary quantitative survey data was collected from 24th April to 15th May 2023. The reliability and validity criteria of the questionnaire utilised in the main quantitative survey were consistent with the criteria adopted in the pilot test, as detailed in the previous section. All data were rigorously inspected to detect and amend any occurrences of missing data, and to address potential multicollinearity concerns, guaranteeing the integrity of the final data analysis.

Missing data is a common issue in the data analysis process, often arising due to participants' failure to answer all the questions in a questionnaire (Tabachnick, Fidell and Ullman, 2013). Such missing data can reduce statistical power and biased estimates due to a smaller sample size (Enders, 2022). It is crucial to determine whether missing values occur randomly or non-randomly (Pallant, 2020). Randomly distributed missing values do not induce bias, while non-randomly distributed missing values can lead to biased estimates that compromise the study's generalisability (Tabachnick, Fidell and Ullman, 2013).

The rule for responding to this questionnaire stipulated that all questions had to be answered. If a respondent failed to answer a question, they would be unable to proceed to the next step, and as a result, their incomplete questionnaire would not be collected. Consequently, no missing data was encountered in this study, and all collected questionnaires (647 received surveys) were fully completed.

6.4.2 Indicator Reliability

The examination of indicator loadings is the initial step in assessing the reflective measurement model (Hair *et al.*, 2019). It is recommended that loadings are above 0.708, as this indicates that the construct explains over 50% of the variance in the indicator, which results in acceptable item reliability (Hair *et al.*, 2019). Table 21 shows that all the indicator loading values exceed the recommended threshold.

Construct	Indicator	Loadings	Construct	Indicator	Loadings
Design leadership			**Technology leadership**		
WRB	WRB1	0.896	EFT	EFT1	0.882
	WRB2	0.913		EFT2	0.867
	WRB3	0.887		EFT3	0.884
INT	INT1	0.884	PR	PR1	0.888
	INT2	0.912		PR2	0.885
	INT3	0.885		PR3	0.870
PELU	PELU1	0.891	RTP	RTP1	0.871
	PELU2	0.917		RTP2	0.879
	PELU3	0.882		PTR3	0.879
FV	FV1	0.886	AIUM	AIUM1	0.880
	FV2	0.909		AIUM2	0.870
	FV3	0.910		AIUM3	0.881
Brand leadership			**Moderator at corporate level**		
BA	BA1	0.937	GRP	GRP1	0.929
	BA2	0.937		GRP2	0.931
PQ	PQ1	0.899	DP	DP1	0.901
	PQ2	0.892		DP2	0.909
	PQ3	0.893		DP3	0.865
BP	BP1	0.892	**Moderator at customer level**		
	BP2	0.882	ESM	ESM1	0.917
	BP3	0.899		ESM2	0.873
COB	COB1	0.888		ESM3	0.899
	COB2	0.880	PV	PV1	0.910
	COB3	0.884		PV2	0.895
BOO	BOO1	0.901		PV3	0.882
	BOO2	0.889	PS	PS1	0.913
	BOO3	0.889		PS2	0.886
Customer Experience of WHT				PS3	0.906
PSAT	PSAT1	0.900	FS	FS1	0.943
	PSAT2	0.909		FS2	0.901
	PSAT3	0.899	**Sustainable consumption of WHT**		
REC	REC1	0.907	SC	SC1	0.887
	REC2	0.896		SC2	0.882
	REC3	0.896		SC3	0.861

Note: AIUM=AI-based usage monitoring; BA=Brand attitude; BOO=Brand of origin; BP=Brand prestige; COB=Customer-oriented behaviour; EFT=Effectiveness; FV=Functional value; INT=Interactivity; PELU=Perceived ease of learning and use; PQ=Perceived quality; PR=Perceived risk; RTP=Real-time process; WRB=Wearability; PSAT=Performance satisfaction; REC=Recommendation; SC=Sustainable consumption of WHT; DP=Disclose policy; ESM=Efficacy of self-health management; FS=Facilitating support; GRP=Government regulation policy; PS=Perceived severity; PV=Perceived vulnerability.

Table 21 Indicator Loadings

6.4.3 Common Method Bias

Self-report data are essentially those that are gathered directly from the individuals participating in the research. Numerous methods exist for obtaining self-report data, including but not limited to in-person interviews and questionnaire-based surveys. The nature of self-report data is such that they are derived from respondents' personal perspectives, including their attitudes, emotions, and beliefs (Jupp, 2006). Self-report techniques are often employed to measure variables in human behaviour studies; they might inadvertently induce a common method bias. (Podsakoff *et al.*, 2003). Consequently, this bias may artificially exaggerate the interconnections among the studied variables (MacKenzie and Podsakoff, 2012).

This study employed a survey based on self-reporting for its data gathering, which could potentially lead to the introduction of common method bias. In an effort to mitigate the impact of this bias on the data, the study employed two specific strategies. Initially, questionnaire items utilized for this study were sourced from prior research and modified to align with this study's specific objectives. This modification was rigorously scrutinized by several faculty members from the University. It was also put to the test in a pilot test to eliminate any ambiguities or potentially confusing elements in the queries. Secondly, according to Kock (2015), a VIF value greater than 3.3 indicates pathological collinearity and may suggest that a model is affected by common method bias. Hence, if the VIFs of all indicators in the inner model resulting from a comprehensive collinearity test are 3.3 or lower, it can be concluded that the model is not affected by common method bias (Kock, 2015). As shown in Table 22, the results indicated that all VIF values were less than 3.3, indicating that the model is unaffected by common method bias.

	CX	SC
AIUM	2.250	
BA	1.814	
BOO	2.340	
BP	1.792	
COB	1.834	
CX		1.209
DP		1.165
EFT	2.191	
ESM		1.150
FS		1.146
FV	1.575	
GRP		1.133
INT	1.814	
PELU	1.947	
PQ	2.32	
PR	1.970	
PS		1.141
PV		1.171
RTP	1.743	
WRB	1.796	
Design Leadership	1.212	
Technology Leadership	1.243	
Brand Leadership	1.215	
SC	-	-

Note: AIUM=AI-based usage monitoring; BA=Brand attitude; BOO=Brand of origin; BP=Brand prestige; COB=Customer-oriented behaviour; EFT=Effectiveness; FV=Functional value; INT=Interactivity; PELU=Perceived ease of learning and use; PQ=Perceived quality; PR=Perceived risk; RTP=Real-time process; WRB=Wearability; CX=Customer experience of using WHT; PSAT=Perceived satisfaction; REC=Recommendation; SC=Sustainable consumption of WHT; DP=Disclose policy; ESM=Efficacy of self-health management; FS=Facilitating support; GRP=Government regulation policy; PS=Perceived severity; PV=Perceived vulnerability

Table 22 Result of Common Method Bias Examination in SmartPLS4

6.4.4 Multicollinearity Test

Multicollinearity is a common problem arising from high levels of correlation between variables in a regression model (Hair, 2006). The variance inflation factor (VIF) is often used to evaluate the multicollinearity of indicators (Hair *et al.*, 2019). If indicators have VIF values of 5 or more, this suggests substantial collinearity issues. Nevertheless, it is important to note that even at VIF values as low as 3, collinearity can still be a concern (Becker *et al.*, 2015). The ideal situation is to have VIF values close to or below 3 (Hair *et al.*, 2019). The tolerance value is another assessment of the multicollinearity issue; the reasonable tolerance value should be greater than 0.1 (Kline, 2023).

As displayed in Table 23, all VIF values were less than 3, and all tolerance values were greater than 0.1, which indicates that the data did not present any significant

Indicator	VIF	Tolerance	Indicator	VIF	Tolerance
AIUM	2.181	0.459	RTP2	2.155	0.464
AIUM1	2.062	0.485	RTP3	2.064	0.484
AIUM2	2.002	0.500	INT	1.705	0.587
AIUM3	2.152	0.465	INT1	2.276	0.439
BA	1.758	0.569	INT2	2.645	0.378
BA1	2.323	0.430	INT3	2.250	0.444
BA2	2.323	0.430	PELU	1.876	0.533
BOO	2.289	0.437	PELU1	2.271	0.440
BOO1	2.430	0.412	PELU2	2.763	0.362
BOO2	2.287	0.437	PELU3	2.338	0.428
BOO3	2.310	0.433	SC1	2.114	0.473
BP	1.771	0.565	SC2	2.145	0.466
BP1	2.269	0.441	SC3	1.970	0.508
BP2	2.214	0.452	PQ	2.271	0.440
BP3	2.417	0.414	PQ1	2.452	0.408
COB	1.785	0.560	PQ2	2.339	0.428
COB1	2.194	0.456	PQ3	2.326	0.430
COB2	2.166	0.462	PR	1.939	0.516
COB3	2.176	0.460	PR1	2.180	0.459
DP1	2.289	0.437	PR2	2.225	0.449
DP2	2.726	0.367	PR3	2.031	0.492
DP3	2.157	0.464	PS1	2.702	0.370
EFT	2.152	0.465	PS2	2.422	0.413
EFT1	2.101	0.476	PS3	2.485	0.402
EFT2	1.979	0.505	PSAT	1.108	0.903
EFT3	2.188	0.457	PSAT1	2.479	0.403
ESM1	2.584	0.387	PSAT2	2.639	0.379
ESM2	2.286	0.437	PSAT3	2.502	0.400
ESM3	2.404	0.416	PV1	2.586	0.387
FS1	1.988	0.503	PV2	2.431	0.411
FS2	1.988	0.503	PV3	2.231	0.448
FV	1.544	0.648	REC	1.108	0.903

FV1	2.291	0.436	REC1	2.584	0.387
FV2	2.677	0.374	REC2	2.451	0.408
FV3	2.703	0.370	REC3	2.388	0.419
GRP1	2.144	0.466	WRB	1.746	0.573
GRP2	2.144	0.466	WRB1	2.433	0.411
RTP	1.696	0.590	WRB2	2.674	0.374
RTP1	1.985	0.504	WRB3	2.320	0.431

Note: AIUM=AI-based usage monitoring; BA=Brand attitude; BOO=Brand of origin; BP=Brand prestige; COB=Customer-oriented behaviour; EFT=Effectiveness; FV=Functional value; INT=Interactivity; PELU=Perceived ease of learning and use; PQ=Perceived quality; PR=Perceived risk; RTP=Real-time process; WRB=Wearability; PSAT=Performance satisfaction; REC=Recommendation; SC=Sustainable consumption of WHT; DP=Disclose policy; ESM=Efficacy of self-health management; FS=Facilitating support; GRP=Government regulation policy; PS=Perceived severity; PV=Perceived vulnerability.

Table 23 Multicollinearity Test Result

6.4.5 Demographic Information

This section provides a detailed description of the demographic characteristics of the respondents who participated in the main survey. A total of 647 valid surveys were collected from participants in China. Table 24 summarises the participants' demographic information, including their gender, age group, educational background, and monthly salary (in Yuan).

Regarding gender distribution, the data shows a near-equal split, with 325 participants (50.2%) male and 322 participants (49.8%) female, totalling 647 participants.

The age group distribution reveals that the largest group of participants were aged 60-65, accounting for 41.3% of the total respondents. The second-largest group comprised individuals aged 66-70, 35.4% of the total respondents. Participants aged 71-75 represented 10.4% of the total, while those aged 76-78 made up 8.8%. Individuals aged over 80 were the smallest group, constituting only 4.2% of respondents.

In terms of educational background, the largest proportion of respondents (38.8%) had a college or equivalent level of education. The second-largest group, comprising 29.8% of respondents, had a senior high school education.

Bachelor's degree holders comprised 15% of respondents, while those with an education level of junior high school or lower constituted 10.4%. At 6%, the smallest group held a master’s degree or higher.

Finally, the monthly salary distribution shows that the majority of respondents (39.1%) had a salary range of 3001-5000 Yuan. The next largest group, constituting 34% of respondents, earned between 5001-8000 Yuan monthly. Those earning 1001-3000 Yuan represented 13% of respondents, while a minority of 6.8% reported a salary of less than 1000 Yuan. An additional 7.1% of respondents reported a monthly salary exceeding 8001 Yuan.

		Frequency	**Percent**
Gender	Male	325	50.2%
	Female	322	49.8%
	Total	647	100.0%
Age group	60-65	267	41.3%
	66-70	229	35.4%
	71-75	67	10.4%
	76-80	57	8.8%
	Over 80	27	4.2%
	Total	647	100.0%
Education background	Junior high school or lower	67	10.4%
	Senior high school	193	29.8%
	College or equivalent	251	38.8%
	Bachelor’s degree	97	15.0%
	Master or higher degree	39	6.0%
	Total	647	100.0%
Salary	<1000	44	6.8%
	1001-3000	84	13.0%
	3001-5000	253	39.1%
	5001-8000	220	34.0%
	Over 8001	46	7.1%
	Total	647	100.0%

Table 24 Demographic Details of the Respondents (N=647)

6.4.6 Reflective Measurement Model

Vinzi *et al*. (2010) suggested a two-step approach for reporting analysis results, which involves presenting the results of the measurement model first and then presenting the structural model. In this section, the reflective measurement model consists of internal consistency reliability, indicator reliability, convergent validity, and discriminant validity.

6.4.6.1 Internal Consistency Reliability

Cronbach's alpha and CR is the most common measurement to assess internal consistency reliability (Chin, 1998). The criteria values of both Cronbach's alpha and CR are greater than 0.70 (Chin, 1998; Hair, 2006; Hair *et al.*, 2019). The values of Cronbach's alpha and CR of this survey are shown in Table 25; all the values are higher than 0.70. Thus, all the remaining measurements are reliable.

	Cronbach's Alpha	Composite Reliability (CR)
AIUM	0.850	0.909
BA	0.860	0.935
BOO	0.873	0.922
BP	0.870	0.920
COB	0.860	0.915
DP	0.872	0.921
EFT	0.851	0.910
ESM	0.878	0.925
FS	0.827	0.919
FV	0.885	0.929
GRP	0.844	0.928
INT	0.874	0.923
PELU	0.878	0.925
PQ	0.876	0.923
PR	0.856	0.913
PS	0.885	0.929
PSAT	0.886	0.930
PV	0.877	0.924
REC	0.882	0.927
RTP	0.849	0.909
SC	0.850	0.909
WRB	0.881	0.927

Note: AIUM=AI-based usage monitoring; BA=Brand attitude; BOO=Brand of origin; BP=Brand prestige; COB=Customer-oriented behaviour; EFT=Effectiveness; FV=Functional value; INT=Interactivity; PELU=Perceived ease of learning and use; PQ=Perceived quality; PR=Perceived risk; RTP=Real-time process; WRB=Wearability; PSAT=Performance satisfaction; REC=Recommendation; SC=Sustainable consumption of WHT; DP=Disclose policy; ESM=Efficacy of self-health management; FS=Facilitating support; GRP=Government regulation policy; PS=Perceived severity; PV=Perceived vulnerability.

Table 25 Results of Cronbach's Alpha and Composite Reliability

6.4.6.2 Convergent Validity and Discriminant Validity

If the Average Variance Extracted (AVE) value equals or exceeds 0.50, it signifies robust convergent validity. This implies that the latent variable accounts for over 50% of the variance in the indicators (Fornell and Larcker, 1981).

The Fornell-Larcker criterion, utilised to assess discriminant validity, proposes that the AVE of each construct should surpass the squared correlation between that construct and all other constructs (Fornell and Larcker, 1981). As displayed in Table 26, the diagonal elements are larger than the corresponding off-diagonal elements. This suggests that the square root of each construct's AVE is greater than its correlation with other latent variables, satisfying the criteria for adequate discriminant validity.

In addition to the AVE, factor loadings can also assess discriminant validity (Chin, 1998). To meet discriminant validity criteria, an indicator's loading should be higher than all its cross-loadings (Chin, 1998). As Table 27 shows, all factor loadings, highlighted in bold, were larger than their corresponding cross-loadings, indicating strong discriminant validity.

Another method used to measure discriminant validity is the heterotrait–monotrait ratio (HTMT) (Henseler, Ringle and Sarstedt, 2015). The HTMT value above 0.90 suggests a lack of discriminant validity (Henseler, Ringle and Sarstedt, 2015). As displayed in Table 28, all HTMT values were below the threshold of 0.90, confirming the discriminant validity of the measurement model.

Convergent validity		Discriminant validity																					
Indicators	AVE	AIUM	BA	BOO	BP	COB	DP	EFT	ESM	FS	FV	GRP	INT	PELU	PQ	PR	PS	PSAT	PV	REC	RTP	SC	WRB
AIUM	0.769	**0.877**																					
BA	0.877	0.209	**0.937**																				
BOO	0.798	0.264	0.580	**0.893**																			
BP	0.793	0.249	0.465	0.582	**0.891**																		
COB	0.782	0.287	0.437	0.599	0.533	**0.884**																	
DP	0.795	0.096	0.088	0.159	0.084	0.157	**0.892**																
EFT	0.770	0.659	0.227	0.241	0.187	0.227	0.102	**0.878**															
ESM	0.803	0.097	0.105	0.208	0.173	0.126	0.222	0.115	**0.896**														
FS	0.850	0.149	0.127	0.156	0.123	0.126	0.163	0.144	0.202	**0.922**													
FV	0.814	0.247	0.168	0.185	0.195	0.180	0.060	0.223	0.051	0.045	**0.902**												
GRP	0.865	0.153	0.066	0.098	0.070	0.102	0.209	0.176	0.151	0.149	0.133	**0.930**											
INT	0.799	0.258	0.264	0.201	0.227	0.232	0.127	0.250	0.058	0.137	0.400	0.123	**0.894**										
PELU	0.803	0.322	0.204	0.244	0.214	0.237	0.133	0.298	0.112	0.153	0.541	0.170	0.576	**0.896**									
PQ	0.801	0.273	0.608	0.654	0.574	0.570	0.131	0.209	0.165	0.138	0.197	0.063	0.271	0.229	**0.895**								
PR	0.777	-0.598	-0.256	-0.259	-0.239	-0.254	-0.087	-0.635	-0.107	-0.152	-0.226	-0.133	-0.230	-0.270	-0.263	**0.881**							
PS	0.813	0.128	0.017	0.059	0.048	0.037	0.215	0.139	0.183	0.167	0.054	0.198	0.073	0.125	0.046	-0.097	**0.902**						
PSAT	0.815	0.376	0.364	0.420	0.378	0.352	0.171	0.406	0.217	0.197	0.419	0.161	0.424	0.399	0.450	-0.379	0.206	**0.903**					
PV	0.803	0.182	0.019	0.094	0.084	0.140	0.239	0.157	0.172	0.207	0.126	0.210	0.054	0.170	0.083	-0.143	0.228	0.186	**0.896**				
REC	0.809	0.445	0.398	0.379	0.301	0.338	0.163	0.469	0.207	0.248	0.364	0.200	0.422	0.458	0.366	-0.461	0.100	0.317	0.171	**0.900**			
RTP	0.768	0.591	0.204	0.241	0.250	0.282	0.069	0.530	0.103	0.167	0.215	0.162	0.232	0.237	0.241	-0.531	0.087	0.390	0.121	0.427	**0.876**		
SC	0.769	0.475	0.338	0.396	0.343	0.384	0.339	0.496	0.406	0.346	0.355	0.356	0.373	0.421	0.393	-0.442	0.324	0.605	0.400	0.587	0.419	**0.877**	
WRB	0.808	0.247	0.179	0.219	0.213	0.182	0.066	0.230	0.058	0.066	0.504	0.082	0.561	0.540	0.224	-0.190	0.075	0.447	0.080	0.397	0.148	0.330	**0.899**

Note:
1. AIUM=AI-based usage monitoring; BA=Brand attitude; BOO=Brand of origin; BP=Brand prestige; COB=Customer-oriented behaviour; EFT=Effectiveness; FV=Functional value; INT=Interactivity; PELU=Perceived ease of learning and use; PQ=Perceived quality; PR=Perceived risk; RTP=Real-time process; WRB=Wearability; PSAT=Performance satisfaction; REC=Recommendation; SC=Sustainable consumption of WHT; DP=Disclose policy; ESM=Efficacy of self-health management; FS=Facilitating support; GRP=Government regulation policy; PS=Perceived severity; PV=Perceived vulnerability;
2. Diagonal elements in the correlation of constructs matrix are the square root of the average variance extracted.

Table 26 Result of Validity - AVE and Correlation of Constructs

	AIUM	BA	BOO	BP	COB	DP	EFT	ESM	FS	FV	GRP	INT	PELU	PQ	PR	PS	PSAT	PV	REC	RTP	SC	WRB
AIUM1	0.880	0.179	0.226	0.202	0.233	0.062	0.600	0.118	0.127	0.224	0.157	0.240	0.301	0.227	-0.546	0.120	0.332	0.149	0.398	0.531	0.398	0.230
AIUM2	0.870	0.163	0.247	0.243	0.279	0.084	0.566	0.081	0.148	0.212	0.117	0.213	0.258	0.240	-0.525	0.105	0.318	0.182	0.391	0.520	0.432	0.191
AIUM3	0.881	0.208	0.221	0.210	0.245	0.109	0.567	0.056	0.117	0.214	0.128	0.226	0.286	0.251	-0.500	0.110	0.339	0.148	0.381	0.501	0.422	0.229
BA1	0.206	0.937	0.538	0.441	0.412	0.063	0.227	0.107	0.122	0.141	0.056	0.226	0.189	0.557	-0.250	0.012	0.322	0.014	0.380	0.182	0.311	0.163
BA2	0.185	0.937	0.548	0.429	0.407	0.102	0.199	0.090	0.117	0.174	0.067	0.268	0.194	0.583	-0.230	0.019	0.359	0.021	0.366	0.201	0.322	0.173
BOO1	0.213	0.537	0.901	0.539	0.537	0.124	0.207	0.215	0.142	0.143	0.098	0.177	0.227	0.597	-0.218	0.048	0.398	0.090	0.351	0.223	0.356	0.191
BOO2	0.234	0.519	0.889	0.490	0.534	0.137	0.207	0.163	0.138	0.179	0.102	0.181	0.234	0.592	-0.225	0.026	0.365	0.081	0.323	0.180	0.339	0.196
BOO3	0.261	0.497	0.889	0.529	0.535	0.166	0.232	0.177	0.138	0.174	0.062	0.180	0.193	0.563	-0.252	0.086	0.362	0.080	0.342	0.242	0.367	0.199
BP1	0.243	0.413	0.537	0.892	0.483	0.059	0.168	0.154	0.122	0.175	0.035	0.204	0.193	0.531	-0.216	0.030	0.342	0.089	0.269	0.241	0.298	0.178
BP2	0.184	0.416	0.493	0.882	0.453	0.104	0.141	0.142	0.131	0.182	0.083	0.210	0.201	0.490	-0.201	0.040	0.333	0.066	0.266	0.195	0.321	0.210
BP3	0.236	0.413	0.524	0.899	0.488	0.063	0.190	0.166	0.077	0.164	0.071	0.193	0.179	0.511	-0.221	0.057	0.336	0.067	0.269	0.231	0.298	0.182
COB1	0.273	0.395	0.536	0.486	0.888	0.164	0.240	0.145	0.101	0.162	0.095	0.195	0.227	0.512	-0.236	0.080	0.327	0.113	0.310	0.283	0.358	0.162
COB2	0.245	0.370	0.512	0.457	0.880	0.140	0.167	0.126	0.145	0.138	0.058	0.236	0.205	0.496	-0.228	0.019	0.297	0.148	0.293	0.237	0.333	0.170
COB3	0.244	0.395	0.540	0.471	0.884	0.113	0.193	0.061	0.090	0.176	0.117	0.185	0.196	0.503	-0.210	-0.003	0.308	0.111	0.294	0.227	0.328	0.152
DP1	0.085	0.065	0.140	0.082	0.134	0.901	0.110	0.190	0.167	0.043	0.204	0.117	0.133	0.112	-0.079	0.226	0.158	0.228	0.156	0.079	0.338	0.061
DP2	0.077	0.095	0.174	0.089	0.163	0.909	0.075	0.227	0.158	0.063	0.165	0.122	0.128	0.146	-0.070	0.187	0.149	0.197	0.164	0.056	0.289	0.049
DP3	0.096	0.077	0.110	0.052	0.124	0.865	0.084	0.178	0.105	0.056	0.189	0.099	0.093	0.092	-0.085	0.156	0.151	0.212	0.112	0.047	0.272	0.067
EFT1	0.594	0.220	0.218	0.189	0.222	0.055	0.882	0.100	0.128	0.190	0.167	0.203	0.262	0.193	-0.574	0.134	0.377	0.168	0.419	0.475	0.439	0.173
EFT2	0.575	0.187	0.200	0.157	0.212	0.122	0.867	0.092	0.115	0.228	0.161	0.233	0.244	0.186	-0.552	0.104	0.357	0.125	0.403	0.466	0.452	0.237
EFT3	0.567	0.190	0.216	0.145	0.163	0.093	0.884	0.111	0.136	0.170	0.135	0.221	0.279	0.170	-0.545	0.126	0.335	0.120	0.413	0.453	0.416	0.198
ESM1	0.135	0.083	0.175	0.148	0.118	0.206	0.130	0.917	0.213	0.047	0.144	0.080	0.121	0.143	-0.140	0.163	0.205	0.169	0.246	0.114	0.403	0.083
ESM2	0.044	0.076	0.171	0.141	0.116	0.174	0.078	0.873	0.143	0.038	0.101	0.008	0.079	0.129	-0.068	0.143	0.168	0.144	0.138	0.090	0.310	-0.001
ESM3	0.072	0.123	0.212	0.175	0.104	0.215	0.095	0.899	0.180	0.051	0.157	0.058	0.097	0.169	-0.073	0.184	0.207	0.149	0.160	0.072	0.369	0.063
FS1	0.154	0.133	0.149	0.135	0.136	0.147	0.147	0.214	0.943	0.070	0.143	0.146	0.158	0.140	-0.156	0.168	0.219	0.209	0.255	0.175	0.356	0.092

	AIUM	BA	BOO	BP	COB	DP	EFT	ESM	FS	FV	GRP	INT	PELU	PQ	PR	PS	PSAT	PV	REC	RTP	SC	WRB
FS2	0.118	0.097	0.138	0.086	0.092	0.156	0.115	0.153	0.901	0.005	0.131	0.103	0.120	0.111	-0.122	0.138	0.134	0.169	0.197	0.129	0.273	0.021
FV1	0.196	0.120	0.152	0.153	0.139	0.060	0.228	0.047	0.043	0.886	0.102	0.345	0.473	0.156	-0.217	0.043	0.354	0.089	0.344	0.202	0.298	0.421
FV2	0.225	0.180	0.186	0.198	0.189	0.050	0.189	0.052	0.045	0.909	0.117	0.355	0.495	0.198	-0.205	0.066	0.387	0.147	0.323	0.186	0.334	0.491
FV3	0.246	0.152	0.161	0.176	0.158	0.052	0.188	0.039	0.034	0.910	0.141	0.383	0.494	0.178	-0.191	0.038	0.392	0.106	0.319	0.195	0.328	0.451
GRP1	0.138	0.042	0.089	0.060	0.078	0.196	0.162	0.158	0.146	0.137	0.929	0.109	0.150	0.044	-0.123	0.191	0.137	0.182	0.166	0.145	0.329	0.063
GRP2	0.147	0.080	0.093	0.070	0.112	0.193	0.165	0.124	0.131	0.111	0.931	0.119	0.166	0.073	-0.125	0.178	0.162	0.208	0.205	0.155	0.333	0.090
INT1	0.229	0.249	0.201	0.194	0.242	0.129	0.228	0.029	0.110	0.327	0.098	0.884	0.479	0.271	-0.228	0.044	0.380	0.033	0.370	0.218	0.337	0.499
INT2	0.242	0.241	0.182	0.212	0.197	0.104	0.229	0.071	0.131	0.374	0.127	0.912	0.560	0.230	-0.175	0.074	0.367	0.059	0.391	0.188	0.328	0.503
INT3	0.221	0.217	0.155	0.202	0.183	0.108	0.214	0.053	0.127	0.372	0.103	0.885	0.504	0.226	-0.217	0.077	0.391	0.054	0.370	0.217	0.337	0.502
PELU1	0.285	0.154	0.208	0.192	0.204	0.102	0.267	0.076	0.121	0.515	0.124	0.519	0.891	0.199	-0.252	0.117	0.353	0.142	0.404	0.195	0.351	0.505
PELU2	0.300	0.215	0.229	0.192	0.228	0.163	0.286	0.112	0.149	0.490	0.189	0.564	0.917	0.222	-0.247	0.111	0.371	0.168	0.432	0.229	0.410	0.514
PELU3	0.279	0.180	0.220	0.193	0.204	0.091	0.247	0.115	0.142	0.445	0.144	0.461	0.882	0.192	-0.226	0.108	0.349	0.148	0.394	0.214	0.370	0.429
PQ1	0.242	0.543	0.565	0.519	0.501	0.145	0.179	0.118	0.097	0.159	0.079	0.237	0.184	0.899	-0.241	0.060	0.394	0.088	0.317	0.217	0.333	0.204
PQ2	0.224	0.551	0.579	0.492	0.522	0.118	0.182	0.136	0.141	0.164	0.013	0.255	0.215	0.892	-0.216	0.033	0.405	0.058	0.327	0.211	0.343	0.202
PQ3	0.265	0.539	0.611	0.529	0.506	0.089	0.200	0.187	0.133	0.205	0.077	0.234	0.214	0.893	-0.250	0.032	0.409	0.075	0.339	0.219	0.379	0.196
PR1	-0.546	-0.245	-0.262	-0.227	-0.255	-0.093	-0.583	-0.121	-0.141	-0.161	-0.137	-0.158	-0.211	-0.255	0.888	-0.098	-0.344	-0.115	-0.407	-0.485	-0.406	-0.129
PR2	-0.524	-0.204	-0.202	-0.216	-0.223	-0.050	-0.548	-0.073	-0.119	-0.212	-0.108	-0.206	-0.233	-0.216	0.885	-0.062	-0.321	-0.121	-0.390	-0.444	-0.369	-0.187
PR3	-0.510	-0.228	-0.219	-0.187	-0.193	-0.087	-0.546	-0.089	-0.144	-0.229	-0.106	-0.249	-0.273	-0.224	0.870	-0.095	-0.335	-0.142	-0.424	-0.475	-0.392	-0.188
PS1	0.101	0.014	0.043	0.056	0.021	0.191	0.123	0.170	0.149	0.038	0.186	0.052	0.111	0.042	-0.076	0.913	0.193	0.205	0.086	0.067	0.302	0.080
PS2	0.113	-0.004	0.078	0.025	0.058	0.178	0.091	0.165	0.115	0.029	0.150	0.069	0.093	0.062	-0.062	0.886	0.158	0.196	0.086	0.056	0.264	0.057
PS3	0.132	0.033	0.042	0.046	0.024	0.212	0.157	0.162	0.184	0.077	0.196	0.077	0.131	0.025	-0.120	0.906	0.203	0.215	0.098	0.108	0.307	0.064
PSAT1	0.349	0.337	0.404	0.362	0.333	0.175	0.376	0.208	0.189	0.368	0.146	0.375	0.323	0.423	-0.347	0.183	0.900	0.195	0.270	0.369	0.553	0.388
PSAT2	0.335	0.324	0.388	0.352	0.304	0.153	0.363	0.192	0.184	0.393	0.150	0.399	0.398	0.407	-0.346	0.188	0.909	0.150	0.309	0.341	0.536	0.429
PSAT3	0.335	0.323	0.345	0.310	0.315	0.135	0.362	0.189	0.159	0.374	0.140	0.374	0.360	0.389	-0.332	0.186	0.899	0.160	0.278	0.347	0.550	0.393

	AIUM	BA	BOO	BP	COB	DP	EFT	ESM	FS	FV	GRP	INT	PELU	PQ	PR	PS	PSAT	PV	REC	RTP	SC	WRB
PV1	0.164	0.036	0.077	0.062	0.125	0.242	0.159	0.163	0.181	0.119	0.198	0.055	0.146	0.086	-0.124	0.215	0.176	0.910	0.153	0.090	0.375	0.059
PV2	0.172	0.000	0.101	0.088	0.131	0.200	0.153	0.153	0.170	0.104	0.200	0.038	0.150	0.084	-0.119	0.208	0.156	0.895	0.149	0.100	0.353	0.067
PV3	0.154	0.013	0.074	0.075	0.120	0.198	0.110	0.146	0.207	0.116	0.164	0.052	0.163	0.052	-0.142	0.190	0.168	0.882	0.158	0.136	0.347	0.090
REC1	0.435	0.360	0.338	0.279	0.316	0.138	0.450	0.193	0.206	0.336	0.177	0.381	0.432	0.311	-0.441	0.136	0.277	0.160	0.907	0.404	0.550	0.335
REC2	0.369	0.343	0.321	0.246	0.298	0.146	0.386	0.171	0.232	0.311	0.172	0.378	0.396	0.332	-0.398	0.064	0.269	0.149	0.896	0.361	0.511	0.330
REC3	0.396	0.372	0.365	0.287	0.297	0.156	0.429	0.193	0.231	0.334	0.189	0.378	0.408	0.346	-0.405	0.069	0.308	0.152	0.896	0.387	0.523	0.406
RTP1	0.524	0.173	0.218	0.228	0.253	0.018	0.468	0.105	0.138	0.187	0.109	0.185	0.219	0.209	-0.467	0.062	0.328	0.125	0.379	0.871	0.340	0.130
RTP2	0.496	0.182	0.217	0.220	0.237	0.096	0.444	0.070	0.177	0.190	0.138	0.231	0.191	0.203	-0.435	0.091	0.355	0.066	0.370	0.879	0.362	0.128
RTP3	0.532	0.181	0.200	0.210	0.252	0.070	0.480	0.095	0.127	0.189	0.177	0.195	0.213	0.221	-0.492	0.076	0.344	0.124	0.375	0.879	0.398	0.131
SC1	0.449	0.307	0.372	0.323	0.376	0.295	0.474	0.352	0.307	0.354	0.307	0.361	0.404	0.352	-0.414	0.281	0.583	0.365	0.542	0.391	0.887	0.346
SC2	0.397	0.270	0.310	0.284	0.308	0.290	0.418	0.371	0.318	0.265	0.325	0.303	0.351	0.317	-0.372	0.309	0.503	0.373	0.509	0.364	0.882	0.256
SC3	0.402	0.313	0.361	0.294	0.323	0.307	0.411	0.345	0.284	0.313	0.304	0.317	0.350	0.367	-0.374	0.261	0.502	0.314	0.493	0.345	0.861	0.263
WRB1	0.236	0.169	0.188	0.195	0.158	0.059	0.195	0.038	0.055	0.432	0.065	0.483	0.495	0.210	-0.192	0.070	0.372	0.077	0.360	0.122	0.293	0.896
WRB2	0.235	0.185	0.211	0.210	0.174	0.043	0.244	0.084	0.061	0.485	0.077	0.537	0.505	0.235	-0.189	0.078	0.420	0.064	0.380	0.148	0.328	0.913
WRB3	0.195	0.128	0.190	0.169	0.159	0.078	0.180	0.033	0.063	0.441	0.081	0.490	0.456	0.158	-0.128	0.053	0.413	0.076	0.329	0.129	0.266	0.887

Note: AIUM=AI-based usage monitoring; BA=Brand attitude; BOO=Brand of origin; BP=Brand prestige; COB=Customer-oriented behaviour; EFT=Effectiveness; FV=Functional value; INT=Interactivity; PELU=Perceived ease of learning and use; PQ=Perceived quality; PR=Perceived risk; RTP=Real-time process; WRB=Wearability; PSAT=Performance satisfaction; REC=Recommendation; SC=Sustainable consumption of WHT; DP=Disclose policy; ESM=Efficacy of self-health management; FS=Facilitating support; GRP=Government regulation policy; PS=Perceived severity; PV=Perceived vulnerability.

Table 27 Results of Validity - Cross Loadings

	AIUM	BA	BOO	BP	COB	DP	EFT	ESM	FS	FV	GRP	INT	PELU	PQ	PR	PS	PSAT	PV	REC	RTP	SC	WRB
AIUM																						
BA	0.244																					
BOO	0.307	0.669																				
BP	0.289	0.537	0.667																			
COB	0.336	0.508	0.691	0.616																		
DP	0.113	0.103	0.182	0.096	0.182																	
EFT	0.775	0.265	0.279	0.217	0.264	0.117																
ESM	0.107	0.120	0.236	0.197	0.145	0.253	0.130															
FS	0.175	0.148	0.183	0.141	0.147	0.190	0.169	0.229														
FV	0.284	0.192	0.210	0.222	0.206	0.069	0.258	0.057	0.051													
GRP	0.180	0.077	0.114	0.082	0.119	0.243	0.207	0.173	0.177	0.154												
INT	0.299	0.304	0.230	0.260	0.268	0.145	0.290	0.067	0.158	0.455	0.143											
PELU	0.372	0.235	0.279	0.245	0.272	0.150	0.344	0.126	0.177	0.612	0.197	0.655										
PQ	0.316	0.701	0.748	0.657	0.656	0.150	0.242	0.187	0.160	0.223	0.073	0.310	0.260									
PR	0.700	0.298	0.299	0.276	0.295	0.101	0.743	0.120	0.178	0.261	0.156	0.268	0.312	0.303								
PS	0.147	0.024	0.070	0.054	0.054	0.241	0.158	0.207	0.191	0.060	0.227	0.083	0.140	0.054	0.109							
PSAT	0.433	0.416	0.477	0.430	0.402	0.194	0.468	0.244	0.223	0.473	0.186	0.482	0.452	0.511	0.434	0.231						
PV	0.211	0.022	0.107	0.096	0.161	0.271	0.181	0.195	0.241	0.143	0.243	0.062	0.194	0.094	0.165	0.258	0.211					
REC	0.513	0.457	0.432	0.343	0.388	0.184	0.541	0.229	0.286	0.412	0.231	0.480	0.520	0.417	0.531	0.113	0.358	0.194				
RTP	0.694	0.239	0.280	0.290	0.329	0.083	0.622	0.118	0.197	0.249	0.191	0.270	0.274	0.279	0.621	0.099	0.450	0.140	0.494			
SC	0.559	0.396	0.460	0.399	0.448	0.391	0.582	0.466	0.406	0.408	0.420	0.433	0.486	0.456	0.517	0.372	0.696	0.462	0.677	0.492		
WRB	0.285	0.205	0.249	0.243	0.210	0.076	0.266	0.070	0.072	0.570	0.096	0.638	0.612	0.254	0.218	0.084	0.506	0.092	0.449	0.171	0.379	

Note: AIUM=AI-based usage monitoring; BA=Brand attitude; BOO=Brand of origin; BP=Brand prestige; COB=Customer-oriented behaviour; EFT=Effectiveness; FV=Functional value; INT=Interactivity; PELU=Perceived ease of learning and use; PQ=Perceived quality; PR=Perceived risk; RTP=Real-time process; WRB=Wearability; PSAT=Performance satisfaction; REC=Recommendation; SC=Sustainable consumption of WHT; DP=Disclose policy; ESM=Efficacy of self-health management; FS=Facilitating support; GRP=Government regulation policy; PS=Perceived severity; PV=Perceived vulnerability.

Table 28 HTMT Ratio

6.4.7 Structural Model

After the satisfactory assessment of the measurement model, the following step in evaluating PLS-SEM results is to assess the structural model. This assessment should consider standard evaluation criteria like the coefficient of determination (R2), the cross-validated redundancy measure Q2, the effect size assessment (f^2), and the significance and relevance of path coefficients (Hair *et al.*, 2019).

6.4.7.1 Model Validity: Path Coefficients

In the structural model, path coefficients indicate the strength and direction of the relationship between constructs (latent variables). A path coefficient can be interpreted similarly to a regression coefficient. It represents the expected change in the dependent construct for a one-unit change in the predictor construct, holding all other variables constant (Hair, Ringle and Sarstedt, 2011). According to Hair *et al*. (2011), the critical t-values for a two-tailed test are as follows:

- For a significance level of 5 per cent, the corresponding t-value is 1.96.
- For a significance level of 1 per cent, the corresponding t-value is 2.85.
- For a significance level of 0.1 per cent, the corresponding t-value is 3.29.

Standardised non-significant paths or exhibiting signs opposite to the hypothesised direction do not support the a priori hypothesis. Furthermore, significant paths that demonstrate the hypothesised direction provide empirical support for the proposed causal relationship. Therefore, if the t-value is equal to or greater than 1.96, the proposed hypotheses will be considered significant and supported. Conversely, if the t-value is less than 1.96, the proposed hypotheses will be regarded as not significant and not supported.

A PLS-SEM algorithm and a bootstrapping approach with 5,000 subsamples were employed to test all the path relationships in the model(Hair *et al.*, 2019). Table 29 and Figure 17 illustrate the results of the hypotheses testing. Figures 18 and 19 depict the results obtained from the models analysed using SmartPLS4.

The PLS-SEM algorithm, along with a bootstrapping approach consisting of 5000 subsamples, was utilised to examine the path relationships within the model, as suggested by Hair *et al*. (2019). The results of the hypotheses testing are illustrated in Table 29 and Figure 17.

Test of hypotheses regarding the relationship between Design Leadership construct and CX (H1, H1a, H1b, H1c and H1d)

The results demonstrate that DL (H1: $\beta=0.406$, $p<0.001$), WRB (H1a: $\beta=0.171$, $p<0.001$), INT (H1b: $\beta=0.123$, $p<0.001$), PELU (H1c: $\beta=0.086$, $p<0.01$) and FV (H1d: $\beta=0.131$, $p<0.001$) are positively related to CX, supporting hypotheses H1, H1a, H1b, H1c, and H1d.

H1: $\beta=0.406$, $p<0.001$. This indicates a strong and positive relationship, suggesting that higher levels of design leadership are associated with a significantly better customer experience.

H1a: $\beta=0.171$, $p<0.001$. A positive and moderate relationship, implying that the wearability sub-construct of design leadership also positively influences customer experience.

H1b: $\beta=0.123$, $p<0.001$. A positive, though relatively smaller relationship, suggesting a lesser but still significant influence of the interactivity sub-construct on customer experience.

H1c: $\beta=0.086$, $p<0.01$. A positive relationship, though weaker compared to other sub-constructs, indicating a modest impact of perceived ease of learning and use on customer experience.

H1d: β=0.131, $p<0.001$. This shows a positive and significant relationship, indicating that function value is an important factor in influencing customer experience.

Test of hypotheses regarding the relationship between Technology Leadership construct and CX (H2, H2a, H2b, H2c and H2d)

The results show that TL (H2: β=0.365, $p<0.001$), EFT (H2a: β=0.174, $p<0.001$) and RTP (H2c: β=0.164, $p<0.001$) have significant positive effect on CX, supporting hypotheses H2, H2a, and H2c. In addition, the results indicate that PR (H2b: β=-0.109, $p<0.001$) is negatively related to CX, supporting hypotheses H2b. Nonetheless, AIUM (H2d: β=0.003, $p>0.05$) is found not significant, hypothesis H2d is not supported.

H2: β=0.365, $p<0.001$. This demonstrates a strong and positive relationship, indicating that technology leadership is a crucial factor in enhancing customer experience.

H2a: β=0.174, $p<0.001$. A strong positive relationship, showing that effectiveness, a sub-construct of technology leadership, significantly affects customer experience.

H2b: β=-0.109, $p<0.001$. A negative relationship, suggesting that perceived risk inversely affects customer experience. This is an interesting finding, as it indicates that higher PR may lead to a poorer customer experience.

H2c: β=0.164, $p<0.001$. Another strong positive relationship, indicating that real-time process significantly contributes to improving customer experience.

H2d: β=0.003, $p>0.05$. This indicates a non-significant relationship, meaning AI-based usage monitoring does not have a meaningful impact on customer experience in this context.

Test of hypotheses regarding the relationship between Brand Leadership construct and CX (H3, H3a, H3b, H3c, H3d and H3e)

The results indicate that BL (H3: β=0.309, $p<0.001$), BA (H3a: β=0.112, $p<0.001$), PQ (H3b: β=0.120, $p<0.001$) and BOO (H3e: β=0.115, $p<0.001$) are positively related to CX, supporting hypotheses H3, H3a, H3b and H3e. However, BP (H3c: β=0.016, $p>0.05$) and COB (H3d: β=0.014, $p>0.05$) are found not significant, hypotheses H3c and H3d are not supported.

H3: β=0.309, $p<0.001$. This shows a positive and robust relationship, indicating that brand leadership is a key driver of customer experience.

H3a: β=0.112, $p<0.001$. Indicates a positive impact of brand attitude on customer experience, though the strength is moderate.

H3b: β=0.120, $p<0.001$. Perceived quality also shows a positive and significant relationship with customer experience.

H3c: β=0.016, $p>0.05$. A non-significant relationship for brand prestige, suggesting it does not substantially influence customer experience.

H3d: β=0.014, $p>0.05$. Similar to brand prestige, customer-oriented behaviour does not significantly impact customer experience.

H3e: β=0.115, $p<0.001$. Indicates a positive relationship between brand of origin and customer experience, suggesting its importance in the model.

Test of hypothesis regarding CX and SC (H4)

The results show that CX (H4: β=0.578, $p<0.001$) has significant positive effect on SC, supporting hypotheses H4: Customer experience of using WHT has a positive relationship with sustainable consumption of using WHT.

H4: β=0.578, $p<0.001$. This demonstrates a very strong and positive relationship, indicating that customer experience is a major factor influencing sustainable consumption.

Test of hypothesis regarding moderator at customer level (Ha, Hb, Hc and Hf)

The results indicate that ESM (Ha: β=0.058, p<0.01), PV (Hb: β=0.054, p<0.05), PS (Hc: β=0.080, p<0.001) and FS (Hf: β=0.092, p<0.001) have significantly positive impact on the relationship between customer experience and sustainable consumption of WHT for senior citizens, supporting hypotheses Ha, Hb, Hc and Hf.

Ha (ESM - Efficacy of Self-Health Management): β=0.058, p<0.01. Indicates that the belief in one's ability to manage their health effectively enhances the impact of CX on SC.

Hb (PV - Perceived Vulnerability): β=0.054, p<0.05. Suggests that the perception of being vulnerable to health issues can positively moderate the relationship between CX and SC.

Hc (PS - Perceived Severity): β=0.080, p<0.001. Implies that the perception of the severity of health issues strengthens the influence of CX on the sustainable consumption of WHT.

Hf (FS - Facilitating Support): β=0.092, p<0.001. Indicates that external support (e.g., from family, health services) plays a significant role in enhancing the CX-SC relationship.

Test of hypothesis regarding moderator at corporate level (Hd and He)

The results show that DP (He: β=0.096, p<0.001) has a significantly positive impact on the relationship between customer experience and sustainable consumption of WHT for senior citizens, supporting hypotheses He. However, the results indicate that GRP (Hd: β=0.041, p>0.05) is found not significant, hypothesis Hd is not supported.

He (DP - Disclose Policy): β=0.096, p<0.001. Shows that corporate policies related to disclosure and transparency significantly strengthen the relationship between CX and SC.

Hd (GRP - Government Regulation Policy): $\beta=0.041$, $p>0.05$. Suggests that government regulations do not significantly influence the CX-SC relationship in this context.

These results demonstrate the nuanced ways in which different factors at both the customer and corporate levels can impact how customer experience influences sustainable consumption of wearable health technology. Factors like self-health management efficacy, perceived vulnerability and severity, and facilitating support at the customer level, as well as corporate disclose policies, play significant roles in this relationship. In contrast, government regulation policies do not appear to have a notable impact in this specific study.

Table 29 provides a concise summary of the coefficients and significance levels associated with all the paths discussed earlier. From the obtained results, 19 of the initial 23 research hypotheses were validated. In contrast, the other four hypotheses were determined to be invalid.

Hypothesis	Path	Path coefficients	t-values	P values	Results
H1	DL→CX	0.406	16.327	***	Supported
H1a	WRB→CX	0.171	5.647	***	Supported
H1b	INT→CX	0.123	4.227	***	Supported
H1c	PELU→ CX	0.086	2.721	**	Supported
H1d	FV→CX	0.131	4.503	***	Supported
H2	TL→CX	0.365	14.842	***	Supported
H2a	EFT→CX	0.174	5.244	***	Supported
H2b	PR→CX	-0.109	3.317	***	Supported
H2c	RTP→CX	0.164	5.550	***	Supported
H2d	AIUM→CX	0.003	0.102	0.919	Not Supported
H3	BL→CX	0.309	12.061	***	Supported
H3a	BA→CX	0.112	3.607	***	Supported
H3b	PQ→CX	0.120	3.550	***	Supported
H3c	BP→CX	0.016	0.520	0.603	Not Supported
H3d	COB→CX	0.014	0.443	0.658	Not Supported
H3e	BOO→CX	0.115	3.320	***	Supported
H4	CX→SC	0.578	24.673	***	Supported
Ha	ESM*CX→SC	0.058	2.741	**	Supported
Hb	PV*CX→SC	0.054	2.519	*	Supported
Hc	PS*CX→SC	0.080	3.814	***	Supported
Hd	GRP*CX→SC	0.041	1.844	0.065	Not Supported
He	DP*CX→SC	0.096	4.417	***	Supported
Hf	FS*CX→SC	0.092	4.033	***	Supported

Note:

1. *p-value<0.05; **p-value<0.01; ***p-value<0.001
2. AIUM=AI-based usage monitoring; BA=Brand attitude; BOO=Brand of origin; BP=Brand prestige; COB=Customer-oriented behaviour; EFT=Effectiveness; FV=Functional value; INT=Interactivity; PELU=Perceived ease of learning and use; PQ=Perceived quality; PR=Perceived risk; RTP=Real-time process; WRB=Wearability; CX=Customer experience of using WHT; PSAT=Performance satisfaction; REC=Recommendation; SC=Sustainable consumption of WHT; DP=Disclose policy; ESM=Efficacy of self-health management; FS=Facilitating support; GRP=Government regulation policy; PS=Perceived severity; PV=Perceived vulnerability; DL=Design leadership; TL=Technology leadership; BL=Brand leadership.

Table 29 Results of Structural Regression Model

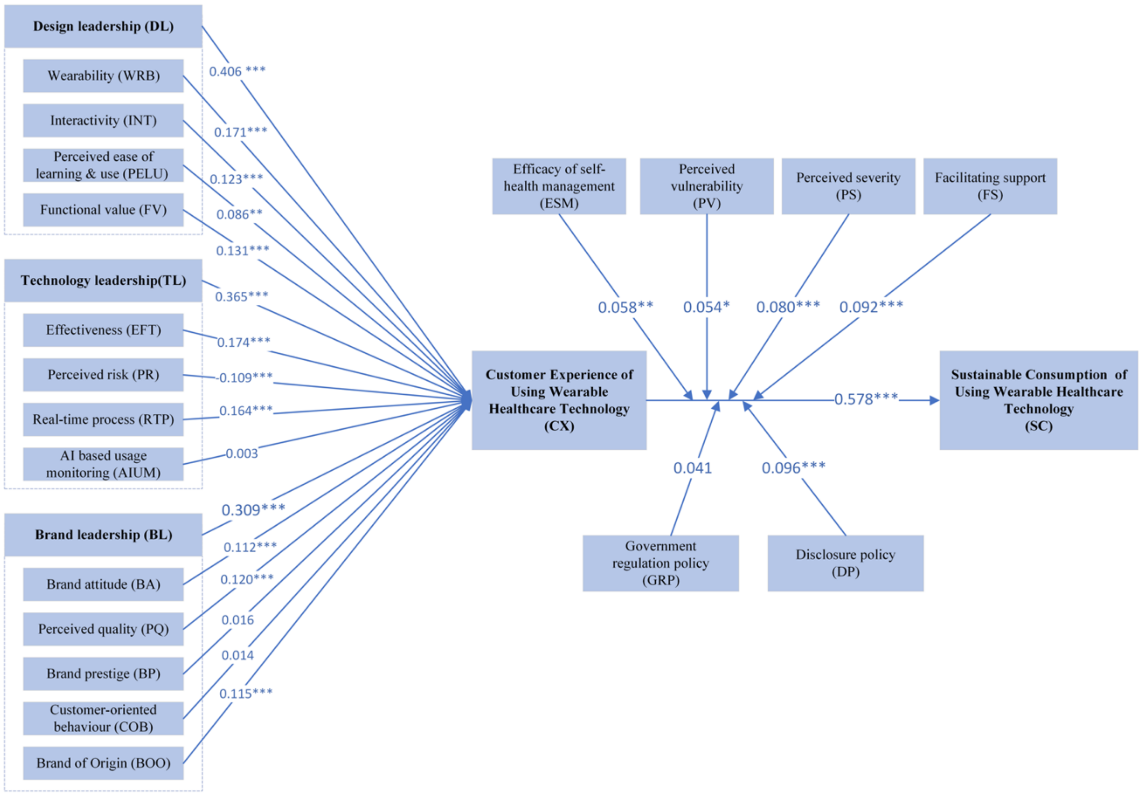


Figure 18 Model with Results

Note: * P-value<0.05; ** P-value <0.01; *** P-value <0.001

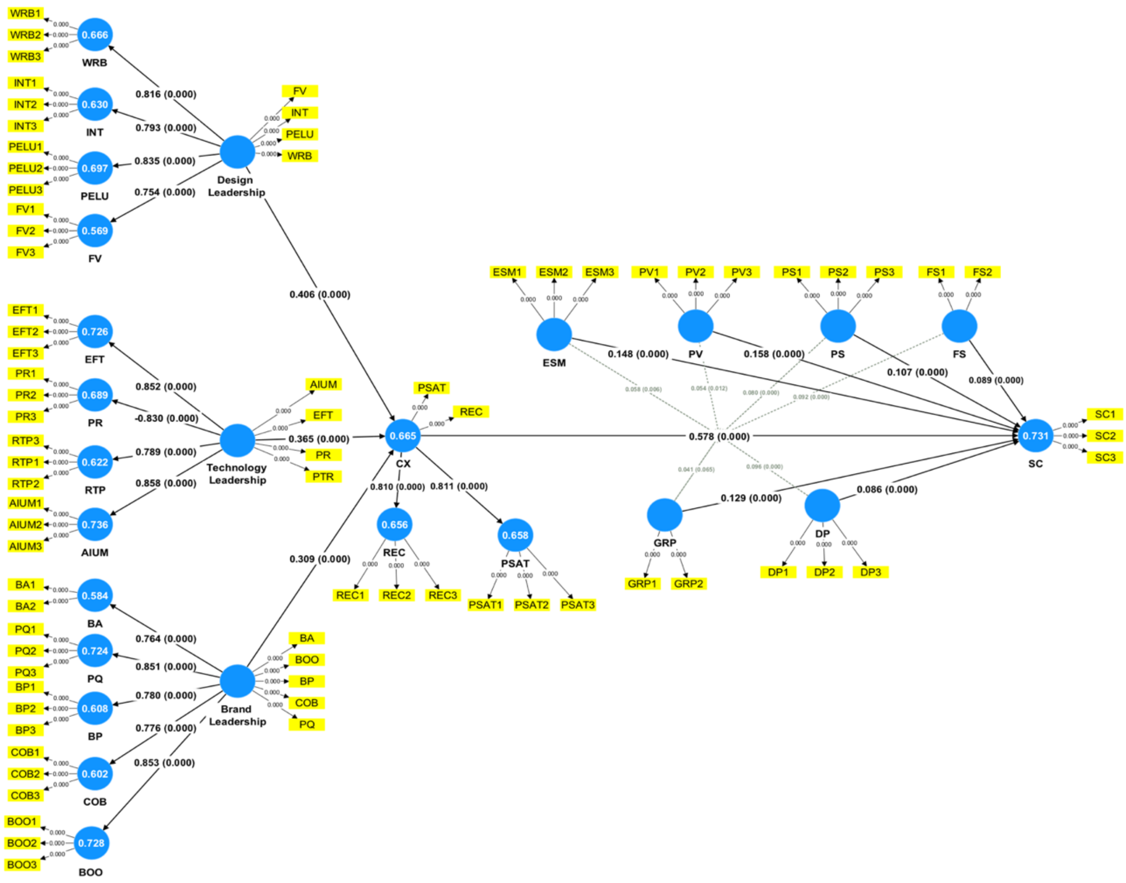


Figure 19 Second-Order Indicators Research Model

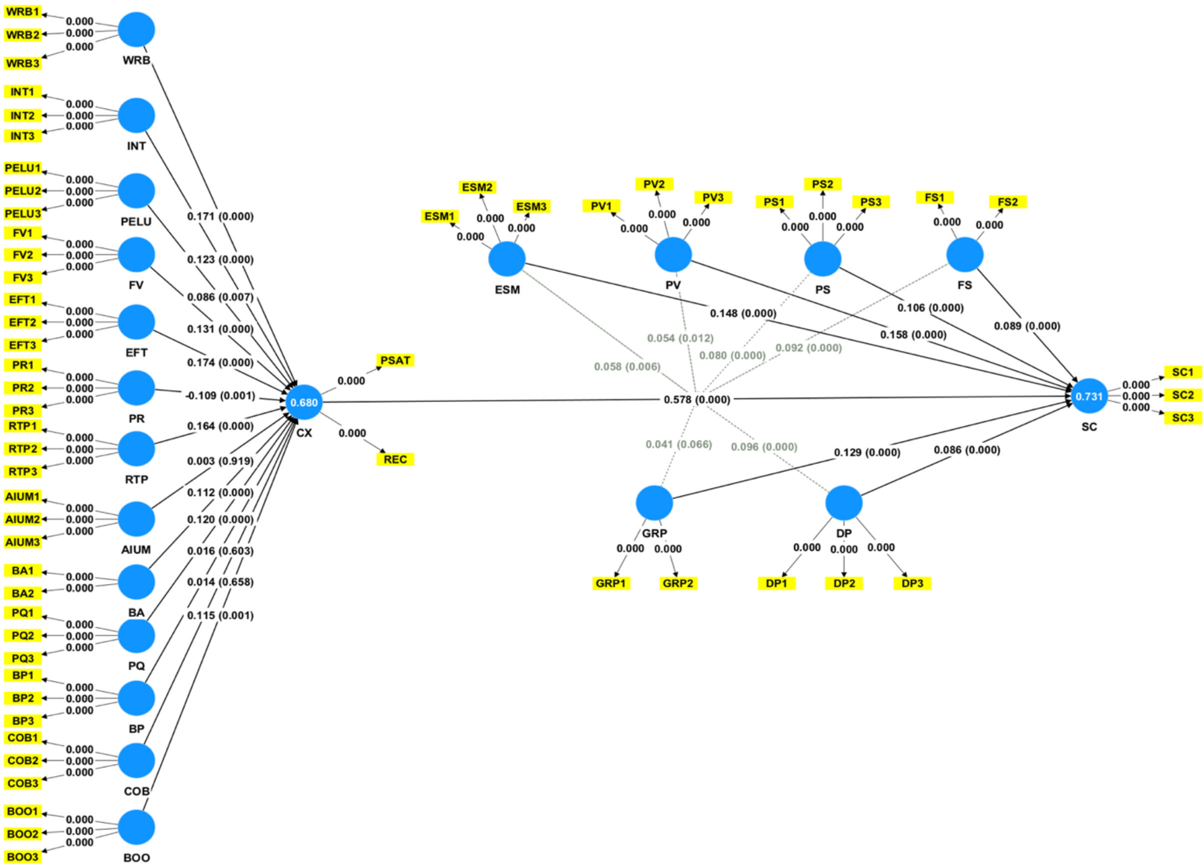


Figure 20 First-Order Indicators Research Model

6.4.7.2 Model Validity: Coefficients of Determination (R^2)

Assessing the quality of a structural model is a crucial task, commonly accomplished by using the metric R^2. This metric measures the proportion of the total variance of a hidden variable that the model's variance can explain. Essentially, R^2 represents the model's explanatory power and can be evaluated by measuring the variance explained in each dependent variable, known as endogenous constructs (Shmueli and Koppius, 2011). R^2 is also referred to as 'in-sample predictive power' in academic literature(Rigdon, 2012). R^2 ranges from 0 to 1, with higher values indicating stronger explanatory power. R^2 values of 0.60, 0.33, or 0.19 indicate a substantial, moderate, or weak effect, respectively (Cohen, 2013). The R^2 for customer experience of using WHT (CX) is 0.680, and the R^2 sustainable consumption of using WHT (SC) is 0.731. Almost 68% of the variance in customer experience of using WHT is explained by the variation of three leadership dimensions. Almost 73.1% of the variance in sustainable consumption of using WHT is explained by the variation in customer experience of using WHT. Hence, the values of R^2 indicate that the interpretability of the model is substantial.

	R Square	**R Square Adjusted**
Customer experience of using WHT	0.680	0.673
Sustainable consumption of WHT	0.731	0.726

Table 30 Coefficient of Determination (R^2)

6.4.7.3 Model Validity: Predictive Relevance (Q^2)

In the context of structural modelling, the evaluation of a model's capacity to predict goes beyond the dimensions of reliability, validity, and explained variance. An additional criterion used is the Stone-Geisser's Q^2 value, which was introduced by Geisser (1974) and Stone (1974). This value serves as an indicator of the model's predictive capacity for the indicators of each endogenous latent construct. The Q^2 value is obtained through the application of the Blindfolding procedure, which assesses cross-validated redundancy measures for each construct. A Q^2 value greater than zero indicates the predictive relevance of an endogenous construct for exogenous constructs (Fornell and Cha, 2014). Researchers such as Chin (1998) and Henseler, Ringle, and Sinkovics (2015) have established thresholds for interpreting Q^2 values: 0.02, 0.15, and 0.35 represent small, medium, and large predictive relevance, respectively, of an exogenous construct on an endogenous latent variable. In our study, all first-order endogenous variables exceeded 0.35, indicating a high degree of predictive relevance.

	SSO	**SSE**	**Q² (=1-SSE/SSO)**
AIUM	1941	851.990	0.561
BA	1294	637.101	0.508
BOO	1941	821.961	0.577
BP	1941	1012.535	0.478
COB	1941	1036.196	0.466
CX	1294	734.893	0.432
EFT	1941	866.127	0.554
FV	1941	1051.885	0.458
INT	1941	972.772	0.499
PELU	1941	865.390	0.554
PQ	1941	824.313	0.575
PR	1941	912.228	0.530
PSAT	1941	915.902	0.528
REC	1941	924.975	0.523
WTB	1941	905.522	0.533
RTP	1941	1023.756	0.473
SC	1941	883.921	0.545

Note: AIUM=AI-based usage monitoring; BA=Brand attitude; BOO=Brand of origin; BP=Brand prestige; COB=Customer-oriented behaviour; EFT=Effectiveness; FV=Functional value; INT=Interactivity; PELU=Perceived ease of learning and use; PQ=Perceived quality; PR=Perceived risk; RTP=Real-time process; WRB=Wearability; PSAT=Performance satisfaction; REC=Recommendation; SC=Sustainable consumption of WHT; DP=Disclose policy; ESM=Efficacy of self-health management; FS=Facilitating support; GRP=Government regulation policy; PS=Perceived severity; PV=Perceived vulnerability.

Table 31 Construct Cross Validated Redundancy (Q^2)

6.4.7.4 Model Validity: Effect Size (f^2)

Another method for evaluating a structural model's quality is through assessing effect sizes (f^2) for each path, as Cohen (1988) proposed. Effect size measures the significant impact of an independent latent variable on a dependent variable. In the context of structural modelling, f^2 values of 0.02, 0.15, or 0.35 indicate small, medium, or large effects, respectively, of an exogenous latent variable on an endogenous latent variable, as suggested by Chin (1998) and Cohen (1988).

The effect sizes of the exogenous variables on the endogenous variables are summarized in Table 32. Grey values indicate small effects. DP, ESM, FS, GRP, PS, and PV have effect sizes of 0.024, 0.071, 0.026, 0.055, 0.037, and 0.079, respectively, indicating minimal impact on SC. Technology leadership and brand leadership, highlighted in blue, have medium effects on CX, with effect sizes of 0.320 and 0.235, respectively. Significant effects are represented by green values. Design leadership significantly affects CX, with an effect size of 0.407. Similarly, CX strongly affects SC, with an effect size of 1.028.

	SC	**CX**
CX	1.028	
Design Leadership		0.407
Technology Leadership		0.320
Brand Leadership		0.235
DP	0.024	
ESM	0.071	
FS	0.026	
GRP	0.055	
PS	0.037	
PV	0.079	

Note:
1. CX=Customer experience of using WHT; SC=Sustainable consumption of WHT; DP=Disclose policy; ESM=Efficacy of self-health management; FS=Facilitating support; GRP=Government regulation policy; PS=Perceived severity; PV=Perceived vulnerability.
2. Grey: small effect; Blue: medium effect; Green: high effect.

Table 32 Effect Size (f^2)

6.5 Conclusion

This study presents a research framework that examines the sustainable consumption of WHT among senior citizens who have experience of using WHT. The framework incorporates three leadership aspects of WHT: design leadership, technology leadership, and brand leadership, while considering the customer experience of using WHT.

Empirical data from 647 senior citizens with prior WHT usage experience were collected and deemed valid. Furthermore, the research model underwent testing using the Partial Least Squares Structural Equation Modelling (PLS-SEM) approach, which provides a robust analytical method for assessing the relationships within the framework.

The data investigation results indicate that the customer experience of using WHT, design leadership, technology leadership, and brand leadership have significant and positive effects on sustainable consumption of using WHT.

Specifically, in the context of design leadership, all the first-order indicators, including wearability, interactivity, perceived ease of learning and use, and functional value, were found to have significant positive impacts on the customer experience of using WHT. This suggests that these indicators play a crucial role in enhancing the overall customer experience.

Similarly, within technology leadership, both effectiveness and real-time process were identified as significant factors positively affecting the customer experience of using WHT. Additionally, brand attitude, perceived quality, and brand of origin within brand leadership were found to have significant and positive effects on the customer experience of using WHT.

However, it is noteworthy that the perceived risk within technology leadership was found to have a significant but negative impact on the customer experience of using WHT. This implies that customers perceive some level of risk associated with the technology used in WHT, which can affect their overall experience negatively. Besides, the results show that AI-based usage monitoring, brand prestige and customer-oriented behaviour did not be identified as having any significant impact on customer experience of using WHT.

Regarding moderators, at the customer level, efficacy of self-health management, perceived vulnerability, perceived severity, and facilitating support were identified as significant and positively impacting the relationship between customer experience of using WHT and sustainable consumption of using WHT. However, at corporate level, government regulation policy did not exhibit any significant effect on this relationship.

The research model explains 73.1% of sustainable consumption of WHT for senior citizens. These findings provide valuable insights into the factors influencing sustainable consumption of WHT among senior citizens and shed light on the importance of customer experience, design leadership, technology leadership, and brand leadership in shaping their consumption behaviours. Additionally, the identified moderators highlight the significance of individual factors, such as self-health management and facilitating support, as well as the role of disclosure policy at the corporate level, in influencing the relationship between customer experience and sustainable consumption of using WHT.

6.6 Discussion

6.6.1 Not Supported Hypotheses

H2d: AI-based usage monitoring has a positive relationship with the customer experience of using WHT.

The H2d: AI-based usage monitoring has a positive relationship with the customer experience of using WHT was not supported in this study. The progress of AI in elderly care has achieved high-speed development, such as social robots to release agitation (Jøranson *et al.*, 2016), robot and environmental sensors to improve the quality of care (Obayashi and Masuyama, 2020), and smart home with AI to support activities of daily living (Rantz *et al.*, 2017). Given the aging population and declining birth rates, particularly in China, AI-based technologies are increasingly recognized as vital in monitoring healthcare conditions and improving care quality for senior citizens. Nevertheless, concerns regarding the implementation of AI applications in healthcare have also been raised. Although technology has rapidly developed, senior citizens seem to be excluded, and a 'physical-digital divide' is produced (Chu *et al.*, 2022). Furthermore, there is a prevalent misconception that older adults constitute a homogeneous group characterized by decline, incompetence, and dependence on younger individuals for guidance in technology (Mannheim *et al.*, 2019). Moreover, these paternalistic stereotypes and patronizing attitudes contribute to a form of ageism known as compassionate ageism, which encompasses prevailing stereotypes about older individuals in public discourse (Binstock, 1983). Unfortunately, these stereotypes become entrenched and internalized by older adults themselves (Vervaecke and Meisner, 2021). These ageist stereotypes contributed to a negative impact on their cognitive and psychological well-being (Hehman and Bugental, 2015). The perception that senior citizens are too old to embrace advanced technology can lead to their belief that they are unable to adopt AI-based technologies (Chu *et al.*, 2022).

Research indicates that people generally perceive algorithmic decisions as less reliable than human decisions and exhibit resistance towards following them (Lee and Rich, 2021). Numerous studies have shown that individuals tend to place less trust in algorithmic decisions compared to human decisions, especially in tasks believed to necessitate human-specific capabilities (Lee, 2018), involve subjective judgments (Castelo, Bos and Lehmann, 2019), or require attention to individual uniqueness (Longoni, Bonezzi and Morewedge, 2019).

In this study, AI-based technologies did not play a significant role in the customer experience of WHTs for senior citizens. As mentioned previously, there is a stereotype that senior citizens may struggle to adopt new technologies without assistance from younger generations. This ageist stereotype can influence their perception of AI-based technologies, leading them to view them as complex rather than convenient tools. This insight was further supported by qualitative data obtained in the interview study, providing additional evidence for the influence of this stereotype on senior citizen's technology adoption attitudes.

> *"I am not familiar with AI. If it can provide some suggestions, yes, I think it is nice. But the details of it are quite complex; I have no idea about it, and I do not know what AI can do in the future... I think highly of this technology; it is a trend. But it is complex for me. I would like to learn, but I do not know the details of it." (Participant 10, female)*

> *"I think I can benefit from AI-based usage monitoring, but I do not know too much about it." (Participant 20, male)*

In addition, combined with qualitative research results, senior citizens tend to express lower trust in algorithmic decisions compared to human decisions. Despite recognizing the significant advancements of AI-based technologies and acknowledging their growing influence in various fields, seniors still perceive human decision-making as more trustworthy.

"I trust the doctor more. AI does not have a comprehensive diagnosis for me. I prefer humans to check my health situation." (Participant 13, female)

"I think I can benefit from AI-based technology…But AI is not human. It can just remind people from some aspects. I think it can be seen as a reference." (Participant 18, male)

This sentiment highlights the enduring value placed on human judgment and expertise, suggesting that trust in technology may require further development and reinforcement among senior populations.

H3c: Brand prestige has a positive relationship with the customer experience of using WHT.

The H3c: Brand prestige has a positive relationship with the customer experience of using WHT was not supported in this study. Brand prestige refers to the elevated status or perception of superiority associated with positioning a brand's products. It signifies the brand's reputation for excellence and distinguishes it from other competitors in the market (EM Steenkamp, Batra and Alden, 2003). Alden, Steenkamp and Batra (1999) stated that consumers often perceive prestige brands as a signal of social status, wealth, or power. This perception stems from the fact that prestige brands are typically associated with infrequent purchases and are closely tied to an individual's self-concept and social image. By choosing to consume prestigious brands, consumers aim to convey their elevated social standing and assert their identity in society. However, brand prestige does not influence all individuals equally (Vigneron and Johnson, 1999). Besides, senior citizens are often overlooked in the advertising landscape, particularly in the context of digital products, despite their status as active consumers. Their needs and preferences are frequently neglected, resulting in a lack of targeted advertising campaigns aimed at this demographic. This oversight fails to recognize senior citizens' purchasing power and potential as a consumer segment (Hirsch, 2023).

Brand prestige is essential in increasing purchase intention (EM Steenkamp, Batra and Alden, 2003). In this study, it was observed that brand prestige did not significantly impact the customer experience of using WHTs for senior citizens. One possible explanation for this finding is that the influence of brand prestige may diminish over time and may not have a continuous impact on the customer experience following the initial purchase. Senior citizens may rely more on recommendations from trusted sources, such as healthcare professionals, friends, or family members rather than brand reputation alone. The influence of personal experiences and opinions from individuals in their social networks could overshadow the significance of brand prestige when evaluating the customer experience of WHTs. The results of the qualitative study also provided evidence of these findings. In other words, word-of-mouth and recommendations sometimes replay or corroborate brand prestige for senior citizens.

"Nearly all my friends use the products of this brand. Everybody chooses it, so I think it is a good brand." (Participant 13, female)

"Nearly all my friends use this brand of products. If it is not good, why do so many people choose it." (Participant 12, female).

H3d: Customer-oriented behaviour has a positive relationship with the customer experience of using WHT.

The behaviour of salespeople holds substantial significance in the success of organizations, as they are perceived as a vital link between customers and the company. Salespeople play a pivotal role in developing and delivering value to customers. Their actions and interactions directly impact customer satisfaction, experience, and overall organizational performance (Amenuvor, Yi and Boateng, 2022). Customer-oriented behaviour refers to specific actions and conduct displayed by individuals during service encounters. This behaviour is characterized by a focus on meeting customer needs, preferences, and expectations. By engaging in customer-oriented behaviour, individuals aim to ensure customer satisfaction and create positive experiences that enhance customer loyalty and overall customer satisfaction levels (Farrell, Souchon and Durden, 2001). Over the past three decades, numerous studies have consistently indicated a strong link between customer-oriented employees and satisfied customers. These studies have revealed that when employees exhibit customer-oriented behaviours, such as actively listening to customer needs, providing personalized assistance, and going the extra mile to meet customer expectations, it positively influences customer satisfaction (Hennig-Thurau and Thurau, 2003; Susskind, Kacmar and Borchgrevink, 2003; Stock and Hoyer, 2005).

This study discovered that there is no significant relationship between customer-oriented behaviour and the customer experience of using WHT for senior citizens in the long-term adoption stage. One potential explanation for this finding is that salespeople play a more critical role in the initial purchasing decision rather than in the long-term adoption stage. After the purchase, customers may not perceive a significant impact from the behaviours of salespeople on their overall experience with the product.

Moreover, the increasing popularity of online shopping among senior citizens allows them to save time and avoid unnecessary communication with salespeople. This diminishes the significance of the salespeople's behaviours on the customer experience. Additionally, some senior citizens may not make the purchase themselves, as their families may handle the purchasing process and experience the sales services on their behalf. In this case, the introduction and assistance from family members replace the direct involvement of salespeople in shaping the customer experience.

The qualitative study also lends support to this perspective by offering evidence that aligns with the lack of a significant impact of customer-oriented behaviour on the customer experience of using WHT for senior citizens. The findings from the qualitative interviews indicate that there is limited communication between salespeople and senior citizens. This further strengthens the notion that the behaviours of salespeople have a minimal effect on the overall customer experience.

For instance, in interviews conducted with senior citizens, participants mentioned that they often rely on online shopping to make their purchases, which reduces the need for direct interaction with salespeople.

> *"I do not have many connections with their staff. My children would buy it for me. And online shopping is the mainstream." (Participant 10, female)*

> *"I do not have many connections with the staff of this brand…I do not care about the service attitude. If the product is good, then I would like to use it, no matter if the service attitude is good or bad." (Participant 1, female)*

Hd: Government regulation policy has a positive impact on the relationship between customer experience and sustainable consumption of WHT by senior citizens.

The Hd: government regulation policy has a positive impact on the relationship between customer experience and sustainable consumption of WHT by senior citizens, which was not supported in this study. As reported in the literature review chapter, some scholars found that the government regulation policy is a crucial impact factor for senior citizens to accept related healthcare services (Hsiao and Tang, 2015; Lupton, 2017; Peng *et al.*, 2023).

In this study, the validation of government regulation policy was not supported. There are several potential reasons for this outcome. Firstly, the adoption and sustainable consumption of WHTs among senior citizens are still in the early stages. This suggests that government regulation policies may not have caught up or become a significant consideration yet. In the absence of a well-established market and widespread adoption, the direct impact of government regulations may be less apparent.

Additionally, the inclusion of monitoring data in the study was limited, and most WHTs examined were non-invasive and lacked treatment functions. This may have led senior citizens to perceive these technologies as posing fewer risks or threats to their well-being. Consequently, the need for government regulations may not be deemed essential in their decision-making process.

It is important to acknowledge that as the field of WHTs evolves and increasingly sophisticated technologies with potential risks emerge, the role of government regulations may become more prominent. Continued research and monitoring of the adoption and usage patterns of WHTs among senior citizens will provide valuable insights for policymakers to consider in shaping future regulations.

6.6.2 Supported Hypotheses

H1: Design leadership has a positive relationship with the customer experience of using WHT.

Design leadership, introduced as a new secondary-order construct in the research framework, plays a pivotal role in visually communicating products to customers. It emphasizes that a product's design has the potential to enhance the overall 'service' and user experience through thoughtful and humanized design principles (Su and Su, 2012). In the context of healthcare products, incorporating empathy into the design process becomes particularly significant as it fosters a meaningful user experience by prioritizing factors such as respect for spiritual pursuits, satisfaction, and humanity (Su and Su, 2012; Carmel-Gilfilen and Portillo, 2016).

This study's findings support the hypothesis that design leadership significantly influences the customer experience of using WHT and the subsequent sustainable consumption of WHT. The absence of design leadership negatively impacts the effectiveness of users in adapting, learning, and utilizing the devices, ultimately resulting in a diminished customer experience and hindering the long-term adoption and consumption of the products.

In summary, design leadership plays a vital role in shaping the customer experience and influencing the sustainable consumption of healthcare devices. By prioritizing user-centred design principles and incorporating empathy into the design process, companies can enhance the effectiveness and usability of their products, ultimately fostering a positive and enduring user experience.

H1a: Wearability has a positive relationship with the customer experience of using WHT.

WHT, in contrast to handheld or embedded devices, must possess all-weatherproof durability to effectively support customers in various aspects of their lives, including sleeping, working, showering, exercising, and more (Gu and Wei, 2021). This necessitates the ability of WHT to withstand different environmental conditions and activities. To seamlessly integrate into daily routines, WHT should possess qualities such as durability, comfort, appropriate sizing, portability, and a strong and long-lasting battery.

The impact of wearability on users' attitudes toward WHT has been emphasized in numerous studies (e.g., Gu and Wei, 2021; Jeong and Choi, 2022; Patil *et al.*, 2022). Consistent with previous research, this study found that wearability has a positive influence on the customer experience of using WHT. This suggests that as customers' expectations for WHT increase, favourable wearability performance enables them to have a better user experience and establishes a foundation for long-term adoption.

In summary, the durability and wearability of WHT are crucial factors that contribute to the overall customer experience. By ensuring all-weatherproof durability and focusing on creating WHT that is comfortable, portable, and properly sized, companies can enhance the usability and acceptance of their products among customers.

H1b: Interactivity has a positive relationship with the customer experience of using WHT.

In the context of using WHT, users are primarily concerned with receiving information feedback through the interface between themselves and the devices. Interactivity, in this context, is recognized as a crucial factor in fostering a positive relationship between users and the device. Consequently, devices with higher levels of interactivity tend to be more appealing to users (Sutcliffe and Hart, 2017).

The role of interaction extends beyond wearable devices and can also be observed in personal health record services. In this domain, interaction plays a significant role in influencing adoption-related behaviours, as highlighted by research conducted by Hietala *et al.* (2009) and Windasari and Lin (2021).

In summary, both in the context of wearable devices and personal health record services, interactivity holds importance in establishing positive user-device relationships and influencing adoption behaviours. Consistent with previous research, this study found that interactivity has a positive influence on the customer experience of using WHT. In the research context of this study, the interactivity of WHT enhances the user experience for senior citizens and encourages them to explore the device's various functions and applications. It is worth noting that some senior citizens may be influenced by ageist stereotypes and may feel apprehensive about complex operations when using WHT. Therefore, it is crucial to provide a user-friendly and concise operating system that enables rapid familiarity and ease of use for senior citizens.

H1c: Perceived ease of learning and use has a positive relationship with the customer experience of using WHT.

Perceived ease of learning and use is recognized as a significant obstacle to the adoption of WHT among senior citizens (Chu, Chen and Wang, 2019; Kim and Choudhury, 2020). It has been suggested that age-related declines in learning ability make it crucial to address the learning issue among senior citizens (Chu, Chen and Wang, 2019). Therefore, fostering motivation for learning becomes essential in facilitating the adoption of WHT among seniors. According to Kim and Choudhury (2020), a considerable number of senior participants believe that new technology is difficult to learn, and some even doubt their learning capabilities. Additionally, many seniors express fear and embarrassment when it comes to learning new technology.

The reluctance of senior citizens to change their established routines, regardless of the value offered by new technology, further exacerbates the challenge of perceived ease of learning (Kim and Choudhury, 2020). This resistance to change hinders their willingness to learn and adopt new technologies. However, once the barrier of perceived ease of learning is successfully overcome, senior citizens can quickly become active users of the technology (Kim and Choudhury, 2020).

This study reveals that perceived ease of learning and use has a positive impact on the customer experience of using WHT for senior citizens. It is observed that some seniors consider learning and using new technology as challenging. Therefore, a WHT that requires minimal learning and is easy to use can create a relaxed and enjoyable user experience for them. Moreover, providing multiple learning channels within the WHT can assist senior citizens in becoming familiar with the device and enhance their overall satisfaction and enjoyment in using it.

H1d: Functional value has a positive relationship with the customer experience of using WHT.

Functional value is one of the key determinants of customer purchase behaviour. It refers to the perceived ability of a product or service to have a functional, practical or physical purpose (Sheth, Newman and Gross, 1991). The initial purpose of using WHT is a factor which can explain the sustainable consumption of WHT (Gouveia, 2016). WHT need to have functions that are irreplaceable by other devices (Gu and Wei, 2021).

In the healthcare domains, WHTs play a crucial role, offering various biometric functions. These devices are equipped with sophisticated sensors that enable them to track essential metrics such as sweat and pulse, monitor aerobic activity, measure body temperature, blood sugar levels, blood pressure, electrocardiograms, sleep patterns, exercise consumption, and more. WHTs offer a broader range of functionalities compared to many handheld devices, making them indispensable tools in these fields. Thus, it is important for WHTs to show their advantage in functional value to make customers know that using WHTs can obtain better customer experience compared with other devices by managing health more conveniently.

This study confirms the positive relationship between functional value and the customer experience of using WHT for senior citizens, which is consistent with previous research findings (e.g., Chu, Chen and Wang, 2019; Kononova *et al.*, 2019; L. Li *et al.*, 2019; Gu and Wei, 2021). In the context of WHT, the functional value encompasses the features, capabilities, and performance of the devices that directly contribute to enhancing the customer experience. The qualitative study in this research also provides support for this relationship. The findings from the qualitative interviews reveal that senior citizens consider the functional value of WHTs as a crucial factor in their decision-making process. Regardless of whether the functions are healthcare-related or not, senior citizens are primarily attracted to the functional benefits offered by WHTs, which influences their purchase, adoption, customer experience and long-term usage of these technologies.

H2: Technology leadership has a positive relationship with the customer experience of using WHT.

Technology leadership, introduced as a secondary-order construct in the research framework. It plays an essential role in presenting the competitiveness in marketing and guaranteeing the performance of the product (Zhang, Zhao and Lyles, 2018; Bendig *et al.*, 2022). With the rapid development of IT, various technologies have been incorporated into WHT. Therefore, it is crucial to understand customers' perceptions of technology and investigate the effectiveness of technology in enhancing the customer experience.

The findings of this study support the hypothesis that technology leadership has a significant impact on the customer experience of using WHT. This implies that the integration of advanced technologies in WHT positively influences customers' overall perception and satisfaction with the product. By leveraging technology leadership, companies can enhance the performance, functionality, and usability of their WHT, ultimately contributing to a more positive and enjoyable customer experience.

In summary, technology leadership plays a vital role in shaping the customer experience of using WHT. Emphasizing technological advancements and effectively incorporating them into WHT can enhance customers' perceptions and satisfaction, leading to increased adoption and sustained usage of these technologies.

H2a: Effectiveness has a positive relationship with the customer experience of using WHT.

In the context of WHT, effectiveness refers to the ability of the device to obtain data that is reliable, of acceptable quality, and comparable to the data obtained from regular healthcare systems (Park and Jayaraman, 2009). In real-life usage scenarios, WHT systems may encounter various unexpected issues, including high levels of bio-signals noise, measurement errors, and weak sensor contact with the skin (Meng, Choi and Kim, 2011). Consequently, the accuracy and reliability of WHTs are concerns for customers when they adopt these technologies (Shin *et al.*, 2019; Sprogis, Currey and Considine, 2019; Wulfovich *et al.*, 2019; Hathaliya and Tanwar, 2020).

This study provides confirmation of the positive relationship between effectiveness and the customer experience of using WHT for senior citizens, which aligns with previous research findings (e.g., Nguyen *et al.*, 2017; Kononova *et al.*, 2019; Lee *et al.*, 2019; Brickwood *et al.*, 2020). In the context of WHT, the accuracy and reliability of data play a crucial role in shaping the customer experience. A low level of accuracy can have a negative impact on the customer experience as it may lead to frustration and a perception that their efforts are not recognized. The qualitative study conducted in this research supports this relationship, as participants emphasized the importance of comparing monitoring results from WHT with data from other medical devices to assess accuracy, reliability, and overall effectiveness.

Overall, ensuring the effectiveness of WHT in terms of data accuracy and reliability is essential for enhancing the customer experience among senior citizens. By addressing these concerns and providing reliable and comparable data, companies can foster a positive user experience, instil confidence in the technology, and encourage sustained adoption and usage of WHT.

H2b: Perceived risk has a negative relationship with the customer experience of using WHT.

Perceived risk refers to the extent to which users believe that a technology may introduce unforeseen risks, including safety concerns, functional issues, and privacy breaches (Chatterjee and Price, 2009). It is a subjective evaluation made by individuals based on their perceptions of potential negative consequences associated with using the technology. Perceived risk plays a significant role in shaping users' attitudes and behaviours towards adopting and using a technology.

In the context of WHT, senior citizens may have concerns about perceived risk related to their personal health, such as the possibility of developing lymphedema or exposure to electromagnetic radiation (Nguyen *et al.*, 2017). However, other studies have found that some participants do not consider sharing personal health information as a violation of their privacy (Lee *et al.*, 2020).

This study confirms the negative relationship between perceived risk and the customer experience of using WHT among senior citizens, which is consistent with previous research by Gao, Li and Luo (2015) and Nguyen *et al*. (2017). In the quantitative study, participants expressed concerns about perceived risk, reflecting a deeper consideration of both personal health and privacy aspects. This differs from the qualitative study, where participants may not have explicitly discussed perceived risk.

The findings suggest that addressing perceived risk is crucial for enhancing the customer experience of using WHT among senior citizens. Companies should proactively address safety, functional, and privacy concerns associated with WHT to alleviate users' perceived risk. By implementing robust security measures, ensuring data privacy, and providing clear information about the potential risks and benefits of WHT, companies can help build trust and mitigate concerns, ultimately leading to a better customer experience.

H2c: Real-time process has a positive relationship with the customer experience of using WHT.

Real-time process in the context of WHT refers to the ability to transmit and process data in real-time (Meng, Choi and Kim, 2011). Real-time transmission and processing of data obtained by WHT offer several benefits and can promote customer acceptance. Compared to the traditional method of professional monitoring, real-time process provides seniors with concise and efficient access to monitoring results. This direct provision of real-time data enhances their experience with WHT.

This study confirms the positive relationship between real-time process and the customer experience of using WHT among senior citizens, which is consistent with previous research by Kekade *et al.* (2018) and Kononova *et al.* (2019). The qualitative study findings further support this relationship. Participants mentioned that real-time process enhances their experience with WHT as reminders from WHTs motivate them to engage in physical activity. The alarms based on real-time heart rates also help participants gain a better understanding of their health conditions. They believed that these features enabled them to achieve their goal of developing better lifestyle habits.

In summary, real-time process capabilities in WHT, including immediate data transmission and timely reminders, positively contribute to the customer experience. Seniors appreciate the direct access to monitoring results and the motivating effect of alarms, leading to a more satisfying and engaging experience with WHT.

H3: Brand leadership has a positive relationship with the customer experience of using WHT.

A services brand serves as a crucial assurance of the quality of a future service experience provided by an organization (Berry and Seltman, 2007). It represents the promises and expectations associated with the service and influences customers' perceptions and attitudes. Conversely, the customer experience with the organization also plays a significant role in building brand awareness and meaning (Berry, 2000). The actual experiences customers have with the service can shape their perception of the brand and influence their loyalty and advocacy. Thus, the interplay between the services brand and the customer experience is essential in shaping customers' perceptions, attitudes, and behaviours towards the organization and its services (Aaker and Joachimsthaler, 2000; Gehlhar *et al.*, 2009; Keller, 2012).

In the healthcare industry, brand leadership is a critical aspect of competitiveness. Unlike other services, healthcare is highly individualized, and brands associated with healthcare services can provide unique meaning and value to customers. Brand leadership is particularly important in healthcare organizations due to the distinctive nature of the doctor-patient relationship, where the buyer (patient) places complete trust in the provider (Berry and Bendapudi, 2007). Healthcare providers with strong brand leadership are able to foster customer trust in intangible aspects of performance (Beckham, 2000; Berry, 2000). Effective brand leadership in the healthcare industry can enhance customer perceptions, build trust, and establish a positive reputation, ultimately contributing to the success and competitiveness of healthcare organizations.

The findings of this study confirm the hypothesis that brand leadership significantly influences the customer experience of using WHT. This aligns with prior research highlighting the interplay between the services brand and the customer experience in shaping customer perceptions, attitudes, and behaviours towards organizations and their services. The customer experience with the organization and the associated brand plays a crucial role in building brand awareness, meaning, loyalty, and advocacy.

In summary, brand leadership in the healthcare industry is instrumental in establishing trust, enhancing customer perceptions, and contributing to the success and competitiveness of healthcare organizations. In the context of WHT, brand leadership significantly impacts the customer experience, highlighting its importance in shaping customer perceptions and attitudes towards WHT and the organization providing it.

H3a: Brand attitude has a positive relationship with the customer experience of using WHT.

Brand attitude refers to an individual's emotional response or evaluation towards a brand, which can be positive or negative in nature (Burton *et al.*, 1998). Brand attitude is influenced not only by the functional aspects of products or services but also by the overall brand experience and symbolic attributes (Brakus, Schmitt and Zarantonello, 2009). Brand attitude and customer experience has a cyclic relationship (Kemp, Jillapalli and Becerra, 2014).

This study confirms the positive relationship between brand attitude and the customer experience of using WHT among senior citizens. The findings highlight the importance of brand attitude in shaping the customer experience. The positive brand attitude contributes to a better customer experience, while a negative brand attitude can hinder the overall experience. The cyclic relationship between brand attitude and customer experience suggests that a positive customer experience can further enhance brand attitude, leading to increased satisfaction, loyalty, and advocacy.

In conclusion, this study highlights the importance of brand attitude in the context of WHT for senior citizens. A positive brand attitude significantly influences the customer experience, emphasizing the need to cultivate and maintain a positive brand image. Understanding and effectively managing brand attitude can lead to enhanced customer experiences, ultimately benefiting organizations operating in the fields of marketing and information management.

H3b: Perceived quality has a positive relationship with the customer experience of using WHT.

Perceived quality refers to a consumer's subjective evaluation of the overall excellence or superiority of a product in comparison to competing products (Zeithaml, 1988). Similarly, perceived service quality pertains to a customer's assessment or impression of an entity's overall excellence or superiority in providing services (Bitner and Hubbert, 1994). When customers perceive a high level of quality in a product or service, it enhances their trust and experience in the brand (Netemeyer *et al.*, 2004). However, in the healthcare industry, accurately assessing the quality of services can be challenging for customers. As a result, customers often rely on assessing the 'functional' quality, which relates to the tangible aspects and functional performance of the healthcare services they receive (Babakus *et al.*, 1991). This implies that customers' perceptions of the healthcare services' effectiveness, reliability, responsiveness, and other functional aspects significantly influence their perception of service quality. In the healthcare context, delivering high functional quality is crucial for building customer trust and satisfaction.

The findings of this study provide further support for the positive relationship between perceived quality and the customer experience of using WHT among senior citizens. This emphasizes the importance of perceived quality in shaping the customer experience. When seniors perceive high quality in WHT, it positively impacts their overall experience with the technology. This study aligns with previous research (e.g., Kemp, Jillapalli and Becerra, 2014; Xie and Sun, 2021) and underscores the significance of delivering high-quality healthcare services to enhance the customer experience with WHT among senior citizens.

In summary, perceived quality plays a critical role in the customer experience of using WHT. When customers perceive high quality in healthcare-related services, it leads to increased satisfaction. Therefore, healthcare-related organizations should prioritize delivering high functional quality to build positive customer experiences among senior citizens using WHT.

H3e: Brand of origin has a positive relationship with the customer experience of using WHT.

Brand of origin is an emerging construct in this framework, encompassing the place, region, or country that consumers associate with a brand (Thakor, 1996). The brand of origin holds psychological significance and can impact the customer experience of using WHTs. Specifically, Within the context of senior citizens in China, patriotic values and a deep sense of national identity foster a belief in supporting domestic brands. This patriotic sentiment evokes a sense of pride when purchasing and using domestic products, thereby enhancing the customer experience. Furthermore, this sense of pride and subsequent experience intensifies when domestic products perform well and meet the expectations of WHTs for senior citizens.

The findings of this study provide empirical evidence supporting the positive relationship between brand of origin and the customer experience of using WHTs among senior citizens. These findings shed light on the significant role of brand of origin in shaping the customer experience and highlight the importance of considering the brand of origin factor in understanding its influence on the customer experience of WHTs among senior citizens. In the quantitative study, participants expressed their pride in purchasing and using domestic products. Some participants believed that products from countries with technological expertise could guarantee better quality and a superior experience when using WHTs.

These findings have implications for healthcare-related organizations and marketers targeting senior citizens in China. Recognizing the influence of brand of origin, they can strategically leverage patriotic sentiments and national identity to enhance the customer experience. By offering products that align with the expectations and values of senior citizens, healthcare providers can strengthen customer satisfaction and advocacy. Moreover, an understanding of the psychological impact of brand of origin can inform marketing strategies and communication efforts, further enhancing the overall customer experience of using WHTs among senior citizens.

H4: Customer experience has a positive relationship with sustainable consumption of WHT.

Customer experience, as defined by Meyer and Schwage (2007), refers to customers' personal and internal reactions to their interactions with a company and its marketing stimuli. It is a result of the customer journey in consuming products or services, where customers' perceptions may vary at different stages (Berry, Carbone and Haeckel, 2002). Research has shown that value is not inherent in a product but is derived from the overall experience and usage processes (Vargo and Lusch, 2004; Tynan, McKechnie and Chhuon, 2010).

Customer experience encompasses a series of interactions between customers and a company or its offerings, leading to various reactions. It is a personal and multidimensional experience involving sensory, rational, physical, emotional, and spiritual aspects (Gentile, Spiller and Noci, 2007). Retrospectively, customer experience plays a constructive role in influencing desired repeat purchases (Cowley, 2008). The findings of this study support the notion that customer experience has a positive relationship with sustainable consumption of WHTs.

This study provides empirical evidence of the positive impact of customer experience on sustainable consumption of WHTs. A positive customer experience enhances customers' engagement with and commitment to sustainable consumption practices related to WHTs. These findings have implications for healthcare marketers and practitioners aiming to promote sustainable consumption of WHTs. By prioritizing the customer experience and addressing customers' needs and desires throughout the consumption journey, healthcare organizations can encourage sustainable choices and build a loyal customer base. Moreover, understanding the multidimensional nature of customer experience enables healthcare-related organizations to design tailored interventions that effectively influence customers' attitudes and behaviours towards sustainable consumption.

Overall, the positive relationship between customer experience and sustainable consumption of WHTs highlights the importance of creating meaningful and engaging customer experiences that align with sustainability objectives. By emphasizing the value derived from the entire customer journey, healthcare-related organizations can contribute to the promotion of sustainable consumption practices in the context of WHTs.

Moderating Effects of Moderators at the Customer Level: Self-health Management Efficacy (Ha), Perceived Vulnerability (Hb), Perceived Severity (Hc), and Facilitating Support (Hf)

This study identified moderating effects for four constructs at the customer level: efficacy of self-health management, perceived vulnerability, perceived severity, and facilitating support. Efficacy of self-health management (Ha) was found to positively influence the relationship between customer experience and sustainable consumption of WHTs among senior citizens. In the context of using WHTs, the long-term adoption of these technologies for monitoring health conditions by senior citizens is influenced by their ability and knowledge of self-health management.

Perceived vulnerability (Hb) and perceived severity (Hc) can be viewed as threat appraisal factors (Floyd, Prentice-Dunn and Rogers, 2000). Consistent with previous research (Sun *et al.*, 2013; Gao, Li and Luo, 2015; Beh *et al.*, 2021), this study confirms that individuals who perceive a high health threat, characterized by a combination of high perceived vulnerability (the belief that they are susceptible to the health threat) and high perceived severity (the belief that the health threat has significant consequences), are more likely to engage in health behaviours aimed at self-protection. In the case of WHTs, perceiving a health threat motivates senior citizens to adopt these technologies as a means of safeguarding their health and mitigating the perceived threat. The perception of being at risk drives proactive measures and long-term adoption of WHTs for self-protection.

Facilitating support refers to individuals who can provide relevant information, suggestions, and guidance (Plumridge *et al.*, 2012). With the support of their families, friends, and other related individuals, senior citizens can have a smoother experience in using WHTs. Additionally, the availability of readily accessible assistance for using WHTs creates a user-friendly environment that encourages senior citizens to adopt these technologies in the long term.

These findings highlight the importance of considering the moderating effects of efficacy of self-health management, perceived vulnerability, perceived severity, and facilitating support in understanding the relationship between customer experience and sustainable consumption of WHTs among senior citizens. By addressing these factors and providing support, healthcare organizations and practitioners can enhance the customer experience and promote the sustainable adoption of WHTs by senior citizens.

Moderating Effects of Moderators at the corporate Level: Disclosure policy (He)

Negative information can harm a company's reputation and result in a decrease in market share (Wrigley, Salmon and Park, 2003). However, the self-disclosure policy implemented by companies has a positive impact on customer choice. Moreover, customers are less influenced by the disclosure policy of a company with a positive reputation (Fennis and Stroebe, 2014). The findings of this study indicate that the disclosure policy implemented by companies has a positive, albeit modest, influence on the relationship between customer experience and sustainable consumption of WHTs among senior citizens. This suggests that while the disclosure policy plays a role, its impact may be relatively limited compared to other factors that influence customer behaviours. When senior citizens have a positive experience with the WHTs they use, the influence of the disclosure policy on their intention to adopt these technologies in the long term is relatively small. Despite the disclosure policy providing transparency and precise information, its effect on shaping sustainable consumption behaviours among senior citizens appears to be modest. By understanding the nuanced relationship between customer experience, disclosure policy, and sustainable consumption behaviours, companies can refine their strategies and develop comprehensive approaches that encompass various elements of customer satisfaction, convenience, product quality, and ethical considerations.

Chapter 7. Conclusion

7.1 Contribution

This research provides clear evidence that design leadership, technology leadership, and brand leadership have a positive effect on the customer experience of using WHTs for senior citizens. The study measures the influencing factors within each leadership to understand how they drive the experience of WHTs for senior citizens. Furthermore, it demonstrates that customer experience of using WHTs positively impacts sustainable consumption of WHTs for seniors. Additionally, the study explores the moderating effects of self-health management efficacy, perceived vulnerability, perceived severity, facilitating support at the customer level, and disclosure policy at the corporate level on the relationship between customer experience and sustainable consumption of WHTs for senior citizens.

This study addresses the primary research question of how to make the consumption of wearable healthcare devices sustainable among senior citizens. It also answers secondary research questions regarding the role of leadership in technology, design, and brand in driving the experience of WHTs among senior citizens and how the experience of senior citizens with the brand influences their sustainable consumption of WHTs.

The development and testing of a new model that incorporates design leadership, technology leadership, brand leadership, and customer experience in the ageing population makes a significant contribution to research on wearable healthcare services. This study is the first to validate the influencing factors of continuance use intention from a leadership perspective and includes the brand as a measured factor. Additionally, it highlights the moderating effects of self-health management efficacy, perceived vulnerability, perceived severity, facilitating support, and disclosure policy.

These findings broaden our understanding and contribute to knowledge regarding continuance use intentions and sustainable consumption of WHTs for senior citizens.

7.1.1 Contribution to Theory

This study contributes valuable insights to the existing academic literature and theories by exploring the influencing factors of continuance intention to continue using technology. The findings build upon and support relevant theories and research area, expanding our understanding of the factors influencing technology adoption and continuance. By examining specific variables and their relationships, this study adds merit to the existing body of knowledge. It provides a deeper understanding of the factors that drive individuals to adopt and continue using technology. The findings also contribute to the advancement of theoretical frameworks.

The present study holds significant value for research and academic purposes within the field of WHT continuance use intention. While previous studies have mainly focused on the adoption and acceptance of WHTs among all age groups (e.g., Jeong *et al.*, 2017; Cheung *et al.*, 2019; Chandrasekaran, Katthula and Moustakas, 2020; Bianchi, Tuzovic and Kuppelwieser, 2023) there is a scarcity of research examining the factors influencing continuance intentions in the context of technology adoption (Bölen, 2020; Sun and Gu, 2022). It is worth noting that the sustainability and long-term success of an IS heavily depend on users' continued usage rather than just their initial adoption behaviours (Bhattacherjee, 2001). While initial adoption is important, it is the ongoing usage and engagement of users that determine the effectiveness and value of the IS. Therefore, understanding the factors that influence users' continued usage and intention to sustain the use of the IS is crucial for achieving sustained success.

Furthermore, this study fills a notable gap by examining the sustainable consumption of WHT, specifically among senior citizens. By focusing on this distinct demographic group, the study provides unique insights and contributes to a more comprehensive understanding of sustainable technology consumption across different age groups. The findings offer valuable contributions to the existing literature and serve as a foundation for future research in the field of technology continuance use among senior citizens.

This study brings a novel perspective to the research field by examining the relationship between design leadership, technology leadership, brand leadership, customer experience, and sustainable consumption of WHTs. Unlike previous studies that have not explored this relationship, this research introduces an innovative research model. The findings demonstrate the significant effects of design leadership, technology leadership, and brand leadership on the customer experience of using WHTs among senior citizens. This study contributes to the research field of customer experience and sustainable consumption by providing empirical evidence that supports the positive relationship between customer experience and sustainable consumption, which is consistent with prior research (e.g., Rose, Hair and Clark, 2011; Rizomyliotis *et al.*, 2022; Amoako, Doe and Neequaye, 2023).

A noteworthy finding of this study pertains to the role of brand leadership, which is a novel variable examined in the context of sustainable consumption of technologies. Current Literature has sidestepped in-depth exploration of brand leadership, especially in relation to its impact on customer experience of WHTs and sustainable consumption patterns. The results indicate that brand leadership has a significantly positive effect on customer experience. This finding underscores the importance of brand leadership in shaping the customer experience of using WHTs among senior citizens. Specifically, when considering senior citizens—a demographic whose interaction with technology is increasingly significant—it becomes evident that their experience with WHTs is closely tied to the strength and spirit presented by brand leadership.

Building on existing theoretical frameworks, this research emphasized the role of brand leadership in guiding customer experience and sustainable consumption behaviour for senior citizens. A brand that epitomizes strong leadership traits can profoundly shift customer perceptions, deepening trust and carving a favourable reputation. As our study suggests, such traits directly translate into an enhanced customer experience. For scholars and practitioners alike, this research illuminates a previously underexplored facet of brand leadership. It underscores the importance of brand leadership, not just as a marketing tool, but as a pivotal determinant in promoting sustainable consumption practices, especially among the older generation.

7.1.2 Contribution to Practice

Wearable healthcare technologies (WHTs) have demonstrated a strong capability to help senior citizens obtain better health services and monitor their health situations, addressing the challenges associated with the ageing population (Talukder *et al.*, 2020). However, the abandonment rate of WHTs remains high, particularly among elderly users (Clawson *et al.*, 2015; Epstein *et al.*, 2016; Sun and Gu, 2022). Therefore, this research offers valuable implications for the practice and management of WHT manufacturers, including key decision-makers, marketing, design, and technology departments.

This research identifies design leadership and its first-order factors, including wearability, interactivity, perceived ease of learning and use, and functional value, as having a positive impact on the customer experience of using WHTs among senior citizens. Ageist stereotypes negatively affect senior citizens' willingness to try new technology or utilise it to enhance their quality of life. It is crucial to showcase design leadership by providing clear and user-friendly designs that enable senior citizens to better understand and engage with the technology or devices. Besides, incorporating intuitive interfaces, tactile feedback, voice control, and other forms of interaction that accommodate the physical and cognitive abilities of the target users is essential. Furthermore, some participants in this study expressed that their intention to sustainably consume WHTs is driven by the different functions offered by the devices. However, it is important to strike a balance between wearability and functional value.

WHT manufacturers should prioritise user-centric design, ensuring that the technology is accessible and meets the specific needs and preferences of senior citizens. By addressing design aspects, incorporating relevant functionalities, and providing a positive user experience, WHT manufacturers can enhance the adoption and sustained use of their products among senior citizens and other target customers, ultimately promoting better health outcomes and improving the quality of life for this population.

The findings demonstrate that technology leadership, including effectiveness and real-time process play an important role in impacting customer experience of using WHTs among senior citizens. Senior citizens rely on WHTs to monitor their health and receive real-time feedback on their well-being. Therefore, the effectiveness of these technologies in accurately capturing and analysing health data is essential. When WHTs provide reliable and accurate information, senior citizens will have confidence in technologies and their ability to support their healthcare needs. This positively influences their overall experience and satisfaction with the technology.

In addition, Senior citizens value the ability to receive immediate feedback and responses from the technology, enabling them to make timely decisions regarding their health. Real-time processing enhances the usability and convenience of WHTs, allowing senior citizens to monitor their health in a more efficient and effective manner. This positively impacts their experience by providing them with a sense of control and empowerment over their health management.

The findings of this study emphasise the significant impact of brand leadership, specifically brand attitude, perceived quality, and country of origin, on the customer experience of using WHTs among senior citizens. The attitudes that senior citizens hold towards the brand have a substantial influence on their overall satisfaction and perception of using WHTs. Positive brand attitudes contribute to a more favourable customer experience, fostering trust and loyalty towards the brand.

Moreover, senior citizens' subjective evaluation of the overall excellence or superiority of the WHTs plays a crucial role in shaping their perception of the brand and their satisfaction with the technology. When senior citizens perceive higher levels of quality in the WHTs, it leads to a more positive customer experience and instils confidence in the brand's offerings.

Additionally, the brand of origin of the WHTs has a notable impact on the customer experience among senior citizens. The association of the brand with a particular place, region, or country influences senior citizens' attitudes and preferences. For instance, if senior citizens perceive the WHTs to originate from their own country or a country renowned for technological expertise, it can evoke a sense of pride and enhance their overall customer experience. The brand of origin serves as a symbolic cue that shapes their perceptions and experiences with the WHTs.

These findings highlight the importance of brand leadership in shaping the customer experience of using WHTs among senior citizens. By focusing on building positive brand attitudes, ensuring perceived quality, and considering the brand (or country) of origin factor, WHT manufacturers and marketers can enhance the customer experience, cultivate trust and loyalty, and ultimately drive sustainable consumption of WHTs among senior citizens.

7.1.3 Contribution to Policy

This study demonstrates that design, technology, and brand leadership significantly influence the customer experience and sustainable consumption of WHTs among senior citizens. However, it is important to emphasise that, for many senior consumers, the gateway into the realm of WHTs is their healthcare needs. The confluence of technology and healthcare drives their inclination to embrace such technologies. Thus, it is imperative for policymakers to rigorously monitor companies centred on WHT. This ensures all users' safety, efficacy, and privacy, particularly senior citizens.

The findings of the quantitative study indicate that perceived risk negatively affects the customer experience of using WHTs among senior citizens. When senior citizens perceive higher levels of risk, they may experience increased anxiety, uncertainty, and discomfort in using the technology. This negative perception of risk can undermine their overall satisfaction and experience with WHTs. However, it is important to note that the qualitative study revealed a discrepancy in the concerns expressed by participants regarding the risks associated with using WHTs. Some participants did not express significant concerns about risk. This disparity between the quantitative and qualitative findings suggests that perceived risk may vary among senior citizens. While some individuals may have considerable concerns and perceive higher levels of risk, others may feel more comfortable and less anxious about using the technology.

Furthermore, specific risks were identified in the quantitative research, which may raise awareness of potential risks among senior citizens. Therefore, it is recommended that government regulation departments establish clear safety standards and implement stringent data privacy and security regulations for

WHT manufacturers. These measures are essential for protecting senior citizens from personal and privacy risks associated with using WHTs.

Additionally, the research suggests that senior citizens are significantly drawn to healthcare-related functions and services offered by WHTs. Recognising this, many WHT manufacturers have increased their investment in research and development. In response, policymakers should implement clear standards and regulatory guidelines concerning the design, production, and marketing of WHTs. This is essential, especially as some WHTs make inflated health claims to boost their sales. Regulatory authorities must ensure that these devices adhere to medical device standards, thereby protecting consumers from misleading technology claims and advertisements. Furthermore, post-market surveillance is crucial and should be rigorously enforced by policymakers. The ongoing safety and effectiveness of WHTs must be continually monitored to safeguard the rights and interests of users. To this end, policies should either encourage or require the reporting of adverse events associated with WHTs, ensuring potential users are forewarned and protected from similar issues in the future.

7.2 Limitations

Whilst this study offers invaluable insights and contributions, it is important to recognise certain limitations.

It is important to note that the current study was conducted within the cultural context of China, a developing country with a collectivist culture (Luo *et al.*, 2021). While the findings of the study shed light on the relationships and dynamics within this specific cultural context, caution should be exercised when generalising the results to other cultural backgrounds. Different cultures may exhibit diverse values, norms, and behaviours, which could influence the outcomes and applicability of the study's findings. Moreover, the acceptance and sustainable consumption of WHTs among senior citizens may vary across different countries and regions. In the case of China, it is notable that the country has the largest internet user group, with an internet penetration rate of 74.4 per cent and approximately 1051 million internet users as of June 2022 (Zhou, Vatsa and Ma, 2023). Given China's unique internet penetration rate and user familiarity with technology, generalising the findings to users in other geographical locations should be done cautiously.

A comprehensive understanding of sustainability necessitates considering all stages of a product's lifecycle, including its production and disposal (Sesini, Castiglioni and Lozza, 2020) However, this study specifically focuses on the long-term utilisation of products. This research approach is predicated on the understanding that the immediate impacts of how a product is used, both on the consumer and the environment, are more significant than the aspects of production and disposal. Additionally, this focus is partly due to the time constraints associated with data collection. Data and research on the usage phase of WHT are likely more readily available compared to conducting a full lifecycle analysis, which is inherently more complex and requires extensive data from across the supply chain.

This study adopts a cross-sectional design, collecting data at a single time point from the target population. Although this design provides a snapshot of the relationships among the variables, it does not allow for the establishment of causal relationships or capture temporal dynamics over time. To further enhance the understanding of these phenomena, future research could employ longitudinal designs or experimental approaches to investigate the causal effects and temporal changes. Another limitation is the age distribution of the participants, which predominantly falls within the 60-70 years age range. While the study aimed to encompass a broader age range, the actual participants who volunteered or were available predominantly fell into the younger senior category, aged 60-70. This was further influenced by the inherent limitations of the snowball sampling method, which tends to result in similar demographics within the sample. Different age cohorts within the older population might exhibit variations in attitudes, preferences, and behaviours, which were not sufficiently explored in this study. Additionally, while 8% of the total population comprises Chinese senior citizens over 70 years old, the Internet penetration rate among the elderly population aged 60 and above is 43.2%. This lower rate of internet usage in the older senior demographic posed challenges in effectively connecting with and recruiting them for the study.

Lastly, this study identified the brand of origin and facilitating support based on qualitative research. Future research should further investigate and verify these two factors based on more comprehensive data and research context. In addition, like any research study, the current study is subject to limitations in data collection. Although efforts were made to ensure the accuracy and reliability of the data, the reliance on self-report measures or surveys introduces the possibility of response biases or inaccuracies. Future research could incorporate multiple data sources or employ alternative data collection methods to overcome these limitations. This study acknowledges individual heterogeneity as a limitation. Due to the diverse nature of the sample, varying personal circumstances such as educational background, living arrangements and cultural values may influence the results and limit the generalizability of the findings.

7.3 Suggestions for Future Research

Having recognised and addressed the limitations of the present study in the preceding section, this section presents potential avenues for future research concerning the sustainable consumption of WHTs among senior citizens in China or similar cultural contexts.

The other countries or regions could be adopted as research contexts for future research context to analyse the sustainable consumption of WHTs among senior citizens or other age-group users and to investigate the generalisability of the research findings. Future researchers are encouraged to adopt this research framework in analysing similar research backgrounds.

Future research could explore cognitive age to deepen our understanding of senior citizens' behaviour and intention. Barak and Schiffman (1981) have noted that individuals often behave younger than their chronological age. Cognitive age comprises four dimensions: feel-age, look-age, do-age, and interest-age (Barak and Schiffman, 1981). Therefore, forthcoming studies might focus on examining these four dimensions of cognitive age when investigating the behaviour of senior citizens. This approach could provide a more nuanced understanding of their behaviour and preferences. Beyond cognitive age and chronological age, future research should also consider the other approaches in segmenting age group when conducting investigation of senior citizens; for instance: health and cognitive function status (Swayne and Greco, 1987; Greco and Swayne, 1992), and cognitive ability and memory (Law, Hawkins and Craik, 1998; Gaston-Breton and Raghubir, 2013).

Furthermore, in order to overcome the limitation of cross-sectional design, future research could conduct longitudinal studies to capture the temporal dynamics and changes in sustainable consumption behaviours among the older population over an extended period. Longitudinal designs can provide valuable insights into the factors influencing sustainable consumption decisions, as well as how these behaviours evolve or remain stable over time within the older age group.

To mitigate the limitations from a research perspective in this study, it is crucial for researchers to consider replicating the findings with other types of WHTs. This research mainly focused on the sustainable consumption of wrist-worn WHTs among senior citizens. It is suggested that future researchers may conduct investigations into other wearable healthcare devices, such as invasive and minimally invasive devices for monitoring blood glucose levels and wearable injectors. Moreover, future research can conduct comparative research across various types of wearable health technologies. It can facilitate a deeper understanding of the variations in sustainable consumption behaviours across different device categories. Comparisons could be made regarding user preferences, adoption barriers, perceived benefits, and factors influencing sustained usage among senior citizens.

7.4 Conclusion

Since the onset of the COVID-19 epidemic in 2019, the world has undergone significant changes. The repercussions of COVID-19 have forced the global community to contemplate solutions for the immediate health crises it has caused. Additionally, the global population has witnessed a substantial increase in the number of elderly individuals since the beginning of the 21st century (Lim *et al.*, 2017). Consequently, the ageing population presents a further challenge for countries in the post-COVID-19 era: how to provide sustainable and efficient healthcare support for citizens, particularly senior citizens who may face difficulties in regularly visiting hospitals and managing their health conditions. The adoption of online healthcare services is regarded as a beneficial method (Bokolo, 2021); however, it asks for support from several continuous health information and healthcare monitoring technologies (Sneha and Varshney, 2009). Thus, the sustainable consumption of WHT is an essential and beneficial method to help senior citizens have a continuous and efficient understanding and management of their health conditions (Talukder *et al.*, 2020). However, the high levelled abandonment rate, which is around 50 per cent among users, especially senior citizens (75%), has become another challenge (Clawson *et al.*, 2015; Epstein *et al.*, 2016). Therefore, the current research investigates the factors impacting senior citizens' sustainable consumption of WHTs.

To achieve the research aims, an innovative research framework was developed. The new constructs, including design leadership, technology leadership, brand leadership and customer experience of using WHTs, were involved in building the proposed research model to predict the sustainable consumption intention of WHTs. This research model demonstrates a significant explanatory power in understanding the factors and relationships examined in the study.

The research findings offer extensive and valuable information that can benefit a wide range of stakeholders, including researchers, WHT manufacturers and related service providers. It is suggested that this research model demonstrates effective performance and yields statistically significant results. Based on the statistical results, the factors that positively influence the customer experience of using WHTs and sustainable consumption of using WHTs include design leadership, technology leadership and brand leadership. Brand leadership is firstly included in examining the customer experience and sustainable consumption in existing literature. This research also confirmed the positive effect of brand of origin in brand leadership, which extends the sight of analysing senior citizens' intention of sustainable consumption of WHTs.

Furthermore, this research also confirmed the moderating effects of efficacy of self-health management, perceived vulnerability, perceived severity, facilitating supports and disclosure policy, which enrich the extant literature on sustainable consumption of IS.

The findings of this study are expected to hold significant value for the development and advancement of the industry in China and similar contexts. By shedding light on the factors influencing the adoption and sustainable consumption of WHTs, the findings provide valuable insights for industry practitioners, policymakers, and other stakeholders. These insights can inform strategic decision-making, marketing strategies, and the development of user-centric products and services in the industry.

Appendices

Appendix A. Interview Guide (English version)

Research Title: The sustainable consumption of wearable healthcare technology for senior citizens

Purpose of the study:

This study aims to identify and measure the determinants that would lead to the sustainable consumption of wearable healthcare devices for senior citizens.

Term explanation:

Sustainable consumption refers to a commitment to long-lasting and responsible use of wearable healthcare technology that aims to minimize negative impacts on the environment, societal well-being, and personal health.

Wearable healthcare technology is a body-attached or body-implanted smart device capable of tracking physiological signals for health-related purposes. For instance: Apple Watch, Huawei Watch and Mi band.

Interview Process:

The researcher will want to interview you. This should take no longer than 60-90 minutes and will take place online.

What will happen to the information collected?

All information collected will be stored anonymously. The analysis of the information will be undertaken by the researcher at Newcastle University Business School, Newcastle upon Tyne, UK. Only the researcher will be privy to the notes, documents, recordings, and the report on the findings. No participants will be identified in future publications and every effort will be made to disguise their identity.

Declaration to participants

If you take part in the study, you have the right to:

- Refuse to answer any question, and to withdraw from the study at any time (including after the interview has been completed).
- Ask any further questions about the study that occurs to you during your participation.
- Be given access to a summary of findings from the study when it is concluded.

Who is responsible?

If you have any questions or concerns about the project, either now or in the future, please feel free to contact either:

- **Researcher:**

  Mingxue Wei (Email: m.wei6@newcastle.ac.uk; Tel: +44(0)7999300324, +8618547132400)

- **Professor:**

  Suraksha Gupta (Email: suraksha.gupta@newcastle.ac.uk; Tel: +44(0)2037522461)

PARTICIPANT CONSENT FORM

Research Title: <u>The sustainable consumption of SMART wearable healthcare device for senior citizens</u>

Consent Form for Participants

I…………………………………… voluntarily agree to participate in this research study. I understand that even if I agree to participate now, I can withdraw at any time or refuse to answer any question without any consequences of any kind. I understand that I can withdraw permission to use data from my interview within two weeks after the interview, in which case the material will be deleted. I have had the purpose and nature of the study explained to me in writing and I have had the opportunity to ask questions about the study. I understand that participation involves the research project, that *the sustainable consumption of SMART wearable healthcare device for senior citizens*. This project will collect information from participants based on their understandings, using experiences and opinions of SMART wearable healthcare technology in the design leadership, technology leadership and brand leadership. I understand that I will not benefit directly from participating in this research. I agree to my interview being audio-recorded. understand that all information I provide for this study will be treated confidentially. I understand that in any report on the results of this research my identity will remain anonymous. This will be done by changing my name and disguising any details of my interview which may reveal my identity or the identity of people I speak about. I understand that if I inform the researcher that myself or someone else is at risk of harm, they may have to report this to the relevant authorities - they will discuss this with me first but may be required to report with or without my permission. I understand that under freedom of information legalisation I am entitled to access the information I have provided at any time while it is in storage as specified above. I understand that I am free to contact any of the people involved in the research to seek further clarification and information. Names, degrees, affiliations, and contact details of researchers (and academic supervisors when relevant).

Signature of research participant:

____

Name:

____

Date:

____

INTERVIEW PROTOCOL GUIDE

Interview Protocol Guide

The interview process is being developed based on reviewed literature and discussions with supervisors and colleagues. Participants to be interviewed are the users (senior citizens) of SMART wearable healthcare devices living in China. Question is how consumption of wearable healthcare devices by senior citizens be made sustainable? This primary research question to provide directions and focus during the interview while maintaining flexibility. The focus of this interview survey is to identify and investigate which factors associated with leaderships will impact the customer experience when senior citizens adopt WHT.

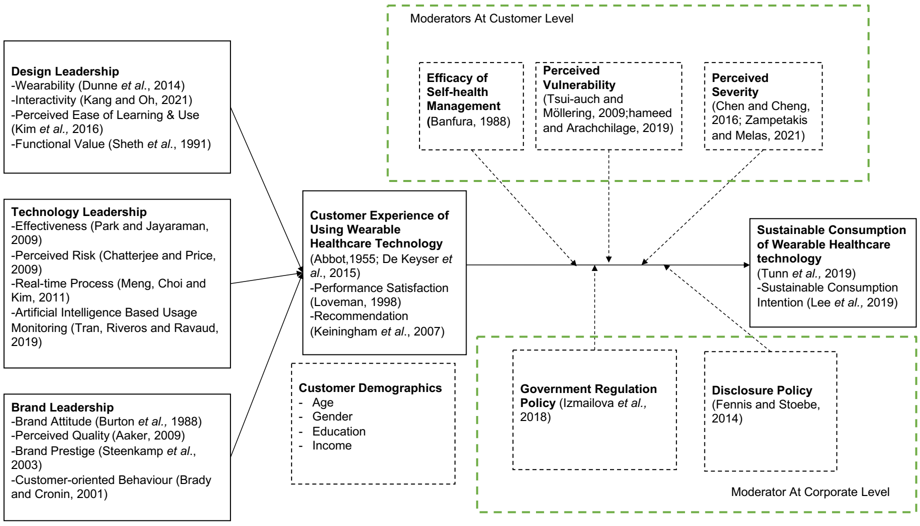


Figure: framework of sustainable consumption of WHT for senior citizens

Interview Questions:

Item No.	Categories	Scheduled question stem and probe
1	Wearability	Do you think the WHT is comfortable?
		Probe: Are there any bad experiences when you use it?
2	Interaction	Can you easily understand how to operate the WHT?
		Probe: Are there any using barriers that impact your experience?
3	Perceived ease of learning and use	Do you think it is easy to learn (using WHT)? Would it be easy for you to become skilful as using the WHT?
		Probe: Why it is not easy to learn?
4	Functional value	Could you share your using experience with the SMART device with me?
		Probe: Are there any functions that really encourage you to keep using it?
		Technology leadership
5	Effectiveness	Do you think the function of the WHT is accurate and reliable?
		Probe: Are there any differences with the result from clinic test?
6	Perceived risk	Do you concern about the WHT?
		Probe: Which aspect is your biggest concern?
		Do you worry about the privacy?
7	Real-time process	Do you think the real-time process is an advantage to you in using WHT?
		Probe Do you think it is good for you to see the real-time processed result?
8	AI-based usage monitoring	Do you think that you can benefit from the AI-based usage monitoring?
		Probe: Do you trust AI-based usage monitoring? Why?
9	Brand attitude	What do you think of the organisation providing this equipment?

		Probe: How does it compare to other commercial companies?
		Would you treat it differently if it was provided by another commercial companies?
10	Perceived quality	What do you think of the quality of service (product) provided by this institution?
		Probe: Will you feel more confident about the quality of WHT when you know it is provided by this agency? Why?
11	Brand prestige	What do you think of this institution?
		Probe: Are there any experiences or storied make you feel like that?
12	Customer-oriented behaviour	What do you think of the staffs in this institution?
		Probe: Are there any experiences or storied make you feel like that?
		Is it impact your using of WHT?

Appendix B. Interview Guide (Chinese version)

采访指南

研究题目： SMART 可穿戴健康设备在老年人群体中的可持续消费

研究目的：

本研究旨在确定和衡量能够导致老年人可穿戴医疗设备的可持续消费的决定因素。

术语解释：

可持续消费是指长期、负责任地使用可穿戴医疗技术的承诺，旨在最大限度地减少对环境、社会福祉和个人健康的负面影响。

可穿戴医疗保健技术是一种附着在身体或植入身体的智能设备，能够跟踪生理信号以用于健康相关目的。 例如：Apple Watch、华为 Watch、小米手环。

采访过程。

研究人员将对您进行采访。采访过程将持续 60-90 分钟，采访将采用在线采访的形式。

收集到的信息将如何处理?

所有收集的信息将被匿名存储。信息的分析将由位于英国纽卡斯尔的纽卡斯尔大学商学院的研究人员进行。只有本项目研究者拥有对采访中产生的笔记、文件、录音以及调查结果的报告拥有访问及使用权

限。在未来的出版物中，不会对参与者的身份信息进行披露，并会对参与者的身份信息进行最大程度的模糊， 以保护参与者个人隐私。

对参与者的声明

如果您参加了这项研究，您有权利

- 在参与过程中，拒绝回答任何问题，并可以在任何时候（包括访谈结束后）退出研究。

- 在参与过程中，提出任何有关研究的问题。

- 在研究结束后，可以获得一份研究结果的摘要。

负责人

如果您对本项目由任何疑问或担心，请在任意时间联系以下研究项目负责人：

研究者：

- **研究员:**

  魏铭雪 (邮箱: m.wei6@newcastle.ac.uk; 电话: +44(0)7999300324, +8618547132400)

- **指导教师:**

  Suraksha Gupta（邮箱：suraksha.gupta@newcastle.ac.uk；电话：+44(0)2037522461)

参与者同意书

研究题目：老年人对SMART可穿戴保健设备的可持续消费

参与者同意书

我___________，自愿同意参加这项研究。我已知晓即使我现在同意参与，我也可以在任何时候退出或拒绝回答任何问题，且不会有任何后果。

我已知晓我可以在访谈结束后两周内撤回对我的访谈数据的使用许可，在撤回使用许可的情况下，所涉及的材料将被删除。该研究的目的和性质已经以书面形式对我进行告知，并且我可以就该项目进行提问。我已知晓，该研究项目，即老年人对SMART可穿戴保健设备的可持续消费；

将收集受访者关于SMART可穿戴保健设备的设计领导力、技术领导力和品牌领导力方面的理解、使用经验和意见的相关信息。我已知晓我本人将不会从参与这项研究中直接受益。我同意对我的采访进行录音。我已知晓我本人所提供的关于该项目的所有信息将被保密。我已知晓

在任何有关本研究结果的报告中，我的个人身份信息将被进行匿名化处理。匿名化处理过程包括但不限于：改变我的名字，以及模糊我在访谈中可能暴露的关于我个人的以及我所谈论到的人的身份信息的任何细节。我已知晓如果我告诉研究者我自己或其他人有受到伤害的危险，他们或将就此危险向有关当局进行报告；

报告流程为：他们将首先与我个人进行讨论，但无论是否获得我的许可授权，该危险都可能要求被报告。我已知晓，根据信息自由的合法化，我有权在上述的信息储存期限内对我所提供的信心随时进行查阅。我已知晓，我可以自由地与任何本项目的研究人员联系，以寻求进一步的澄清和信息。包括研究人员的姓名、学位、隶属关系和联系方式（如有关联，亦可要求提供学术导师的信息）。

项目参与者签名：

姓名：

日期：

采访协议指南

访谈协议指南

访谈过程是根据所查阅的文献以及与主管人员和同事的讨论制定的。将要采访的参与者是居住在中国的 SMART 可穿戴医疗设备的老年用户。问题是如何使老年人对可穿戴医疗设备的消费具有可持续性？ 这个主研究问题为采访提供了方向和重点，同时保持了灵活性。这个访谈调查的重点是确定和调查当老年人采用可穿戴医疗技术时，哪些与领导力相关的因素会影响客户体验。

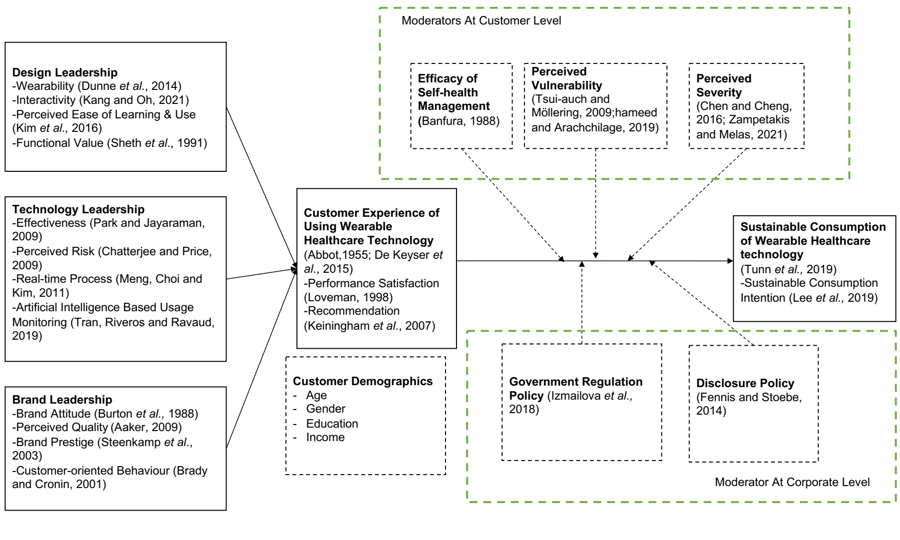


Figure: Framework of Sustainable Consumption of WHT for Senior Citizens

采访问题

编号	类别	预设问题及探究追问
1	耐用性	请问您认为可穿戴设备使用起来舒适吗？ **探究追问:** 您在使用过程中有什么让您感受不佳的体验吗？（在您使用时，有什么让您感觉特别称心的方面吗？）
2	交互性	在您使用的过程中，您觉得操作过程是简单的吗？ **探究追问：** 在您使用过程中， 是否存在使用障碍影响到您的体验？
3	感知易学易用性	您觉得该设备简单易学吗？ 您是否很容易就能熟练掌握它呢？ **探究追问：** 您为什么觉得它的使用方法学起来比较困难？
4	功能价值	您能跟我分享一下您日常的使用经验吗？ **探究追问：** 有什么功能让您觉得这个设备应该继续使用下去？（该设备有什么功能特别吸引您，让您觉得它值得一直使用？）
5	效果	您觉得该设备的功能方面是准确且值得信赖的吗？ **探究追问：** 与您平时常用的测量方式（比如：诊所里测量）有什么区别吗？
6	性能风险	您对该设备有什么担心的点吗？ **探究追问：** 哪一方面是您最担心的？ （您觉得隐私方面您有什么担心吗？）
7	实时处理	您觉得实时处理对您的使用有促进吗？ **探究追问：** 您希望看到实时处理结果吗？ （为什么？）

8	基于人工智能的监测	您觉得人工智能的介入，会对您的使用有帮助吗? **探究追问：**您相信人工智能的能力吗？为什么?
9	品牌态度	您对提供该设备的医院有什么看法吗? **探究追问：**与其他商业公司相比，您对该医院有什么态度看法上的不同吗? 如果该设备由一些商业公司提供，您会对该设备由不同的看法吗?
10	感知价值	您觉得医院提供的这个设备质量如何？或者您觉得这个医院的服务质量如何? **探究追问：**您是否会觉得该医院提供的设备的质量更可信（更好）？ 为什么?
11	品牌声誉	您觉得这家医院声誉如何? **探究追问：** 有什么体验或者故事让您有这样的感觉吗?
12	客户导向行为	您觉得该医院的员工态度如何? **探究追问：** 有什么体验或者故事让您有这样的感觉吗? 这会影响您使用（由这家医院提供的）该设备吗?

Appendix C. Arrangement of Interview Questions

备注：

1. Do you think the WHT is comfortable?
2. Can you easily understand how to operate the WHT?

Appendix D. The Nodes of Qualitative Interview Research

Nodes

Name	Description	Files	References
Sustainable Consumption	sustainable consumption is shaping and satisfying consumer needs and using experience to continuously improve the quality of consumer's life, and reduce the negative impacts of consumption on the society (Tunn *et al.*, 2019)	20	61
Long-term adoption intention	Users' intentions for long-term use of WHTs.	20	24
Negative intention	Users hold negative intentions for long-term use of WHTs.	4	5
Positive intention	Users hold positive intentions for long-term use of WHTs.	17	19
Exercises	Users hold positive intentions for long-term use of WHTs with the purpose of exercises.	3	3
Health monitoring	Users hold positive intentions for long-term use of WHTs with the purpose of health monitoring.	11	11
Overall experience	An overall user experience of using WHT.	18	18
Using frequency	Frequency of using WHTs by users.	19	19
Design Leadership	A type of leadership that encourages and supports the creation of novel design solutions (Muenjohn *et al.*, 2015).	20	156
Functional value	The perceived ability of a product or service to have a functional, practical or physical purpose (Sheth, Newman and Gross, 1991).	20	25

Name	Description	Files	References
Barriers	Barriers encountered by users during use.	2	3
Valuable functions	The functions that users find valuable in the course of use.	20	22
Encourage	Functions that make users feel encouraged and want to keep using them.	2	2
Health monitoring	Functions that users used to monitor health.	17	17
Non-health-related	User perceived valuable but non-health related functions.	1	1
Reminder	Functions that act as reminders to users.	1	1
Interaction	The feedback of information via interface between customers and wearable device[9]	20	65
Battery capability	Battery life performance.	6	6
Easy and convenient	The operations that make users feel easy and convenient.	14	16
Basic functions	The basic functions of WHTs which are adopt by users.	8	8
Hard and inconvenient	The operations that make users feel hard and inconvenient.	7	15
Age	A reason that caused hard and inconvenient.	4	4

[9] *Note*

1. Interactivity is loosely defined and conceptualized in different ways (Downes and McMillan, 2000; Walther *et al.*, 2005). Scholars tend to define and conceptualize interactivity differently according to the approach they adopt (Bucy, 2004). In this framework, the interactivity is considered in different way, according to the function of wearable healthcare, it asks the ability to provide a range of services with little involvement of user interaction. Thus, it should also be performed with minimal cognitive effort of the user, i.e., simple and intuitive interface(Lukowicz, Kirstein and Tröster, 2004)

Name	Description	Files	References
Complex operation	A reason that caused hard and inconvenient.	2	3
Connection with doctor	A reason that caused hard and inconvenient.	1	1
Link with smartphone	A reason that caused hard and inconvenient.	3	4
System update	A reason that caused hard and inconvenient.	2	2
Screen size	A reason that caused hard and inconvenient.	8	9
Training	The need for training in the course of use.	17	19
Needed	The training is needed.	7	8
Human to human	Training is person-to-person.	1	1
Machine to human	Training is machine-to-person	4	4
Unneeded	The training is unneeded.	10	11
Family's help	Families can provide necessary help in training the usage of WHTs.	1	1
Manual	Users can know about the usage of WHTs from reading manual.	4	4
Perceived ease of learning and use	The degree to which a person believes that learning and using a particular system would result in reduced effort (Kim *et al.*, 2016).	20	40
Easy	Users believes that learning and using WTHs is easy.	19	21
Experienced in smart device	Users believes that learning and using WTHs is easy because they have experience of using smart devices.	3	3
Manual	Users believes that learning and using WTHs is easy because they can be supported by manual.	4	4
Hard	Users believes that learning and using WTHs is hard.	1	1

Name	Description	Files	References
Manual	Users believes that learning and using WTHs is hard because they cannot be supported by manual.	1	1
Learning time	The time that users spent on learning using WHTs.	16	17
All function usage	The user has mastered the use of all functions.	10	10
Wearability	The physical ability to mount a device on the body or the physical and mental comfort of the wearer (Dunne, Profita and Zeagler, 2014).	20	26
Comfortable	Users believes the WHTs is comfortable.	19	19
Uncomfortable	Users believes the WHTs is uncomfortable.	7	7
Technology Leadership	An ability to assist in the facilitation of change, to present the competitiveness in marketing, and guarantee the performance of the product.	20	141
AI-based usage monitoring	The technology which combines the AI and wearable biometric monitoring devices to benefit in informing diagnosis, predicting patient outcomes, and better treatment providing (Hinton, 2018; Fagherazzi and Ravaud, 2019; Tran, Riveros and Ravaud, 2019).	20	34
Distrust	Users do not trust AI in helping them to monitor health.	2	2
Human preference	Users believes human can have much better performance than AI.	1	1
Trust	Users trust AI in helping them to monitor health.	12	22

Name	Description	Files	References
AI trust	Users trust AI from scientific aspect.	12	12
Existed adoption	A reason that makes users believe AI is trustworthy.	1	1
Reference	A reason that makes users believe AI is trustworthy.	2	2
Trend of science development	A reason that makes users believe AI is trustworthy.	9	9
Uncertain trust	Users unsure if they trust AI can help them in monitoring health.	8	10
Inexperience	A reason that makes users unsure if they trust AI.	3	3
Less of knowledge	A reason that makes users unsure if they trust AI.	2	2
Reference	A reason that makes users unsure if they trust AI.	2	2
Uncertain trust of AI	A reason that makes users unsure if they trust AI.	3	3
Effectiveness	The ability to obtain data by using a wearable healthcare system should provide reliable and acceptable quality and accuracy as that obtained by a regular healthcare system (Park and Jayaraman, 2009).	20	35
Accurate and trustworthy	Users believes WHTs are accurate and trustworthy.	17	18
Reference	Users believes WHTs can provide reference of monitoring health.	5	5
Inaccurate	Users believes WHTs are inaccurate.	2	2
Measurement	A reason makes users believe that WHTs are inaccurate.	15	15
Perceived risk	The degree to which users believe the technology may bring unanticipated risks, such as safety risk, functionality risk, and	20	50

Name	Description	Files	References
	privacy violation (Chatterjee and Price, 2009).		
Risk exist	Users can perceive the risk of WHTs.	2	2
Privacy risk	The risk of privacy in using WHTs.	0	0
Government regulation	The government regulation makes users recognize the risk of WHTs.	1	2
Risk of information diffusion	The risk that information would be diffused to the other platform.	3	3
Risk of device	The risk that caused by WHTs.	2	2
Risk inexist	Users cannot perceive the risk of WHTs.	20	48
Risk of device	The risk that caused by WHTs.	16	20
Quality of device	The quality of devices makes users think the WHTs have no risk.	4	5
Risk privacy	The risk of privacy in using WHTs.	18	28
Brand trust	The brand is trustworthy and makes users think the WHTs have no risk.	3	3
Can recognize fraud	Users believes that they can recognize fraud so as avoid it.	1	1
Commoner	Users thinks that they are commoners, so their health data is not important.	2	2
Data accessing	Data can only be accessed via specific approaches.	3	3
Data category	Health information is not considered private (different from financial information).	12	14
Family choice	Families can help them to avoid risk of data leakage.	1	1

Name	Description	Files	References
The normalization of data leaks	The normalization of data leaks makes users abandon to protect data.	2	2
Real-time process	The ability to transmit and process the obtained data in real-time[10](Meng, Choi and Kim, 2011)	16	22
Neutral	Users can not significantly benefit from real-time process.	2	2
Positive	Users can significantly benefit from real-time process.	14	20
Encouragement	A reason that users can significantly benefit from real-time process.	7	7
Monitor health	A reason that users can significantly benefit from real-time process.	6	6
Reminder	A reason that users can significantly benefit from real-time process.	6	7
Brand Leadership	An ability to differentiate its product and services from competitors (Gehlhar *et al.*, 2009).	20	135
Brand attitude	An affective reaction to a brand, or a predisposition to respond in a favourable or unfavourable manner to a brand (Burton *et al.*, 1998).	19	36
Positive	Users hold a positive attitude to a brand.	19	35
Company size	A reason that makes users hold a positive attitude to a brand.	4	4

[10] The customer can see the results displayed without delay and to know the health or physical state in real time.

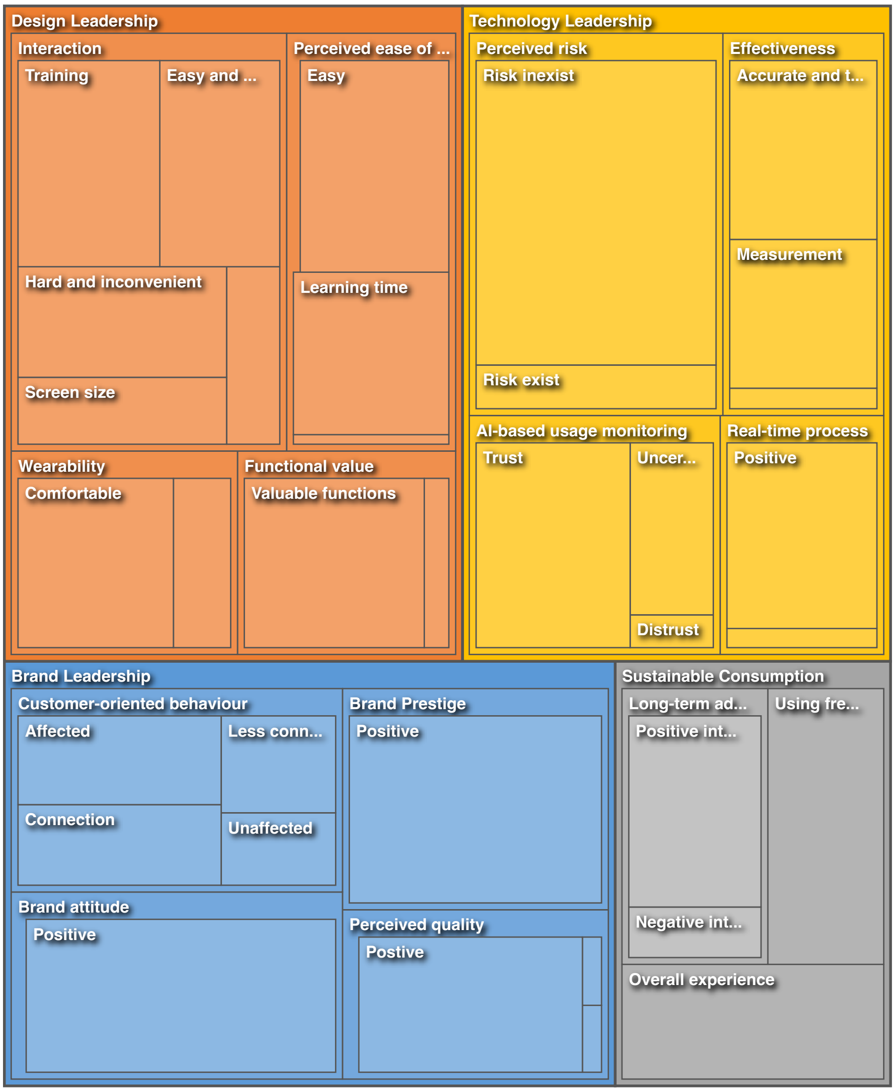
Name	Description	Files	References
Domestic brand	A reason that makes users hold a positive attitude to a brand.	9	9
Government	A reason that makes users hold a positive attitude to a brand.	1	1
Leading technology	A reason that makes users hold a positive attitude to a brand.	1	1
Popular	A reason that makes users hold a positive attitude to a brand.	3	3
preference on selected brand	A reason that makes users hold a positive attitude to a brand.	2	4
Reasonable price	A reason that makes users hold a positive attitude to a brand.	2	2
Usage habit (same brand of products)	A reason that makes users hold a positive attitude to a brand.	7	7
Brand Prestige	A high status positioning of a brand (EM Steenkamp, Batra and Alden, 2003).	19	34
Positive	Users believes a brand has a good reputation.	19	34
Brand ethos	The culture (ethos) expressed by a brand.	5	7
Leader charisma	Leader charisma earns a high status of brand prestige for a brand.	4	4
Domestic brand	A reason that makes users believes a brand has a good reputation.	5	9
Chip War	A reason that makes users believes domestic brand has a good reputation.	3	4
Ecosystem	A reason that makes users believes a brand has a good reputation.	1	1

Name	Description	Files	References
Government support	A reason that makes users believes a brand has a good reputation.	1	1
High-qualitied product	A reason that makes users believes a brand has a good reputation.	3	3
Popular	A reason that makes users believes a brand has a good reputation.	2	2
Word of mouth	A reason that makes users believes a brand has a good reputation.	7	7
Customer-oriented behaviour	The set of beliefs that puts the customer's interest first (Brady and Cronin Jr, 2001).	20	39
Affected	Users are affected by the customer-oriented behaviour.	13	13
Connection	Users has connection with staffs.	11	12
Negative	The connection duration was unhappy for users.	1	1
Positive	The connection duration was happy for users.	11	11
Less connection	Users has less connection with staffs.	8	8
Unaffected	Users are not affected by the customer-oriented behaviour.	6	6
Perceived quality[11]	The consumer's subjective assessment about a product's overall excellence in reference to competitive offerings (Aaker, 1991)	20	26

[11] In this research context, perceived quality is concentrate on perceived service (product and staff) quality which is defined as a consumer's judgment of, or impression about, an entity's overall excellence or superiority (Bitner and Hubbert, 1994).

Name	Description	Files	References
Market	The market is too chaotic to make users to measure the quality.	1	1
Negative	Users consider the brand to be of poor quality.	1	1
Positive	Users consider the brand to be of good quality.	18	23
Adopted product	A reason that makes users consider the brand to be of good quality.	6	7
After-sale	A reason that makes users consider the brand to be of good quality.	2	2
Word of mouth	A reason that makes users consider the brand to be of good quality.	3	3

Appendix E. Nodes Compared by Number of Coding References (Qualitative Interview Research)



Appendix F. Survey of Sustainable Consumption of Wearable Healthcare Technology for Senior citizens (English Version)

Survey of Sustainable Consumption of Wearable Healthcare Technology for Senior citizens

This study aims to identify and measure the determinants that would lead to the sustainable consumption of wearable healthcare technology (WHT) for senior citizens. I would be very grateful if you would take part in this survey. It will take about 5-10 minutes. All information collected will be stored anonymously. The analysis of the information will be undertaken by the researcher at Newcastle University Business School, Newcastle upon Tyne, UK. You are therefore being asked to participate and answer the questionnaire below, which should take between 10 to 15 minutes to complete.

Term explanation:

Sustainable consumption refers to a commitment to long-lasting and responsible use of wearable healthcare technology that aims to minimize negative impacts on the environment, societal well-being, and personal health.

Wearable healthcare technology is a body-attached or body-implanted smart device capable of tracking physiological signals for health-related purposes. For instance: Apple Watch, Huawei Watch and Mi band.

Thank you for your participation and for your contribution to this research study!

Section 1: Demographic details

1. My gender is: ☐ Male ☐ Female ☐ Other **2. My age group is:** ☐ 60-65 ☐ 66-70 ☐ 71-75 ☐ 76- 80 ☐ over 80 **3. My education background is:** ☐ Junior high school or lower ☐ Senior high school ☐ College or equivalent ☐ Bachelor's degree ☐ Master or higher degree **4. My salary is (Yuan/ monthly):** ☐ <1000 ☐ 1001-3000 ☐3001-5000 ☐ 5001-8000 ☐ over 8000

Section 2: Design leadership

This section is related to the design leadership of WHT (e.g., Apple Watch, Huawei Smart watch and other medical wearable devices). It will explore how the design leadership of WHT has impacted customer experiences and sustainable consumption. You are asked to rate your level of agreement with WHT's performance in design leadership based on your personal usage experiences.

	Strongly disagree	**Disagree**	**Somewhat disagree**	**Neither agree nor disagree**	**Some-what agree**	**Agree**	**Strongly agree**
5. I feel comfortable using WHT during the day	☐	☐	☐	☐	☐	☐	☐
6. I feel comfortable using WHT during the night	☐	☐	☐	☐	☐	☐	☐
7. I did not experience any uncomfortable symptoms while wearing the WHT, such as itchiness, skin allergy or	☐	☐	☐	☐	☐	☐	☐

burning sensation.							
8. The health data is displayed quickly on WHT	☐	☐	☐	☐	☐	☐	☐
9. I am able to freely select the functions I want to use on WHT	☐	☐	☐	☐	☐	☐	☐
10 I can quickly search for the required health information through WHT	☐	☐	☐	☐	☐	☐	☐
11 It is easy to learn and use the WHT	☐	☐	☐	☐	☐	☐	☐
12 WHT provides clear instructions to help me unlock useful and hidden functions	☐	☐	☐	☐	☐	☐	☐
13 I would not have to spend too much time learning and using WHT	☐	☐	☐	☐	☐	☐	☐
14 The functions on WHT perform stably	☐	☐	☐	☐	☐	☐	☐
15 I believe using WHT could effectively improve my health by helping me monitor my health situation.	☐	☐	☐	☐	☐	☐	☐
16 The functions on WHT are handy	☐	☐	☐	☐	☐	☐	☐

Section 3: Technology leadership

This section is related to the technology leadership of WHT (e.g., Apple Watch, Huawei Smart watch and other medical wearable devices). It will explore how the technology leadership of WHT has impacted customer experiences and sustainable consumption. You are asked to rate your level of agreement with WHT's performance in technology leadership based on your personal usage experiences.

	Strongly disagree	**Disagree**	**Somewhat disagree**	**Neither agree nor disagree**	**Some-what agree**	**Agree**	**Strongly agree**
17. I believe that the quality of data obtained by WHT can be considered as trustworthy as data obtained through the conventional healthcare system (e.g., Sphygmomanometer)	☐	☐	☐	☐	☐	☐	☐
18. The data displayed on WHT are accurate and correct	☐	☐	☐	☐	☐	☐	☐
19. The health information I received from WHT is complete	☐	☐	☐	☐	☐	☐	☐
20. I am concerned about the potential leak of personal data when using WHT	☐	☐	☐	☐	☐	☐	☐
21. I am concerned about the potential risks to my physical health (e.g., electromagnetic radiation or skin burns)	☐	☐	☐	☐	☐	☐	☐

from using WHT							
22. If I used WHT, I may feel psychologically uncomfortable (e.g., anxious and stressed caused by monitoring)	☐	☐	☐	☐	☐	☐	☐
23. I think the real-time process of WHT can help me get the data I need at any time	☐	☐	☐	☐	☐	☐	☐
24. The real time process helps me to better monitor my health at all times by sending me real-time alerts (e.g., heart rate changes, sedentary reminder)	☐	☐	☐	☐	☐	☐	☐
25. I am happy to receive and check the information provided by the real-time processing technology in WHT	☐	☐	☐	☐	☐	☐	☐
26. I use AI (a virtual assistant that can perform actions via voice queries, e.g., Siri in Apple products) to assist me in using WHT to	☐	☐	☐	☐	☐	☐	☐

monitor my health							
27. I believe that AI is useful in helping me use WHT to monitor my health.	☐	☐	☐	☐	☐	☐	☐
28. I believe that AI can recognize potential risks of disease by analysing various data sources	☐	☐	☐	☐	☐	☐	☐

Section 4: Brand leadership

This section is related to the brand leadership of WHT (e.g., Apple Watch, Huawei Smart watch and other medical wearable devices). It will explore how the brand leadership of WHT has impacted customer experiences and sustainable consumption. You are asked to rate your level of agreement with WHT's performance in brand leadership based on your personal usage experiences.

	Strongly disagree	**Disagree**	**Somewhat disagree**	**Neither agree nor disagree**	**Some-what agree**	**Agree**	**Strongly agree**
29 My attitude toward this brand is trustworthy	☐	☐	☐	☐	☐	☐	☐
30 I am satisfied with the brand of WHT I am using	☐	☐	☐	☐	☐	☐	☐
31 The quality of this brand’s WHT is reliable	☐	☐	☐	☐	☐	☐	☐
32 The quality of this brand’s WHT is good	☐	☐	☐	☐	☐	☐	☐
33 The quality of this brand’s	☐	☐	☐	☐	☐	☐	☐

	WHT is acceptable							
34	I think the brand of WHT I am using is prestigious in its industry	☐	☐	☐	☐	☐	☐	☐
35	I think the brand of WHT I am using has high status in its industry	☐	☐	☐	☐	☐	☐	☐
36	I think this brand’s WHT is very upscale	☐	☐	☐	☐	☐	☐	☐
37	I think the brand employees I've encountered are friendly	☐	☐	☐	☐	☐	☐	☐
38	I think the brand employees I've encountered are capable of promptly assisting me in resolving problems according to my needs (e.g., pre-purchase introduction and after-sales service)	☐	☐	☐	☐	☐	☐	☐
39	I think the brand employees I've encountered are able to think from my perspective.	☐	☐	☐	☐	☐	☐	☐
40	I think the origin of the brand is important to my	☐	☐	☐	☐	☐	☐	☐

consumption experience							
41 It is important to me to purchase domestic products to support the national economy	☐	☐	☐	☐	☐	☐	☐
42 Whenever possible, I prefer to purchase domestic brand	☐	☐	☐	☐	☐	☐	☐

Section 5: Customer experience of using WHT

This section is related to the customer experience of using WHT (e.g., Apple Watch, Huawei Smart watch and other medical wearable devices). It will explore your customer experience of using WHT. You are asked to rate your level of agreement with your personal usage experiences of WHT.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Some-what agree	Agree	Strongly agree
43. The WHT I am using always meets my requirements	☐	☐	☐	☐	☐	☐	☐
44. I am satisfied with the performance of the WHT I am using	☐	☐	☐	☐	☐	☐	☐
45. The performance of the WHT makes me feel that my choice is wise	☐	☐	☐	☐	☐	☐	☐
46. I encourage other people to use WHT	☐	☐	☐	☐	☐	☐	☐

47. I will recommend WHT to other people if they ask my advice about WHT	☐	☐	☐	☐	☐	☐	☐
48. I say positive things about WHT to other people	☐	☐	☐	☐	☐	☐	☐

Section 6: Sustainable consumption of WHT

This section is related to the sustainable consumption of WHT (e.g., Apple Watch, Huawei Smartwatch, and other medical wearable devices) and the moderators that may impact it. You are asked to rate your level of agreement with regards to your intention to practice sustainable consumption of WHT and the moderators that may impact it.

	Strongly disagree	**Disagree**	**Somewhat disagree**	**Neither agree nor disagree**	**Some-what agree**	**Agree**	**Strongly agree**
49. It is easy for me to self-manage my health conditions by using WHT	☐	☐	☐	☐	☐	☐	☐
50. I have the capability to use wearable devices to self-monitor my physical conditions	☐	☐	☐	☐	☐	☐	☐
51. I am able to use WHT to self-manage my health conditions without much effort	☐	☐	☐	☐	☐	☐	☐
52. I am at risk of suffering from chronic diseases	☐	☐	☐	☐	☐	☐	☐

53. I am likely to suffer from chronic diseases	☐	☐	☐	☐	☐	☐	☐
54. It is possible for me to suffer chronic diseases	☐	☐	☐	☐	☐	☐	☐
55. If I suffered the chronic disease, it would be severe	☐	☐	☐	☐	☐	☐	☐
56. If I suffered the chronic disease, it would be serious	☐	☐	☐	☐	☐	☐	☐
57. If I suffered the chronic disease, it would be significant	☐	☐	☐	☐	☐	☐	☐
58. When I have difficulty using WHT, I can seek help from others (e.g., family, friends, or staff)	☐	☐	☐	☐	☐	☐	☐
59. I was encouraged by relatives to use the WHT (e.g., purchasing equipment for me, supervising my usage)	☐	☐	☐	☐	☐	☐	☐
60. I hope that the relevant government departments can issue more detailed specifications and requirements for WHT to ensure my rights and	☐	☐	☐	☐	☐	☐	☐

interests when using it							
61. If the relevant governmental bodies implement more comprehensive policies and regulations pertaining to WHT, it will strengthen my long-term inclination to utilize it.	☐	☐	☐	☐	☐	☐	☐
62. When I have had a good experience with the WHT I use, negative disclosures about the brand in the media will not affect my long-term adoption intention	☐	☐	☐	☐	☐	☐	☐
63. When I have a good experience with WHT I use, the brand's self-disclosure of negative information does not affect my long-term adoption intention	☐	☐	☐	☐	☐	☐	☐
64. When I have had a good experience with the WHT I use, the negative information about this brand does not affect my long-term	☐	☐	☐	☐	☐	☐	☐

adoption intention							
65. I will continue to use WHT	☐	☐	☐	☐	☐	☐	☐
66. I will continue to use WHT frequently	☐	☐	☐	☐	☐	☐	☐
67. I am willing to use WHT in the future	☐	☐	☐	☐	☐	☐	☐

THANKS FOR COMPLETING THIS SURVEY!

Appendix E. Survey of Sustainable Consumption of Wearable Healthcare Technology for Senior citizens (Chinese Version)

可穿戴医疗保健设备在老年人群体中的可持续消费

本研究旨在确定和衡量能够导致老年人可穿戴医疗保健设备的可持续消费的决定因素。非常感谢您愿意参与此次调查研究。所有收集到的信息都将以匿名方式保存并由英国纽卡斯尔大学商学院的研究人员进行分析研究。希望您能够就您对于可穿戴健康设备的使用经验，对以下问题提供您的看法与意见。本次问卷调查耗时约5-10分钟。再次感谢您对于此次研究的大力支持与合作！

术语解释:

可持续消费是指长期、负责任地使用可穿戴医疗技术的承诺，旨在最大限度地减少对环境、社会福祉和个人健康的负面影响。

可穿戴医疗保健技术是一种附着在身体或植入身体的智能设备，能够跟踪生理信号以用于健康相关目的。 例如：Apple Watch、华为Watch、小米手环。

第一节: 基本情况

1. **性别：** ☐男性 ☐ 女性 ☐ 其他 2. **年龄：** ☐ 60-65 ☐ 66-70 ☐ 71-75 ☐ 76- 80 ☐ over 81 3. **教育背景：** ☐ 初中及以下 ☐高中 ☐ 专科或同等学历 ☐ 本科 ☐ 硕士及以上 4. **月收入：** ☐ <1000 ☐ 1001-3000 ☐3001-5000 ☐ 5001-8000 ☐ over 8000

第二节: 设计方面的领导力

此节调查关于可穿戴医疗保健设备（例如：苹果手表，华为智能手表以及其他可穿戴医疗保健设备）在设计方面所表现的领导力。此节旨在探讨可穿戴医疗保健设备在设计方面所表现出的领导力如何影响客户体验和可持续消费。希望您能够基于您的个人使用经验，来对以下表述进行评价。

	非常不同意	不同意	比较不同意	一般	比较同意	同意	非常同意
5. 可穿戴医疗保健设备在白天的使用的体验感是舒适的	☐	☐	☐	☐	☐	☐	☐
6. 可穿戴医疗保健设备在晚上的使用的体验感是舒适的	☐	☐	☐	☐	☐	☐	☐
7. 在使用可穿戴医疗保健设备时，我没有出现任何不适的症状（例如：皮肤瘙痒、皮肤过敏以及皮肤表面低温烫伤等）	☐	☐	☐	☐	☐	☐	☐
8. 可穿戴医疗保健设备能够快速显示健康数据	☐	☐	☐	☐	☐	☐	☐
9. 在使用可穿戴医疗保健设备时，我能够很容易的选择我想使用的功能	☐	☐	☐	☐	☐	☐	☐
10 在使用可穿戴医疗保健设备时，我能够快速搜索到我需要的信息	☐	☐	☐	☐	☐	☐	☐
11 可穿戴医疗保健设备是简单易学且易于使用的	☐	☐	☐	☐	☐	☐	☐

12 可穿戴医疗保健设备能够提供明确的提示信息来帮助我发现和使用一些我未曾了解的功能	☐	☐	☐	☐	☐	☐	☐
13 我不需要花太多时间来学习和使用可穿戴医疗保健设备	☐	☐	☐	☐	☐	☐	☐
14 可穿戴医疗保健设备在功能上的表现是稳定的	☐	☐	☐	☐	☐	☐	☐
15 使用可穿戴医疗保健设备可以帮助我监控自己的健康状况，从而有效改善我的健康情况	☐	☐	☐	☐	☐	☐	☐
16 可穿戴医疗保健设备的功能很方便	☐	☐	☐	☐	☐	☐	☐

第三节: 技术方面的领导力

此节调查关于可穿戴医疗保健设备（例如：苹果手表，华为智能手表以及其他可穿戴医疗保健设备）在技术方面所表现的领导力。此节旨在探讨可穿戴医疗保健设备在技术层面所表现出的领导力如何影响客户体验和可持续消费。希望您能够基于您的个人使用经验，来对以下表述进行评价。

	非常不同意	**不同意**	**比较不同意**	**一般**	**比较同意**	**同意**	**非常同意**
17. 我认为通过可穿戴医疗保健获得的数据质量可以被认为与通过传统医疗系统（例如血压计）获得的数据一样值得信赖	☐	☐	☐	☐	☐	☐	☐
18. 我认为可穿戴医疗保健设备上显示的数据准确无误	☐	☐	☐	☐	☐	☐	☐
19. 我认为可穿戴医疗保健设备提供的健康信息是全面的	☐	☐	☐	☐	☐	☐	☐
20. 我担心使用可穿戴医疗保健设备时会泄露我的个人数据等信息	☐	☐	☐	☐	☐	☐	☐
21. 我担心使用可穿戴医疗保健设备会对我的身体健康造成风险（例如，电磁辐射或皮肤灼伤）	☐	☐	☐	☐	☐	☐	☐
22. 使用可穿戴医疗保健设备可能会让我精神上感到不适 （例如：由于被监控引起的紧张压力）	☐	☐	☐	☐	☐	☐	☐

23. 我认为可穿戴医疗保健设备的数据实时显示处理功能可以帮助我随时获取我所需要的数据	☐	☐	☐	☐	☐	☐	☐
24. 我认为可穿戴医疗保健设备的所提供的实时提醒（如：心率变化，久坐提醒）能够帮助我更好的监控我的健康（如：心率变化，久坐提醒）	☐	☐	☐	☐	☐	☐	☐
25. 我愿意收到并查看可穿戴医疗保健设备基于实时监控技术所提供的反馈（例如心率过速、久坐提醒）	☐	☐	☐	☐	☐	☐	☐
26. 我使用人工智能（可以通过语音呼叫来提供帮助服务的虚拟助手，例如呼叫小爱同学或小度）来帮助我使用可穿戴医疗保健设备监测我的健康状况	☐	☐	☐	☐	☐	☐	☐
27. 我认为人工智能对我使用可穿戴医疗保健设备来监测我的健康状况是有助益的	☐	☐	☐	☐	☐	☐	☐
28. 我认为人工智能可以通过分析多种数据来识别潜在的疾病	☐	☐	☐	☐	☐	☐	☐

第四节:品牌方面的领导力

此节调查关于可穿戴医疗保健设备（例如：苹果手表，华为智能手表以及其他可穿戴医疗保健设备）在品牌方面所表现的领导力。此节旨在探讨可穿戴医疗保健设备在品牌层面所表现出的领导力如何影响客户体验和可持续消费。希望您能够基于您的个人使用经验以及对您使用的可穿戴医疗保健设备的品牌的认知，对以下表述进行评价。

	非常不同意	不同意	比较不同意	一般	比较同意	同意	非常同意
29. 我认为该品牌是值得信赖	☐	☐	☐	☐	☐	☐	☐
30. 我对该品牌很满意	☐	☐	☐	☐	☐	☐	☐
31. 我认为该品牌的可穿戴医疗保健设备的质量是值得信赖的	☐	☐	☐	☐	☐	☐	☐
32. 我认为该品牌的可穿戴医疗保健设备的质量是好的	☐	☐	☐	☐	☐	☐	☐

33. 我认为该品牌的可穿戴医疗保健设备的质量是在可接受范围内的	□	□	□	□	□	□	□
34. 我认为该品牌在同产品行业中是有声望的	□	□	□	□	□	□	□
35. 我认为该品牌在同产品行业中是处于很高地位的	□	□	□	□	□	□	□
36. 我认为该品牌的产品是比较高档的	□	□	□	□	□	□	□
37. 我认为我所接触过的该品牌的员工是友好的	□	□	□	□	□	□	□
38. 我认为我所接触过的该品牌的员工能够根据我的需要帮我解决问题（例如售前咨询和售后服务）	□	□	□	□	□	□	□
39. 我认为我所接触过的该品牌的员工能够站在我的角度上考虑	□	□	□	□	□	□	□
40. 我认为该品牌的所属国（例如中国华为，美国苹果）会对我的消费体验造成影响	□	□	□	□	□	□	□
41. 购买国产品牌以支持经济对我来说很重要	□	□	□	□	□	□	□
42. 如果有可能，我更倾向于选择国产品牌	□	□	□	□	□	□	□

第五节: 可穿戴医疗保健设备的用户体验

此节调查关于可穿戴医疗保健设备（例如：苹果手表，华为智能手表以及其他可穿戴医疗保健设备）的用户体验。希望您能够基于您的个人使用体验，对以下表述进行评价。

	非常不同意	不同意	比较不同意	一般	比较同意	同意	非常同意
43. 我所使用的可穿戴医疗保健设备能够满足我的需求	□	□	□	□	□	□	□
44. 我对我所使用的可穿戴医疗保健设备的性能感到满意	□	□	□	□	□	□	□
45. 我认为使用可穿戴医疗保健设备的选择是明智的	□	□	□	□	□	□	□
46. 我会推荐我的亲朋好友使用可穿戴医疗保健设备	□	□	□	□	□	□	□

47. 如果有人问我关于可穿戴医疗保健设备的建议，我会推荐他们使用	☐	☐	☐	☐	☐	☐	☐
48. 当别人向我咨询使用可穿戴医疗保健设备时，我会提供使用这一设备好处以及相关的积极信息	☐	☐	☐	☐	☐	☐	☐

第六节: 可穿戴医疗保健设备的持续使用

此节调查关于可穿戴医疗保健设备（例如：苹果手表，华为智能手表以及其他可穿戴医疗保健设备）的持续使用意向及其调节因素。希望您能够基于您的持续使用意向及相关调节因素，对以下表述进行评价。

	非常不同意	不同意	比较不同意	一般	比较同意	同意	非常同意
49. 通过使用可穿戴医疗保健设备，我能够很容易对我的健康状况进行自我管理	☐	☐	☐	☐	☐	☐	☐
50. 我有能力使用可穿戴医疗保健设备来自我监测身体状况	☐	☐	☐	☐	☐	☐	☐
51. 我能够轻松使用可穿戴医疗保健设备来自我管理我的健康状况	☐	☐	☐	☐	☐	☐	☐
52. 我很有可能会患多种慢性病	☐	☐	☐	☐	☐	☐	☐
53. 我有可能会患多种慢性病	☐	☐	☐	☐	☐	☐	☐
54. 我不一定会患多种慢性病	☐	☐	☐	☐	☐	☐	☐
55. 如果我得了慢性病，情况（经济、健康、生活质量）会有点严重	☐	☐	☐	☐	☐	☐	☐
56. 如果我得了慢性病，情况（经济、健康、生活质量）会比较严重	☐	☐	☐	☐	☐	☐	☐
57. 如果我患上慢性病，情况（经济、健康、生活质量）会特别严重	☐	☐	☐	☐	☐	☐	☐
58. 当我使用可穿戴医疗保健设备有困难时，我可以向他人（例如家人、朋友、员工）寻求帮助	☐	☐	☐	☐	☐	☐	☐

59. 我的家人亲友都支持我使用可穿戴医疗保健设备 （例如：为我购买设备，监督我使用）	☐	☐	☐	☐	☐	☐	☐
60. 我希望有关部门能够出台对于可穿戴医疗保健设备的更详尽规范的监管措施，从而保障我在使用时的利益不受侵害	☐	☐	☐	☐	☐	☐	☐
61. 如果关于这类设备有更完善的政策法规，我长期使用这一设备的意愿就会更强	☐	☐	☐	☐	☐	☐	☐
62. 当我使用可穿戴医疗保健设备时的体验很好的时候，媒体报道出关于该品牌负面信息并不会影响我长期使用这一设备的意愿	☐	☐	☐	☐	☐	☐	☐
63. 当我使用可穿戴医疗保健设备时的体验很好的时候，该品牌自己发布出一些负面信息并不会影响我长期使用这一设备的意愿	☐	☐	☐	☐	☐	☐	☐
64. 当我使用可穿戴医疗保健设备时的体验很好的时候，关于该品牌的一些负面信息并不会影响我长期使用这一设备的意愿	☐	☐	☐	☐	☐	☐	☐
65. 我打算继续使用可穿戴医疗保健设备来监测我的身体状况	☐	☐	☐	☐	☐	☐	☐
66. 我打算在未来增加对可穿戴医疗保健设备的使用频率	☐	☐	☐	☐	☐	☐	☐
67. 我以后也愿意使用可穿戴医疗设备	☐	☐	☐	☐	☐	☐	☐

再次感谢您对于本次研究的参与和贡献！

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