



Faculty of Economics and Business

**Assessment of Healthcare Providers' Acceptance of Telemedicine
Consultation in Sarawak**

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Assessment of Healthcare Providers' Acceptance of Telemedicine
Consultation in Sarawak

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A dissertation submitted

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DECLARATION

I declare that the work on this thesis was carried out in accordance with the regulations of Universiti Malaysia Sarawak. It is original and is the result of my work, unless otherwise indicated or acknowledged as referenced work. The thesis has not been accepted for any degree and is not concurrently submitted in candidate of any other degree.

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ABSTRACT

In order to provide information, education, medical consultation, diagnosis, treatment, support, and governance, Malaysia formed the Telemedicine Blueprint in 1997. The COVID-19 epidemic enhanced consumer knowledge of telemedicine, but patients and healthcare providers still have low levels of adoption, according to the Malaysian Medical Council in year 2020. Despite the advantages of using such technology, healthcare personnel under utilize it due to several factors. Based on the background and problems of acceptability towards telemedicine, no market data for Sarawak is available, and has not yet been established. Besides, there are no user perspectives from healthcare providers that are found to match with telemedicine adoption based on the Sarawak context, and there are no guidelines based on data-riven (current-status in Sarawak) decisions. The telemedicine might able to leverage the issues of delayed diagnostic and the needs of medical consultations, yet the alarming still persist in Sarawak due to lack of medical officers in primary centers. As a result, the experiment aims to estimate the acceptability. The initial goal of this study is to identify the demographics and consumer attitudes towards telemedicine in Sarawak among healthcare providers. Next, determine consumers' perceivance of telemedicine in Sarawak. Finally, to demonstrate the broad correlations between consumer attitude and intention. Cross sectional study is embarked, 164 sample are collected from healthcare providers. Healthcare professionals of Sarawak's four largest cities, Kuching, Sibul, Bintulu and Miri, are the targeted. Questionnaires based on the TAM models are constructed to evaluate and forecast the acceptability of telemedicine. The association was examined using PLS-SEM. Throughout the study, four variables were shown to have a significant link in the TAM (6 hypothesis accepted out of 11). Researchers reviewed the significant variables related to the intention to use telemedicine systems to

assist healthcare business stakeholders in understanding how potential users embrace and adopt such a system. The significant of the study, might act as initial data platform to both the government and privates for the better understanding (knowledge and research) of how consumers can use an efficient telemedicine system in healthcare business settings from the perspectives of healthcare providers.

Keywords: Telemedicine, Acceptance, Healthcare provider, Perception and TAM.

***Penilaian Penerimaan Sistem Teleperubatan di dalam Kalangan Penyedia
Perkhidmatan Kesihatan di Sarawak***

ABSTRAK

Akta Teleperubatan 1997 yang digubal di Malaysia, telah menyediakan kemudahan seperti maklumat, pendidikan, rundingan perubatan, diagnosis, rawatan dan sokongan urus tadbir. Sejak pandemik COVID-19, kesedaran penggunaan khidmat teleperubatan semakin meluas, walaubagaimanapun penerimaan masih rendah di Malaysia seperti yang dilaporkan pada tahun 2020 oleh Majlis Perubatan Malaysia. Walaupun sistem tersebut membawa kebaikan dan kemudahan, tetapi sambutan penggunaan masih rendah dikalangan penyedia perkhidmatan kesihatan. Berdasarkan latar belakang dan masalah penerimaan terhadap teleperubatan, setakat ini tiada maklumat tentang pengaruh penerimaan sistem teleperubatan di Sarawak. Tambahan pula, tiada data perspektif daripada penyedia perkhidmatan kesihatan, tiada rujukan asas data semasa di dalam konteks populasi di Sarawak. Teleperubatan mungkin dapat memanfaatkan isu diagnostik yang tertangguh dan keperluan perundingan perubatan, namun yang membimbangkan masih berterusan di Sarawak kerana kekurangan pegawai perubatan di pusat-pusat primer. Dengan ini, aspek kajian dimulakan dari segi pengaruh penerimaan. Objektif kajian ini adalah untuk mengenalpasti demografi pengaruh penerimaan, faktor-faktor pengaruh penerimaan di kalangan penyedia perkhidmatan kesihatan. Seterusnya, tentukan persepsi pengguna terhadap teleperubatan di Sarawak. Objectif akhir adalah, untuk meninjau hubungan keseluruhan antara faktor-faktor perspektif pengguna. Kajian keratan rentas dimulakan dengan 164 saiz sampel daripada penyedia perkhidmatan kesihatan. Empat kawasan bandar utama di Sarawak akan diutamakan untuk mendapatkan responden dari penyedia perkhidmatan kesihatan iaitu di Kuching, Sibu, Bintulu dan Miri. Alat kajian soal selidik

berdasarkan model Technology Acceptance Model (TAM), untuk mentafsir pengaruh penerimaan. Data analisis menggunakan PLS-SEM untuk pengujian model pengukuran statistik T. empat indikator menunjukkan signifikan dalam hubungan TAM modal (6 hypothesis diterima daripada jumlah 11 hypothesis). Faktor-faktor yang menggalakan penggunaan teleperubatan telah ditonjolkan, dan ini dapat membantu memberi pemahaman kepada pihak-pihak berkenaan khususnya dalam bidang perubatan. Signifikan dalam kajian kuantitatif ini berkemungkinan mampu bertindak sebagai platform data asas bagi rujukan pihak kerajaan dan swasta dalam memahami (pengetahuan dan penyelidikan) pengguna yang menggunakan sistem perkhidmatan teleperubatan secara berkesan dalam pengurusan penjagaan kesihatan, ataupun dari perspektif penyedia perkhidmatan kesihatan.

Katakunci: *Teleperubatan, Penerimaan, penyedia perkhidmatan kesihatan, perspektif dan TAM*

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LIST OF ABBREVIATIONS

%	Percentage
AI	Artificial intelligence
ATT	Attitude Toward Use
AVE	Average Variance Extracted
B2B	Business-to-business
B2C	Business-to-customer
BI	Behaviour Intention to use
BI	Behavior Intention
CA	Cronbachs Alpha
COVID-19	Coronavirus disease
CR	Composite Reliability
DV	Discriminant Validity
ICT	Information and communications technology
IoT	Internet of things
M2M	Machine to machine
PEU	Perceived Ease of Use
PLS-SEM	Partial least squares structural equation modeling
PU	Perceived Usefulness
TAM	Technology Acceptance Model
TPB	Theory of Planned Behavior
VIF	Variance Inflation Factor
WHO	World Health Organization

CHAPTER 1

INTRODUCTION

1.0 Overview

This section provides an overview on introduction of concept of research areas, research background in the context of Malaysia's market, a problem statement based on the gaps spotted in Malaysia, research questions development, objective of the research towards contributions, followed by the statement of research significant aspects, and the scope of research dimensions. In addition, the limitation of this study are stated.

1.1 Introduction

The provision of healthcare by adopting and integrating the healthcare system with information and communication technology (ICT) to improve the services has emerged as a call for virtual healthcare consultation (Jamieson et al., 2015 & Al-Shorbaji, 2022). This improves communication between patients, caregivers, and health care teams without requiring a physical visit. The patients receive healthcare through so-called e-visit, tele-consultation or virtual visits (Jung & Padman 2014; Mehrotra et al., 2013) to enable smooth continuation of medical care.

From the healthcare business dimensions, the implementation of telemedicine will increase the hospital performance and cost-effectiveness (Zhao et al., 2020), and this might help the health organization's business strategy as a competitive advantage (Chen et al., 2019). The positive demand and well-adopted progress of telemedicine into the business model due to

the increase return on investment (Sterling & LeRouge, 2019). With telemedicine as the upcoming wave of trend in medical business, it would help to boom in medical businesses. As healthcare providers are currently lacking in manpower (World Health Organization, 2013 & Džakula et al., 2022) in hospital, clinics would be given chances to assign patients to help out the governments in medical business. Nonetheless, pharmacies would also receive benefits. Health care stations can be set up at pharmacies for patients to do normal health check-up such as blood pressure monitoring, blood glucose monitoring, temperature monitoring, and body fat monitoring. Patients' results would be saved into the cloud system as healthcare providers would have assessed through the cloud, enabling them to increase their accuracy in diagnosing the patient (Webster, 2019).

The cost and safety aspects were improved by reducing the cost for both patients (Bynum et al., 2003) and healthcare, as well as enhancing the safety of self-centred management (Snoswell et al., 2020). In addition, Wade et al, (2010) systematically reviewed based on the economic aspect of telehealth services was shown cost-effective. This causes the new progress phenomena demands of telemedicine among the patients due to the factors of cost and logistic issues, such as at: China (Wang et al., 2019) and OCED countries (Eze et al., 2020).

Along with the rising awareness of telemedicine, yet omnipresence due to the several factors was identified (worldwide) such as: technical, resistance to change, age factor, education level, and reimbursement (Scott et al., 2018); geographic factor (Zhang and Zaman, 2020); However, there are still some limitations due to geography or education, whereby some remote areas do not have internet access (Drake et al., 2019). Patients

would not be able to practice telemedicine, as this requires both health care providers and patient cooperation to make it happen. Nonetheless, some patients with low education levels on devices such as smartphones, laptops, or tablets do not know how to have a meeting online during their appointment with their appointed healthcare provider (Scott et al., 2018). The factors that facilitate and resist telemedicine are different (from systematic reviews) and collectively grouped for better observations and improvement (Almathami et al., 2020). Besides, the health policy of telemedicine also contributes to the barrier factor towards implementation based on the systematic reviews (Kruse et al., 2021).

During the COVID-19 pandemic and unprecedented situation, the trend of telemedicine adoption increased. Several countries are starting to introduce and improve access to telemedicine services, especially in the Southeast Asia region (Gudi et al., 2021). Patients and healthcare providers are able to practice social distancing and reduce the risk of cross infections. Some patients who have difficulty with transportation or whose residential area is too remote and far from the nearby clinic would sometimes miss their appointment time, causing a huge issue.

Despite the non-monetary factors, the monetary valuation towards the telemedicine also part of the dimension in terms of marketing in the context of understanding patient preferences. As a result of the overview from this perspective, a systematic review of the 11 studies (7 countries) indicates: significant correlation between age and distance towards the WTP for telemedicine; with a broad range of percentage and amount of WTP with 19%-70% and US\$0.89-US\$821.25, respectively (Chua et al., 2022). From the healthy

patient perspective, the WTP for a healthy lifestyle programme through the telemedicine platform show positive feedback based on the distance journey (Rauch et al., 2020).

From the fact of the various unique indications and factors of telemedicine adoption, it is paramount and vital to understand potential user behaviour in order to maximise the telemedicine health system for patient well-being. As the COVID-19 pandemic raged and entered post-pandemic, the telemedicine healthcare concept continued to innovate to increase utilisation (Sigh et al., 2022) and overwhelming demand (Jercich, 2022). Patient preferences may not be the same after the Covid-19 pandemic in terms of cost-related factors, where patients are sensitive to out-of-pocket costs for video visits (Predmore et al., 2021).

Hence, this study was initiated to reviews the patterns of telemedicine in Malaysia especially in Sarawak state. The following sub-section reviews the background of the study to develop the desired research paradigms.

1.2 Background of the Study

Health concerns and resources in society are considered part of the socio-economic system worldwide, including Malaysia. Malaysia is among the countries to start virtual healthcare after establishing Malaysia's Telemedicine Blueprint in 1997 (Ministry of Health, 1997). Under this blueprint, the aim of service ranges from providing: information, education, medical consultation, medical diagnosis, medical treatment, medical support, and governance (Ministry of Health Malaysia, MOHM). In this context of the research, the element of consultation in the healthcare setting has been focused on. Under the

Telemedicine Act 1997, ‘telemedicine’ is defined in a practical way: the practice of medicine using the audio mode, visual mode and data communications. The existence of telemedicine approaches in the healthcare system has brought benefits to both providers and patients (Maroop et al., 2011a). Overall, the proliferation of telemedicine adoption is slow and still needs to improve the system (Som et al., 2010; Zailani et al., 2009).

The acceptance of telemedicine among healthcare providers is based on a positive response and willingness to adopt from the 4 hospitals (Selayang Hospital, Kuala Lumpur Hospital, Sungei Buloh Hospital, and Putrajaya Hospital) (Zailani et al., 2014) and 17 main hospitals plus 62 district hospitals (Ibrahim et al., 2010), respectively. In contrast, a cross-section study in a single hospital (Hospital of Conselor Tuanku Muhriz) shows moderate acceptance among the doctors (Abushaar & Ismail, 2018). While from the public (Selangor) perspective, a recent study from Lee et al. (2020) shows mobile health (m-health) is well perceptive.

In the last decades, the Malaysian Medical Council (2020) found that consumers have been boosted to consider their demand for health monitoring. Their consciousness of telemedicine increased even more drastically during the COVID-19 pandemic. Therefore, the healthcare industry continues to provide services, especially primary care, by starting to adopt the telemedicine approach (Malaysian Medical Council, 2020). This contrasts with a recent cross-sectional study and a short survey during the pandemic in Malaysia, which indicate the status of telemedicine among healthcare providers’ perspectives is not well reflected, such as the benefits and real practices of telemedicine being low (Thong et al., 2021). The healthcare providers in Malaysia outlooks the benefits of telemedicine with the

concern factors of: digital literacy, disability, language, location, or internet connection, and these will lead to weak patient-outcomes (Salleh, 2021).

From the above reviews, despite evidence of effectiveness for telemedicine, there is still a low rate of practice among healthcare providers and patients. Therefore, recognising the factors from the consumers' perspective regarding telemedicine can assist healthcare systems, either from the government or private sector, to improve acceptance levels. This is in line with the positive findings of evidence-based research that properly identify the factors able to increase the acceptance level among patients (Woo & Dowding, 2018). In addition, it is important to evaluate telemedicine attitudes as a foundation for successful implementation (Waschkau et al., 2020). Hence, recently the first study to look at views towards telemedicine in East Malaysia was done in Sabah, and it revealed (attitude foundation data) a high level of acceptability among respondents from rural areas (Manzoor et al., 2022).

1.3 Problem Statement

Although the Malaysian government developed and revised the version of telemedicine with the aim of ensuring to restructure the healthcare communication from doctor-centred to patient-centred care by incorporating Information and communications technology (ICT) (Som et al., 2010). In the past two decades, the system should have matured enough to be part of the healthcare system for the public. Based on the studies over the past two decades have provided important information on factors by using several theories to estimate the influence of the adoption of telemedicine in Malaysia. For instance, phenomenology mixed method design and a one-phase approach (Maroop et al., 2011a); theory-driven and

prior-research approach (Maroop et al., 2011b); and mixed method convergent design and a one-phase approach (Maroop et al., 2014); Technology Acceptance Model (Abushaar & Ismail, 2018). Even with all these studies, the acceptance among the users are still not dominant enough, as portray from a cross-sectional study revealed that pharmacists and allied health care providers accessed teleconsultation less frequently (Ng et al., 2022). The majority of studies are conducted from the perspective of healthcare providers rather than the public/patient or two perspectives in a single research approach. This lead, the acceptance of certain factors is not always clear visualized in Malaysia. In addition, these previous studies of findings are based on peninsular Malaysia and would perhaps not be applicable in the Sarawak context as there are no solid indications of similar factors.

Moreover, the following questions highlight the problem: "The healthcare sector is subject to strict regulation. Are we ready to abide by our rules. Are there any telemedicine services available right now?", in regard to the issues mentioned by the Ministry of Health delegate during the Selangor International Healthcare Conference 2022 (Moreira, 2022). Which means the situation is still unclear. According to the most recent news, the utilisation of technology in the field is still minimal, according to a statement from Health Digital Technologies (DoctorOnCall) co-founder Hazwan Najib (Ignatius, 2023). While in Sarawak, the planning and research are undertaken in Sarawak to improve all digital infrastructure, particularly to improve telemedicine connectivity in 2020 (Jee & Yih Boon, 2020). Although telemedicine as a concept has been developed and supported by the Sarawak government since 2011 (Sarawak Government, 2011) and was introduced in year 1997 (blueprint telemedicine under Ministry of Health Malaysia). With this scenario, informed the delayed of unknown causes in Sarawak. This might due to lack of perspective

determinants from consumers. In which, the new mode of medical services feedback are part of the important factors towards the telemedicine business developing framework (Velayati et al., 2021).

The implementation continues to face challenges in Sarawak. As the demographic structure in Sarawak was different compared to Peninsular Malaysia. The demographic also acts as a factor of acceptance towards the desired study (Maroop et al., 2014). There is no telemedicine market data available in Sarawak based on the context of acceptance towards telemedicine, which has yet to be determined due to the previous studies focusing on Peninsular Malaysia. Furthermore, there are no guidelines based on data-driven (current status in Sarawak) decisions available, and no comprehensive user perspective factors are identified to align with telemedicine adoption based on the Sarawak context. Therefore, the current study was designed to investigate the telemedicine market in Sarawak. As the discrepancies in healthcare between rural and urban areas have been evident, and it has been argued that patient and provider satisfaction are two important determinants of whether telemedicine services can be established (Falcon, 2019). Hence, this study to initiate investigate the perspective of health-care providers acceptance of telemedicine. The healthcare-dimensional perspective is a crucial step in fostering public engagement and involvement in their healthcare system through the use of telemedicine.

Telemedicine is an important technique for increasing access to medical treatment in remote places. It serves to bridge the gap between healthcare providers and patients in distant areas, particularly in Sarawak. The scarcity of medical officers in rural areas, such as Sarawak, is a pressing issue. According to reports, more than half of Sarawak's remote

community health centres lack medical professionals (Ling & Vethasalam, 2023; Jamie, 2020). On top of the shortage of medical officers, rural communities in Sarawak also face challenges in accessing important health information (Panting et al., 2023). This lack of access to health information further delays the diagnostic process and hinders effective healthcare delivery (Wan et al., 2020; Mohamad et al., 2022).

Overall, despite the increasing availability of telemedicine services, their acceptance level still remains low in the Malaysia market. This is despite research that suggests it could improve patient outcomes and reduce healthcare costs. In order to better understand why telemedicine is not being adopted as widely as it should be, we need to identify the specific factors that are preventing its acceptance in this market. Through an analysis of existing research and data, this study seeks to identify these factors and provide recommendations on how they can be addressed.

1.4 Research Questions

Based on the reviewed background of study, there is a gap of undefined telemedicine in Sarawak. Thus, this study to proceed with the research questions:

- i. What are the demographic characteristic patterns of telemedicine in Sarawak among the healthcare providers?
- ii. What are the healthcare providers' attitudes towards the telemedicine in healthcare system in Sarawak?
- iii. What are the healthcare providers' perceptions towards the telemedicine in healthcare system in Sarawak?

- iv. What are the healthcare providers' intentions influencing towards telemedicine services in healthcare system in Sarawak?

Overall, a review of the acceptance concepts is selected in this study in order to focus on predicting market acceptance values. Therefore, the researcher is trying to investigate factors affecting the use of telemedicine. With this aspect of acceptance measurement of the current market, this project will investigate the pattern of telemedicine of healthcare system demand in Sarawak.

1.5 Objectives of the Study:

General Objective

In Sarawak, there is no published data available for telemedicine. The acceptance of telemedicine investigations is unclear market values in Sarawak. Understanding and identifying of different kinds of factors, their relationship, and the factors that trigger the intentions of to use telemedicine are essential for the healthcare business industry.

This present work was to investigate the healthcare provider's attitude towards telemedicine, which is already in the healthcare system, and how the system is starting to boom, especially during the pandemic COVID19. The adoption of telemedicine in the healthcare industry would have benefits, and the healthcare provider would convey their possible acceptance level of intention to use it by answering the questionnaire based on the well-known theory (refer to chapter 3, page 44).

Telemedicine has been gaining popularity in recent years, as it provides an effective and convenient way for medical practitioners to provide healthcare services. This study will look into the factors that lead to high or low acceptance levels of telemedicine and how these findings might differ from those found in the Sarawak context. The findings of this study could be used by healthcare practitioners and policymakers to better understand the level of acceptance of telemedicine in different contexts. The holistic and uniform telemedicine guidelines that any nation might modify according to the local circumstances to find the right tune accordingly (Intan Sabrina & Defi, 2021).

Specific Research Objective

Therefore, this study was developed to estimate the acceptance. This study designed to aim (perspective from healthcare provider):

- i. To assess the demographic characteristic factors (age, gender and education) of healthcare providers toward telemedicine in Sarawak.
- ii. To investigate the acceptance variables of healthcare providers' attitudes on telemedicine.
- iii. To determine the patterns of association between healthcare providers' perceptions of telemedicine.
- iv. To ascertain the elements influencing the intention to use telemedicine services among the healthcare providers.

To achieve the objectives, the following three conceptual frameworks of theories for this study are proposed based on their well applied and tested extensively for prediction:

- i. Technology Acceptance Model (TAM) (Abushaar & Ismail, 2018; Ramírez-Correa et al., 2020) is used to assess the adoption of telemedicine among healthcare providers.

Therefore, to answer these research questions, the frameworks are outlined as following:

Frameworks outline:

- i. TAM is to assess healthcare providers' perceived usefulness, ease of use, relative attitudes towards of telemedicine.

The TAM concept is to measure the perceptions of telemedicine consultation among healthcare providers. This is the finding from the systemic reviews by Harst et al. (2019). In addition, a survey (2020-2021) performed by McKinsey found that the perspectives in terms of convenience, experience, and future outlook are different from those of patients and physicians, which the patients are more preference (the three factors as mentioned above) as compared to physicians ("Patients Love Telehealth—physicians Are Not so Sure," 2022). Additional rationale for using TAM rather than UTAUT in this healthcare provider study is provided in section subtopic: TAM and UTAUT practicability of usefulness.

The theoretical model is based on TAM. The hypotheses are formulated based on the core element relationships of the model (Chapter 2; page 41).

1.6 Significance of the study

To the best of my knowledge, this is the first study of its kind in Sarawak. This study might serve as an initial data platform for both the government and private sector for better

planning and decision-making, especially in light of the new ages of digitalization in the healthcare industry and the geographic challenges in Sarawak. The valuation of these benefits is necessary to determine the suitable investment policy in the healthcare industry in Sarawak. This data also might contribute to an understanding (knowledge and research) of how consumers (from the perspective of healthcare providers) can embrace an effective telemedicine system in healthcare business settings in order to achieve sustainable telemedicine management (formulate the marketing strategy). Firstly, it improves healthcare system practices that suit the new technology and its demands by introducing telemedicine and enlightening policymakers about the role of telemedicine; Secondly, it enhances awareness of telemedicine and its role for telemedicine providers. Thirdly, it provides guidelines for healthcare providers to realise and understand the significance of using telemedicine. Finally, this research presents the current potentials and challenges of telemedicine based on the desired theories (which might be generalised to assessing the impact and effectiveness of telemedicine) used to frame the research.

1.7 Scope of Research

The aim of this study is to investigate the acceptance of telemedicine in the Sarawak market. Target locations are in the main cities (Kuching, Sibul, Bintulu and Miri) in terms of population and economic contribution to Sarawak state. The scope of this study is limited to healthcare providers (all health professionals from the private and government sectors) only. Healthcare providers who have served Sarawak for more than two years and above are the target group. The sample size for this study was calculated using G-power. This sample size was calculated with a markup 20% of the non-response rate for backup. The data collected from the respondents was based on (by answering the

questionnaire, an online survey): socio-demographic, socio-economic status, and attitude (the questionnaire was constructed based on the TAM theory).

This study is organised into three chapters, including: Chapter 1 presents an overview of telemedicine; Chapter 2 presents reviews of telemedicine based on the theoretical and empirical literature; and Chapter 3 presents the methods used for this investigation of the paper.

CHAPTER 2

LITERATURE REVIEWS

2.0 Introduction

This chapter of the literature review focuses on the areas based on the previous research on telemedicine within this research question (Section 1.4). Basically, it reviews telemedicine with its concept, definition, terminologies and classification/branches. This allows for the identification of research topics and contextualising the research within that literature. Then to explore the trends of telemedicine adoption characteristics: changes in innovation, benefits, and theories of adaptation with challenges. As well introduces the current practice status along with relevant sources of technology adoption in Malaysia. This literature review was done collectively to acknowledge the current and common factors (information, data, and evidence) that influence technology acceptance in Malaysian hospitals. By reviewing such factors and studying them, this able us to implement the improvements in the telemedicine context. Lastly, this review leads to the conceptual frameworks that are well-established to develop hypotheses, as well as the desired overview of the remedy to find the right tunes for implanting and adopting telemedicine in healthcare systems. Table 2.1 below summarises the outline purposes of the literature review.

Table 2.1: Outline purpose of a literature review

Literature review purpose	Section
Supporting the research topic areas by confirming the definitions	2.1 - 2.1.2
Supporting the research context areas in healthcare system	2.2 - 2.2.1

Table 2.1: Continued.

Supporting the research context areas in business entity within healthcare system	2.3
Supporting the categories of determinant factors research areas	2.4 - 2.4.1
Supporting the desired conceptual research scope area	2.5 - 2.5.1
Supporting the theoretical reflected within the research scope	2.6 - 2.7.9
Supporting Hypothesis development	2.8

Note: In general, to find the direction within the right context based on: Telemedicine, concepts, categories of themes and solutions to study questions.

2.1 The System Concept of Telemedicine

The telemedicine system requires the Five (5) components (Information gathering, Conversion, Transmission, Reconversion and Interpretation) to function from data collected through equipment to be transmitted from one hospital to another (Jerant, & Epperly, 1997). Which, the principles component in the ICT play an important roles in telemedicine development (Ramalingam, 2022) and related services for collecting, evaluating, and disseminating health-related data (Novillo-Ortiz, 2016).

Physical examination record component, Statistical graphic components of the system, Synchronization components. (Jaramillo et al., 2021). The technology continues developing to integrate in the telemedicine from the aspect of technical design, technical applications, interoperability, and security (Ackerman et al., 2002). After a decade, the new developing of next-generation telehealth was evolved. The new developed based on the patients (increase the availability), systems (enhance the medical tools for individual with system)

and data (integration of electronic medical data) perspectives (Ackerman et al., 2010). Another aspect of elements also highlighted in the telemedicine are the clients, communication elements, APIs and business logic, and storage and infrastructure services are the four main components (Cressler, 2021).

In general, the telemedicine application consists of electronic information of communication devices to provide the links between the healthcare providers with candidates (patients and healthcare providers) as illustrated at Figure 2.1.

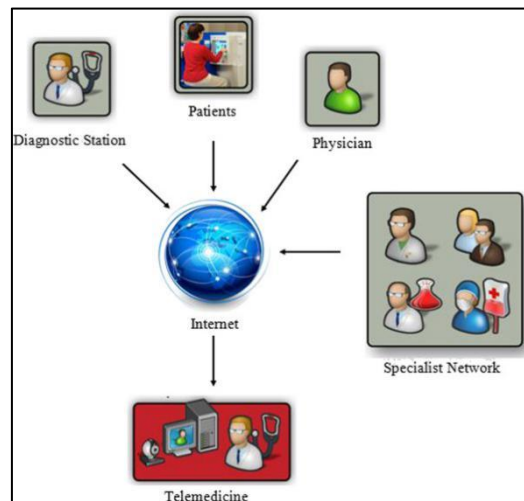


Figure 2.1: Components of Telemedicine

Sources: Telemedicine. <http://www.ustudy.in/node/5162>.

The telemedicine system of communication can be divided into two modes: online (synchronous) and offline (asynchronous). Online mode requires the audio-video synchronously by sending and obtaining the consultations (Nord et al., 2019). While for the offline modes, the medical data is converted into a recorded version, such as images, sound, video, and text, which is then sent to candidates. The instances of telemedicine's communication are: WeChat-based (Xu et al., 2020); Wireless Emergency (Abo-Zahhad et

al., 2014); email-based (Caffery & Smith, 2010); text and video based (Gur et al., 2017); message Apps (Ganapathy et al., 2020). All these examples are due to the vast development and creation of the Health 4.0 concept. This industry concept aims to improve efficiency, reduce costs, and transition to customised services for certain medical disciplines needs. This required technologies such as big data, the internet of things (IoT), Machine-to-machine (M2M), and artificial intelligence (AI) to generate medical aids and provide possible accessibility for patients and healthcare providers, especially in remote areas (Dubgorn et al., 2018).

Based on the evolution of the healthcare industry from healthcare industry 1.0 towards healthcare industry 4.0, as depicted in Figure 2.2, the healthcare system is heading from single, simple, and small data to more complex, teamwork with networks and health community, and lastly, the patient-centred concept (Li & Carayon, 2021).

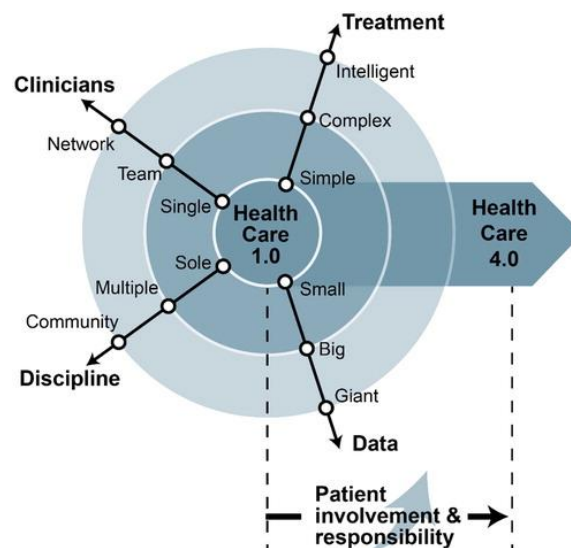


Figure 2.2: Evolution of Healthcare industry from 1.0 to 4.0

Source: Li et al. (2021)

2.1.1 Non-uniform Definition

The interoperability between the ICT onto medical disciplines to communication created the term telemedicine. Since then, the World Health Organization (WHO) published the Telematic policy to support and align the concept of Health-For-All strategy development globally in 1997. Hence, proposed the definition as stated in the following:

“The delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities”

There are different definitions presented by previous studies and no internationally accepted so far (WHO, 2009). In the same year, Malaysia aligns by established the “Telemedicine Blueprint” in 1997 with practical way of definition: practice of medicine using the audio mode, visual mode and data communications to link the participants in the healthcare system. Therefore, in this study referred to the definition accordingly.

2.1.2 Terminologies and Taxonomy of Telemedicine

The nomenclature of telemedicine and its derived terms: telehealth, e-health, m-health, and other new terms are under the main domain of ICT in healthcare and are used interchangeably. But with different conceptual and dimension approaches in each term, which were proposed by Bashshur et al. (2011). Another study from Combi et al. (2016) proposed the broader dimensions of taxonomy but still holds the concept of telemedicine.

The purpose of their review is to improve telemedicine in a more specific and focused manner based on its characteristics. A different perspective from another study presented the simple taxonomy for telehealth and telemedicine based on the three functions (telemetry, telephysis, and telepraxis) and application (Colucci et al., 2019). They believe that by focusing on different ICT-based practices, they might provide useful data for improving health policies, healthcare provision, and new developments.

The most recent study shows the telemedicine taxonomy in an empirical way by using the CAFÉ (collect, lign/fuse and evaluate) method. The final taxonomy consists of: Tele-consultation, Tele-diagnosis, Tele-ambulance, Tele-monitoring and digital self-management (Figure 2.3) (Harst et al., 2021). Since there is an unclear taxonomy of telemedicine, this study focused on all five types of telemedicine applications.

Application Type	Personnel Involved		Target Population	Setting	Technology	Data Provision	Intended Outcome
Tele-consultation	Patient	Pharmacist	Diagnosis (incl. Comorbidities)	Home-based	Web-based	Text-based (store-and forward)	Optimizing Care Processes
Tele-diagnosis	Physician	Tele-medicine institute	Disease specific characteristics	Hospital-based	Smartphone-based	Text-based (real-time)	Improvement of hard clinical outcomes
	Clinician						Improvement of social situation
Tele-ambulance	Para-medic	Physician's assistant	Demographics	Reha-facility-based	Telephone-based	Image-based (store-and forward)	Improvement of subjective health
Tele-monitoring	Social Worker	Case Manager		Portable	Wearables / Body Area Networks	Image-based (real-time)	Improvement of self-management support
	Dietitian	Nurse					Improvement of overall health status
Digital self-management	Physical Therapist	Psycho therapist			AAL / smart home technology	Image-based (real-time)	Decrease of workload for healthcare provider
	Funding agency					Video-based (store-and forward)	Improvement of economic efficiency
						Video-based (real-time)	Increase of patient safety
							Decrease of health service use
							Increased access to healthcare
							Improvement of diagnosis and early detection

Figure 2.3: Taxonomy of Telemedicine

Source: Harst et al. (2021)

2.2 The Trends of Telemedicine

In the past decade, the most published papers have been in Japan (37%) among Asian countries. The high rate of applications: store-and-forward modality (43%); 35% using videoconferencing; and 15% using a hybrid approach (Durrani & Khoja, 2009).

In India, acceptance is low, both from the public and professionals, and lack of awareness with the steady rise (Chellaiyan et al., 2019). During the pandemic, the acceptance of telemedicine was well-adopted, from 11% (early stage) up to 57% among the clinicians, and positive attitudes towards telemedicine after pandemic indicated 69% (Garg et al., 2020).

During the pandemic, the worldwide trend of interest in telemedicine was widely acceptance, as depicted in Figure 2.4 (Arshad Ali et al., 2020). The red line indicates the new cases, and the blue line indicates the relative search volume (RSV) in terms of public interest. This is in line with the finding from Wong et al. (2021), in which the demand for telemedicine increased during the pandemic in 50 countries.

According to the new research, the telemedicine concept is still continually strong and preferable in consumer perception as well as tangible investment in 2021 after the pandemic (Bestsennyy et al., 2022). Therefore, this research direction is still relevant to current practical scenarios.

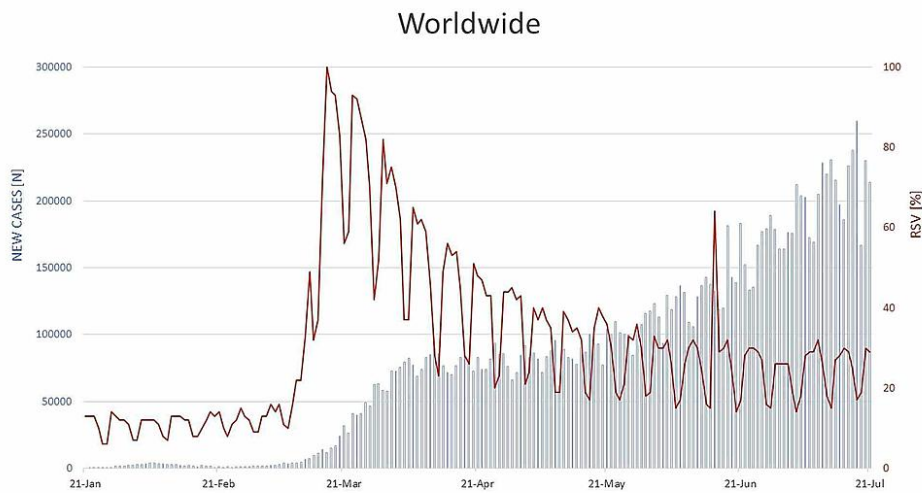


Figure 2.4: The emerged trend of telemedicine demand pattern during pandemic
Source: Arshad et al. (2020)

2.2.1 Telemedicine trend in Malaysia

After the Telemedicine Act 1997 was established in Malaysia, Abidi et al. (1998)'s team evaluated the adoption of telemedicine pilot projects from 1998 to 2003. In 1998, they started the four key pilots of telemedicine models in Malaysian government hospitals: Customised or Health Information of personalization and Health Education, Continuing Medical Education (CME) for healthcare providers; Tele approach for consultation and Lifetime Health Plan (LHP) integration for patient. The progress of the Telemedicine flagship in Malaysia with the growth of 42 teleconsultation hubs (unspecified the breakdown) has been set up and is functional (Mohan et al., 2004).

In 2009, Zailani et al. (2009) concluded that the potential of telemedicine, tele-health and e-health in Malaysia is still left to the question of unclear answer on: whether its adoption is successful or not. In the following year, Som et al. (2010) presented a statement of overview of telemedicine in Malaysia: Malaysia is delayed in the adoption process but on

the right track. For instant data from their study, Teleconsultation was developed in 2005, and not all of the government's hospitals implement it: 73 clinics (Johor, Selangor, Kuala Lumpur, Perlis and Sarawak). In the subsequent years, several researchers started to explore the benefits and factors of telemedicine in Malaysia to provide a better perspective for improvement (Table 2.2). As per the current status, telemedicine utilisation is still low in public primary care clinics in Malaysia (Ng et al., 2022).

Table 2.2: Research on Telemedicine in Malaysia

No	Title	Year Publisher	Authors
1	Telemedicine and medical informatics in the multimedia super corridor: the Malaysian vision.	Studies in health technology and informatics, 1998	Abidi etl al.
2	The Malaysian Telehealth Flagship Application: a national approach to health data protection and utilisation and consumer rights.	International Journal of Medical Informatics, 2004	Mohan et al.
3	Telemedicine in the Malaysian Public Hospitals: Are We There Yet?	International Conference on Business, Finance and Tourism Management, 2009	Zailani et al.

Table 2.2 Continued

4	Telehealth in Malaysia — An overview.	IEEE Symposium on Industrial Electronics and Applications (ISIEA), 2010	Som et al.
5	Teleconsultation Technology and Its Benefits: In the Case of Public Hospitals in Malaysia.	International Conference on Information Resources Management in association with the Korea Society of MIS Conference, 2011	Maarop et al.
6	Exploring Factors That Affect Teleconsultation Adoption: In The Case Of Malaysia.	Pacific Asia Conference on Information Systems, PACIS, 2011	Maarop et al.
7	Determinants of Telemedicine Acceptance in Selected Public Hospitals in Malaysia: Clinical Perspective.	Journal of Medical System, 2014	Zailani et al.
8	Understanding Demographics Influence on Teleconsultation Acceptance in Hospitals: A Mixed-Method Study.	Journal of Advanced Management Science, 2014	Maarop et al.

Table 2.2 Continued

9	Acceptance of Tele-Consultation and its Determinant Factors among Doctors in Outpatient Clinics in the Hospital of Conselor Tuanku Muhriz, Kuala Lumpur, Malaysia.	Journal of Community Medicine & Health Education, 2018	Abushaar et al.
10	m-Health views and perception among Malaysian: findings from a survey among individuals living in Selangor	<i>mHealth</i> , 2020	Lee et al.
11	Perception of telemedicine among medical practitioners in Malaysia during COVID-19	Journal of Medicine and Life, 2021	Thong et al.
12	Assessing the Availability of Teleconsultation and the Extent of Its Use in Malaysian Public Primary Care Clinics: Cross-sectional Study	JMIR Formative Research, 2022	Ng et al.
13	Attitudes towards and the confidence in acceptance of telemedicine among the people in Sabah, Malaysia.	International Journal of Health Sciences, 2022	Manzoor et al.

This review of the literature in chronological order focuses on the investigative process before moving on to how the case has evolved through time to look at any hidden patterns (Figure 2.5). Telemedicine is a rapidly growing technology, and its acceptance by the public is an important factor in its successful implementation. Collectively, factors such as:

user demographics, perceived benefit and usefulness, trust, hospital characteristics, government policies, top-management support, computer self-efficiency, attitude, medical-legal, bill, technical, education, willingness, and confidence are all important considerations when it comes to the acceptance of telemedicine.

Another review finding from the chronological, the Technology Acceptance Model (TAM), was used in two articles (Abushaar & Ismail, 2018; Manzoor et al., 2022) to evaluate how healthcare providers and the general public perceived the usage of technology in west Malaysia and Sabah, respectively. In a different study (Maroop et al., 2011b), the perception in west Malaysia was investigated using a qualitative theme question method based on the TAM and UTAUT. These variances (qualitative approach) of TAM and UTAUT models highlight the patterns of findings (Factors: Trust and Facilitating), and consumers' target groups are mostly healthcare providers. It should be noted that the conclusions of these chronology studies could not apply to the Sarawak region. Because user demography and hospital characteristics have a substantial impact on telemedicine adoption (Maroop et al., 2014). Notably, as reflected in the chronology of research patterns in Malaysia (Figure 2.5), except for two studies by Lee et al. (2020) and Manzoor et al. (2022), the majority of previous studies were done from the standpoint of a healthcare provider. These two investigations were carried out in a specific neighbourhood. Lee et al. (2020) from Selangor state (encompassing Klang and Petaling) and Manzoor et al. (2022) from rural districts in Sabah state (Penampang and Putatan). In terms of a single study, there is no conceptual research to frame the two perspectives from healthcare providers and the general public/patient.

In addition, it is unclear how well telemedicine will be implemented in Malaysia (after 25 years since the establishment of telemedicine blue print in 1997), and telemedicine connectivity in Sarawak is still being planned and researched (Figure 2.5). In this scenario in Sarawak, there is no foundation database available in terms of telemedicine acceptance perspective. To convey the significance of telemedicine in the healthcare setting, the next sub-topic will examine the advantages and difficulties of telemedicine deployments in order to understand certain important aspects of the healthcare system in the context of healthcare business. Then investigate the telemedicine context's acceptance theories to be proposed in this study.

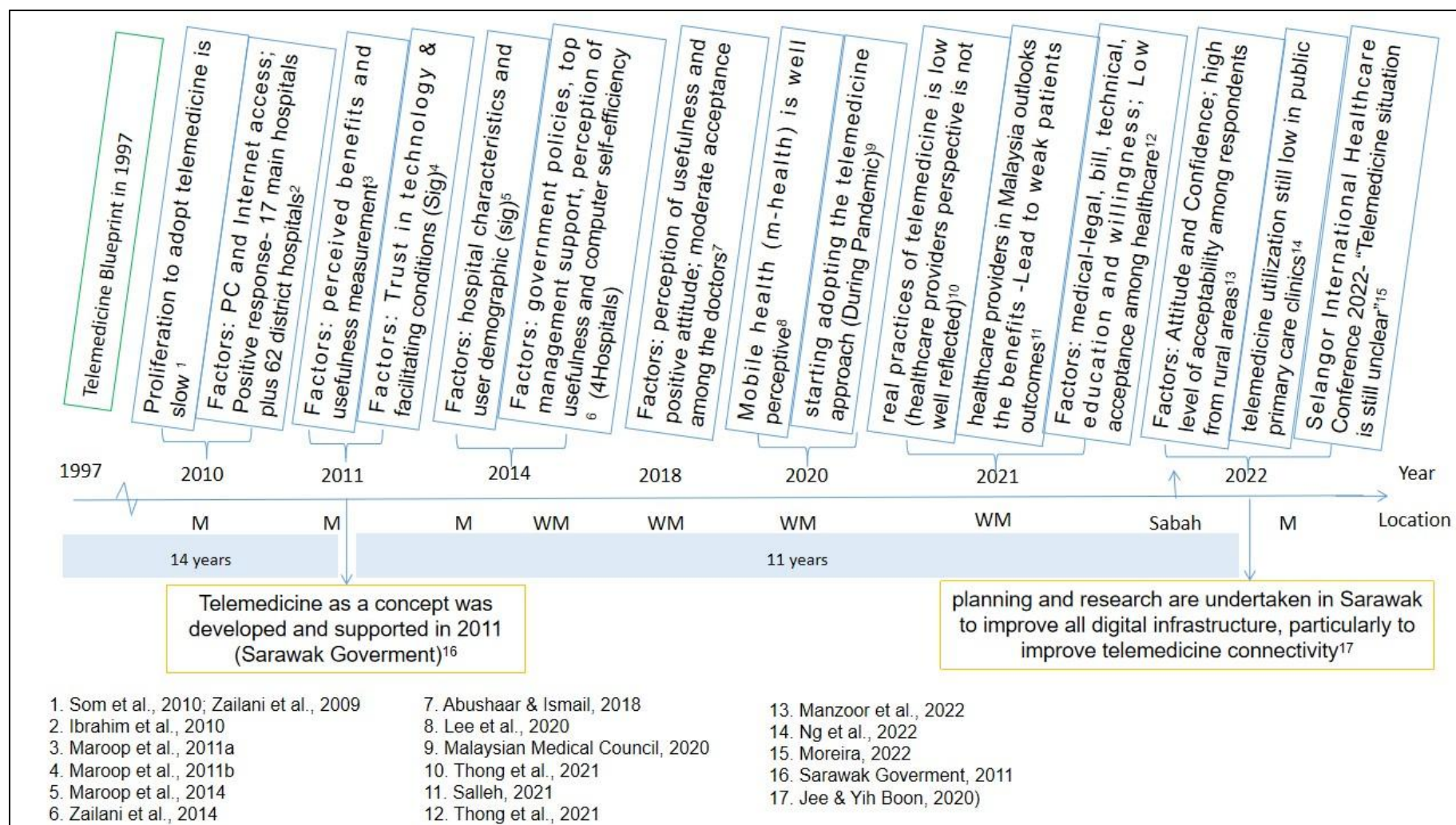


Figure 2.5: Chronology of Telemedicine research in Malaysia

Note: Only two studies based on public oriented: Lee et al. (2020) and Manzoor et al. (2022), the rest of the studies are based on healthcare providers.

2.3 Benefits of Telemedicine in the Context of Business

Overall, telemedicine saves time, reduces costs, and improve patient engagement with their healthcare providers. But it also improves privacy issues, reliability, security, and quality concerns (Maryam Alvandi, 2021).

Research from Whitacre (2011) reveals the positive impact in terms of economics of the telemedicine adopted in 24 rural communities in the USA. He presents four main economic contributions: hospital internal cost savings (outsourcing the telemedicine technology to third parties); transportation savings for both the hospital and patients; safe incomes if missed work for patients; and enhanced laboratory and pharmacy work performed locally.

A case study from Moreira et al. (2021) reported the path of a telemedicine platform in Brazil. They present the telemedicine platform called Conexa, which initially run business-to-business (B2B) but diversified into business-to-customer (B2C) by launching the Docpass during the pandemic. This B2C segment platform grew spectacularly in terms of the number of patients and registered physicians in the system. As they believe, more patients bring higher remuneration, while a more registered physician can contribute to faster healthcare service at a good price and greater medical coverage.

Peter et al. (2015) carefully evaluate the successful telemedicine business models for complex services. They identified the three business model patterns (enablement, support, and empowerment) for telemedicine services that might be the remedy for this industry. The enablement, support, and empowerment concept patterns focus on the business-to-business environment with the healthcare provider dimension, the business-to-business environment

with the patient dimension, and the business-to-consumer environment with direct contact with patients, respectively.

Hence, there is no doubt that telemedicine is getting popular and demanding, and more scholars and practitioners are needed to ensure the implementation of telemedicine with an evident approach.

2.4 Adaption of Telemedicine with Challenges

Besides the benefits of telemedicine in the healthcare system, the challenges and drawbacks that coexist lead to resistance to the integration process. This scenario illustrates that in developing countries, the success rate is still low due to the challenges (Bali, 2018). Even with the global (38 countries) trend of telemedicine acceptance increasing among paediatricians, the barriers such as limited access, home environment distractions, preference for physical care, effectiveness of telemedicine, healthcare efficiency, and cost are indicated that hinder the telemedicine implementation process (Srinivasan et al., 2021).

According to new research using a systematic approach, a total of 98 obstacles were reviewed and grouped into three factor categories: people-related (4 factors: patient, healthcare provider, culture, and disease), process-related (6 factors: health sector, standards and guidelines, legislation, finance, organisation and methodology), and object-related (technology factor). These three main factors correlates with and impact the implementation process of telemedicine (Lena & Lorenz, 2019).

Based on the above-identified barriers, no specific “one-size-fits-all” model is available. Some barriers are categorised based on the weightage, where scoping reviews were done and

13 issues were pin-out based on the weightage (Table 2.3) for a better guideline for Southeast Asia (Intan Sabrina & Defi, 2021). Hence, factors and obstacles might not be the same based on the telemedicine implementation context setting.

Table 2.3: List of issues for Telemedicine to be addressed based on weightage.

Issues	Weightage
Clinical governance	100
Information and communication technology infrastructure	83.3
Privacy, storage, and record-keeping	77.8, respectively
Ethics and legal	77.8
Security and safety	72.2
Definitions and applications of telemedicine	72.2
Confidentiality	66.7
Licensing	66.7
Identification	55.6
Cost of information and communication technology infrastructure	55.6
Reimbursement	16.7
Mobile applications	11.1
Feedback and choices	5.6%

2.4.1 Issues of Adaptation Telemedicine in Malaysia

In the Malaysia context during the pandemic, the majority cited medico-legal issues and consent (80.6%), billing and charges (66.7%), insurance reimbursement (62.5%), and technical difficulties (62.5%) as their barriers to the adoption of telemedicine (Thong et al., 2021). In addition, trust in technology appeared significant in terms of personal data and effectiveness (Maarop et al., 2011). The support from government policies, top management support, perceptions of usefulness, and computer self-efficiency are part of the contributions towards adoption (Zailani et al., 2014).

Given these issues and problems in this telemedicine adaptation, it would be beneficial to be able to identify and resolve issues as a means of improving and ensuring the success of implementation. However, behavioural and social factors continue to play a significant role in success. According to a review of the literature, acceptability (behavioural) is a crucial component in telemedicine deployment, outweighing the other components (financial, organisational, policy, and technological) (Broens et al., 2007). This component is still employed as one of the variables that contribute to the success of implementation, as far as the users' attitude and viewpoint are concerned (Jacob et al., 2020).

As a result, the following subtopic will discuss the acceptance and willingness to pay concepts in the telemedicine platform to round out the research path.

2.5 Telemedicine Platform

Each platform has a comparable ecosystem comprised of four distinct categories of players (producer, provider, and customer). Platform providers and owners are in charge of intellectual property and platform governance. The platforms' user interface is provided by

providers. Customers use the products developed by producers (Alstyne et al., 2016). An empirical evidence demonstrating how traditional linear value chains in the healthcare industry were disrupted by platform-mediated two-sided markets (consumers and providers) (Hermes et al., 2020). This led to the new healthcare business model toward the platform to enable ecosystems (Gisby et al., 2022; Science Service - Dr. Hempel GmbH, 2019). Besides, this platform enables high-value transactions to take place between producers, service providers, and consumers (Viswanadham, 2021).

2.5.1 Stakeholder perspectives

From this platform, two important stakeholders (providers and consumers) play an important role in providing perspective on how telemedicine can be used most effectively. Providers can offer advice on how best to use this technology, while consumers can give feedback on their experiences with it. Hence, according to prior research, the service provider view and customer perspective combined with the service provider perspective and consumer perspective have a beneficial influence on customer development (Yuliandiastary et al., 2019).

According to the previous study, significant points of view may include, but are not limited to: 1) the health plan enrollee (potential customer-not patients), 2) the patient, 3) the health plan manager, 4) the provider, 5) the technology maker, 6) the specialist society, 7) government regulators, or 8) society as a whole. Depending on the decision environment, a valid and useful cost effectiveness analysis could be undertaken from the standpoint of any of these stakeholders (Garrison et al., 2018).

As a result of these findings, the purpose of this study was to analyse the perspectives of healthcare providers and public/patients. This allows us to gain the distinct stakeholder behaviour.

2.6 Research direction based on research questions

The direction of this project's research paradigm was streamlined by analysing the most recent results of systematic review publications. Sociotechnical aspects are evaluated using a systematic method to analyse the prevalence of various elements by categorising them in order to discover the significance of adoption in mobile health technology. They classified the issues into three categories: social and personal factors, technological aspects, and health-related factors (Jacob et al., 2022). Demographic, personal qualities, and cultural and social components are the four themes that comprise social and personal factors. Six themes were discovered for technological considerations: usefulness, ease of use, data-related, monetary factors, technical difficulties, and user experience. Finally, there are six major themes in health-related factors: the sickness or health condition, the role of the care team, health consciousness and literacy, health behaviour, relation to other therapies and integration into the patient journey, and the patients' insurance status.

It should be mentioned that there are numerous factors impacting the acceptance of technology-related medicine. A systematic review was conducted based on consumer behaviour in the context of technological advancement, as the tendency in this research is increasing to understand the components that fall within the frame of consumer behaviour. One of the most recently investigated emphasis themes is user acceptability, which has led to the application of numerous theories such as TAM, innovation diffusion theory (IDT),

Theory of Reasoned Action (TRA), theory of planned behaviour (TPB), and others to determine the adoption of technological innovation (Carvalho et al., 2022).

2.6.1 Acceptance perspective

Acceptance language is not unified and interchangeable with acceptability and adoption in the context of healthcare technology. Each word is used at various levels of the technology adoption journey (pre-use, first use, sustained use) (Nadal et al., 2019). This team expanded on the scoping by reviewing the technology acceptance terminology and measuring techniques. They classified the terms or interpreter items that measure acceptance into three categories: acceptance, acceptability, and adoption. The TAM model is used to generate all of the interpretation terms (Nadal et al., 2020). A systematic study reviewed that there are two main criteria of acceptance in the cluster of productivity-oriented approaches: utility (usefulness) and ease of use, based on the two acceptance models: TAM and UTAUT (Alexandre et al., 2018). Therefore, the following (Section 2.6) theories are explored to frame the research study.

2.7 End-User Acceptance of Telemedicine: Theories

To understand technologically appropriate and acceptance, there are several theories were presented by researchers. In this section, only three theories are highlighted for the purpose of this study concept. Users from healthcare providers are an important factor in the perspectives of telemedicine towards implementation in the healthcare system business. The desired TAM model of technology acceptance is pinned in this study due to the frequency of application and explanatory power on the subject group, where TAM was used most to translate acceptance among healthcare providers and UTAUT was often used to translate acceptance among patients (Harst et al., 2019). The demand and needs of telemedicine are

desired by healthcare organisations rather than individual healthcare providers (Maarop et al., 2009).

Therefore, the technology acceptance data (from perspectives of healthcare providers and patients) are important sources as a foundation of knowledge before implementation, for the purpose of a strategic evidence-based action plan (Scheibe et al., 2019 and Schwamm et al., 2017) and key factors in developing telemedicine (Velayati et al., 2021). To enhance the desired model in this study, a systematic review of recent findings states that the TAM is the most commonly used model for analysing factors impacting how various healthcare technologies are accepted by a variety (healthcare context) of user groups, situations, and nations, according to the study's primary conclusions (AlQudah et al., 2021).

In the following review on how adoption or acceptance are influenced by people's ideas and attitudes, TAM model serves as the primary focus of the literature review that is most likely to advance the subject. Which recommended creating alternative strategies to organise the complexity of telemedicine-related concerns (Shachak et al., 2019). Thus, for the following TAM model to be reviewed, the selection of a specific model is referred to as the foundation to match this research context in the healthcare provider aspect.

2.7.1 Technology Acceptance Model (TAM)

The origin of TAM was introduced by Davis (1986) to review holistic perspectives in terms of interactions among the various dimensions (Figure 2.6). The following figure demonstrates the components of the TAM concept. The consumer's behaviour of intention to use telemedicine are influenced by the dimensions of "attitude" and "perceived usefulness". In which it also factors towards the attitude, meanwhile the "perceived ease of use" dimension

affects both “attitude” and “perceived usefulness”. The external variables might determine the degree of both “perceived usefulness” and the “perceived ease of use”.

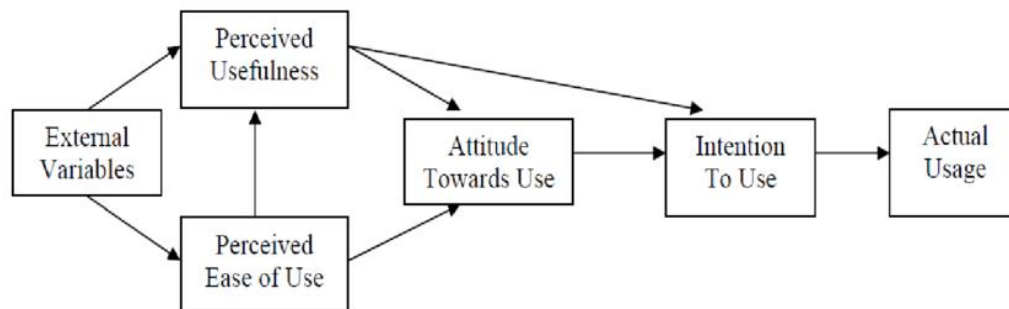


Figure 2.6: The Technology Acceptance Model’s components dimension

Source: Davis (1989).

2.7.2 TAM in Healthcare

This theory, which is applied in telemedicine, was attempted to investigate and is the most widely applied model of users' acceptance (Harst et al., 2019). The overall review findings indicated that TAM model is most commonly used by scholars to investigate the theories of telemedicine acceptance from the perspectives of usefulness, social influences, and attitude. This model remains the most practiced in e-Health research paradigm (Wang & Yu, 2022). According to the TAM, "perceived ease of use" and "perceived utility" are two variables that are crucial in determining whether a person will embrace a specific technology. According to research, when it comes to acceptance of healthcare technology, the "perceived ease of use" factor influences both "attitude" and "perceived usefulness." This section will examine current research in this area to determine how this dimension may affect the adoption of healthcare technologies.

2.7.3 TAM explanatory in Healthcare

Abushaar & Ismail (2018) concluded that the TAM model is a suitable and applicable model to understand the behaviour and technology of acceptance among healthcare providers. Their findings in two aspects, “perceived usefulness” and “attitude toward use” had an indicatively significant (63.3%) with the acceptance of telemedicine among healthcare providers. Another study from Kissi et al. (2020) shows the variable aspects of “perceived usefulness” and “perceived ease of use” are predictive determinants of accepting telemedicine towards “intention”. These parameters in the TAM model illustrate the relationship between the customer's local cultural preferences and the developer's requirements for successful technological implementation (Kashada et al., 2020).

Ramírez-Correa et al. (2020) show that the TAM model has less explanatory power as compared to the Theory of Planned Behaviour (TPB) based on the explanation of behavioural intention. They indicate the explanatory power of 85.5% in the TPB and 81.5% in TAM model during the COVID-19 pandemic. But this model is still continuously applied today. For instance, a study by An et al. (2021) used the modified or extended TAM model to determine the factors affecting telemedicine usage after flattening the COVID-19 curve in South Korea. They identified the factors: increased accessibility, enhanced care, usefulness, ease of use, and privacy/discomfort (except the factor of COVID-19 anxiety) influencing the acceptance of telemedicine.

2.7.4 Systematic reviews on TAM effectiveness

An extensive systematic review of the TAM by Marangunic & Granic (2014) and Rahimi et al. (2018) concludes that there is no one-size-fit-all version as there is still ongoing progress to enhance the predictive output of the TAM. In addition, it was recently discovered that

there was little difference between the route coefficients of the extended TAM (models as TAM2, TAM3, and UTAUT) computed using meta-analysis and meta-meta-analysis techniques in the context of the healthcare industry (Feng et al., 2020). In contrast, Opoku and Enu-Kwesi (2020) found that the approach is consistent, so this study will have a solid foundation upon which to accept or reject the TAM model as a tool for examining the relationship between behavioural intentions to use and actual usage and perceived utility and ease of use. Since their research is not focused specifically on the healthcare sector, it may not have an impact on the model that was provided in this study. Therefore, TAM model was chosen as the theoretical framework for this study in order to evaluate healthcare providers' perceptions.

Overall, the TAM model is a widely used framework to evaluate the acceptance of technology in different contexts. It has been used to gain insights into user acceptance of technologies in various domains, such as healthcare. TAM provides information about the perspectives and motivations of people when it comes to accepting new technologies in healthcare. It helps researchers understand how people perceive and interact with new technologies, as well as which factors influence their decisions to accept them or not. With the help of TAM, researchers can identify areas where healthcare providers need more support and guidance when it comes to adopting new technologies.

2.8 Hypothesis Development

The hypotheses are formulated based on the core elements of variable relationships in TAM model. Except for the 'Actual use' variable element in the TAM not used in this study to be hypothetical, on account of the undefined status of 'Actual use' on telemedicine applications in healthcare adoption in Sarawak. The main finding from Roudi et al. (2022) of this review

demonstrates that, despite their age and the fact that they were not initially developed to be used in the context of remote care technologies, the TAM model is still useful for predicting how health professionals will respond to these technologies when they become available.

AlQudah et al. (2021) conducted a systematic review in the context of healthcare, presented the outcomes that supported the major linkages proposed by the TAM models. To put it another way, the frequency in Figure 2.7 shows how many researchers have verified the validity of each variable. The top two significant correlations of hypotheses are between the “perceived usefulness (PU)” and the “behavioural intention (BI)” to use a specific technology and between the “perceived ease of use (PEOU)” and “perceived usefulness (PU)”, with a total of 61 and 59 studies, respectively.

Followed by other significant relation between: the “Social Influences (SI)” and the “Behaviour Intention to use (BI)” (N = 40), the “perceived ease of use (PEOU)” and the “Behaviour Intention to use (BI)” (N = 35), and others (Figure 2.7). This data enable this study to further validate the hypothesis development.

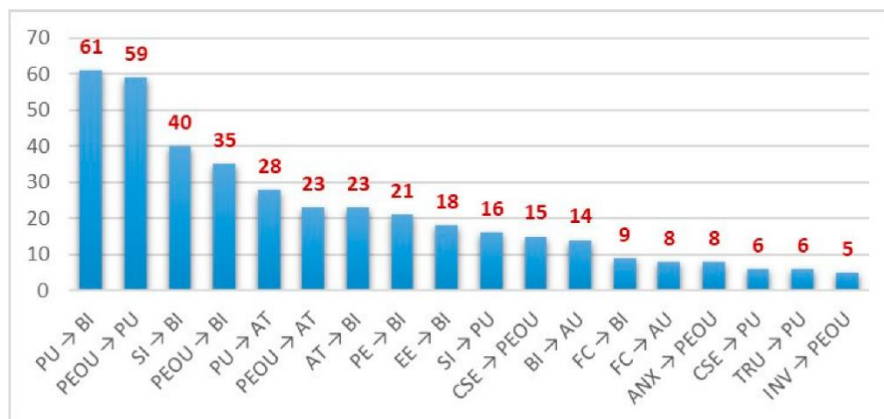


Figure 2.7: Frequency of hypotheses with significant impact.

Sources: AlQudah et al. (2021)

Based on the literature reviews of the significant effects for the desired/proposed models (Figure 2.8), The conceptual linkages between endogenous and external constructs are shown by the arrows connecting them. These variables are expected to show a similar output, as summarised by the following hypotheses:

i) The development of hypothesis was based on TAM's variables relationship.

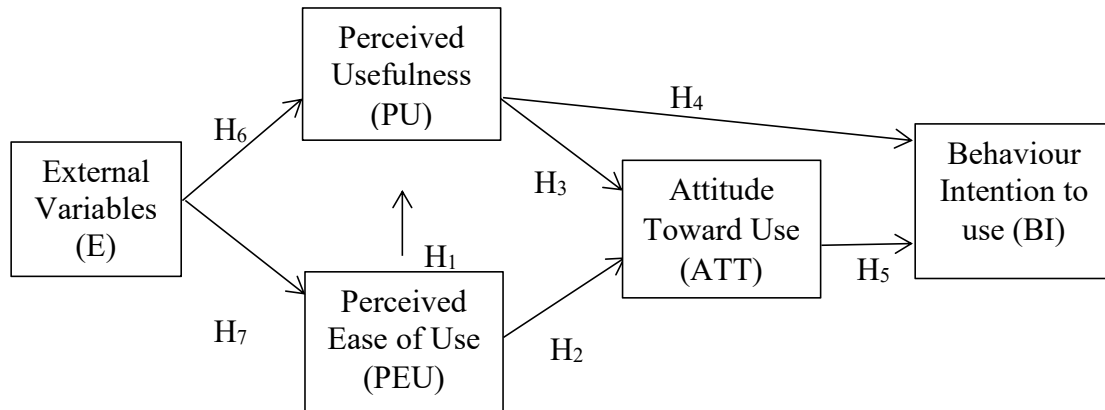


Figure 2.8: TAM of hypothesized model

Perceived usefulness (PU) acts as an independent variable and is referred to as a healthcare provider's belief is presumed that telemedicine platforms will benefit their healthcare system functions (quality of healthcare). PU has direct significant positive towards on both ATT and BI (AlQudah et al., 2021). The significant variables, perceived usefulness have a favourable impact on perceived usability and user behavioural intent to use, according to a systematic study by Binyamin and Zafar (2021). BI acts as a dependent variable and represents an individual's intention towards using a particular technology (Davis, 1989).

Perceived eases of use (PEU) act as an independent variable and is referred to as the application learning of ease to use in telemedicine by healthcare providers (Davis, 1989). PEU is easiness in administration of usage and indicated the significant influence of an

individual's PU (AlQudah et al., 2021). Both variables of PU and PEU have a significant influence on attitudes towards using telemedicine (AlQudah et al., 2021).

Attitude towards use (ATT) refers to an individual intellectual and emotional entity using technology in a positive way (Shiferaw et al., 2021). ATT acts as independent and also as a mediator for PU and PEU towards the BI (Pal et al., 2018). ATT variable towards using has a significant positive influence on behavioural intention to use (Kissi et al., 2020; Abushaar & Ismail, 2018; Kalayou et al., 2020).

External variable (E) act as moderating factors in the main core of TAM (Marangunic & Granic, 2014; Rahimi et al., 2018). Factors such as the: user's age (Zhou et al., 2007), education level (Susskind, 2017) or demographic characteristic (Akinbobola & Adeleke, 2016) indicate a positive relationship between PU and PEU. In this proposed study, demographic aspects were used as the external variable.

Overall, health technology is frequently linked to perceptions of utility, perceived ease of use, attitude towards behaviour, and favourable circumstances.

Therefore, the TAM model's Hypotheses are summarised:

Hypothesis PEU (H₁): Healthcare Provider's ease of use has a positive and significant impact on Perceived usefulness of telemedicine

Hypothesis PEU (H₂): Healthcare Provider's ease of use has a positive and significant impact on attitude toward using telemedicine consultation

Hypothesis PU (H₃): Healthcare Provider's perceived usefulness has a positive and significant on attitude toward using telemedicine consultation

Hypothesis PU (H₄): Healthcare Provider's perceived usefulness has a positive and significant on behaviour intention toward using telemedicine consultation

Hypothesis ATT (H₅): Healthcare Provider's attitudes has a positive and significant on intention toward using telemedicine consultation

Hypothesis ATT (H_{5i}): Healthcare Provider's attitudes has a positive and significant mediating the perceived usefulness toward behaviour intention of using telemedicine consultation

Hypothesis ATT (H_{5ii}): Healthcare Provider's attitudes has a positive and significant mediating the perceived ease of use toward behaviour intention of using telemedicine consultation

Hypothesis E (H₆₋₈): External factors (age, gender and education) has a positive and significant on perceived usefulness of telemedicine

Hypothesis E (H₉₋₁₁): External factors (age, gender and education) has a positive and significant on perceived ease of use of telemedicine

2.9 Chapter Summary

The literature has revealed trends, factors, and theories of telemedicine. Telemedicine adoption is evolving from demands due to Health Care 4.0, and it has synergistic the acceptance during the pandemic COVID-19. The TAM model of survey study in the context of telemedicine demonstrated useful conceptual theory in a healthcare system industry survey. The following chapter will elaborate on constructing a method framework based on the desired TAM model. It illustrates the outline of the construct measures of the respective model and develops the analysis design for this study.

CHAPTER 3

METHODOLOGY

3.0 Introduction

The TAM framework was used in this study to investigate the status and acceptability of technology among healthcare providers. The target population, the sample frame, and the location, all be covered in detail in this chapter's assessment of the instrument and construct measurement. In this chapter, the data analysis for TAM is discussed.

The composition of the questionnaire was as follows (Figure 3.1): The first segment was an introduction to the study's purpose and demographics with a socio-economic survey. The second part is based on the TAM model variables reflected by the healthcare providers.

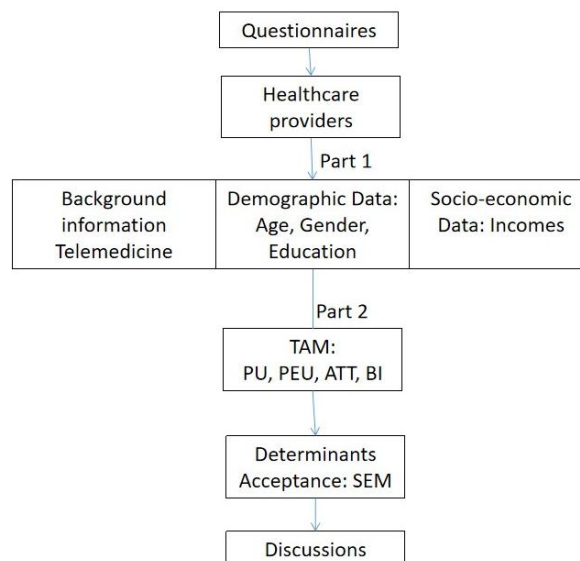


Figure 3.1: Research flow.

Note: General outline of research flow for healthcare providers and general public.

3.1 Variables of measurements

As explained in the hypothesis development, the measurements of telemedicine acceptance prediction are based on the two conceptual models of correlation. Therefore, the focused variables from the desired TAM model in this study are: perceived of usefulness (PU), perceived ease to use (PEU), attitude (ATT), behaviour intention (BI). All of the set-ups were adopted from prior studies related to TAM. Each variable was proposed 3 to 4 variances based on the scope of principle definition.

Table 3.1 described the definitions of the variables based on models as guide to set the variances and each variance is made up of 5-point scale reflects by respondents. The point format scale denoted ranging from: 1 (Strongly Disagree); 2 (Disagree); 3 (Neutral); 4 (Agree); and 5 (Strongly Agree). This likert scale format was used due to simple for the respondent to read (Dawes, 2008) and mostly used (Abdel Fattah, 2008).

Table 3.1: Variable's definition

Variables	Definition	Source
perceived usefulness	degree to which the person believes that using the particular system would enhance her/his job performance	Davis,1989; Alsamydai, 2014
perceived ease of use	degree to which the person believes that using the particular system would be free of effort	Davis, 1989; Nunkoo et al., 2013
External factors	various external variables or moderating factors to the two major belief constructs	Marangunić & Granić, 2014

Table 3.1: Continued.

Behaviour	described as the behavioural proclivity to	Alharbi & Drew, 2014
Intention to use	to continue utilising technology in the future; thus, it determines technological acceptance	
Attitude	an intellectual and emotional entity that shows how people reason, perceive, and incline to act with regard to an event or object	Shiferaw et al., 2021

3.2 Tools and Questionnaires

The factors affecting the use of telemedicine are the vital information in the questionnaire. Hence, the questionnaires are based on the TAM model. The questionnaires for this study were proposed and adopted from previous studies. The questionnaires are divided into 2 sections: the first section is socio-demographic, and the second section is the TAM model of 4 variables (E, PU, PEU and ATT). The questionnaires were uploaded into the Google form, which provided a link for the respondents to access.

3.2.1 Questionnaires based on TAM

The TAM consist of 15 questions and grouped in 4 construct variables: PU, PEU, ATT and BI (adapted from Ramírez-Correa et al., 2020 and Kissi et al., 2020) as presented in Table 3.2.

Table 3.2: Questions construct based on TAM variables

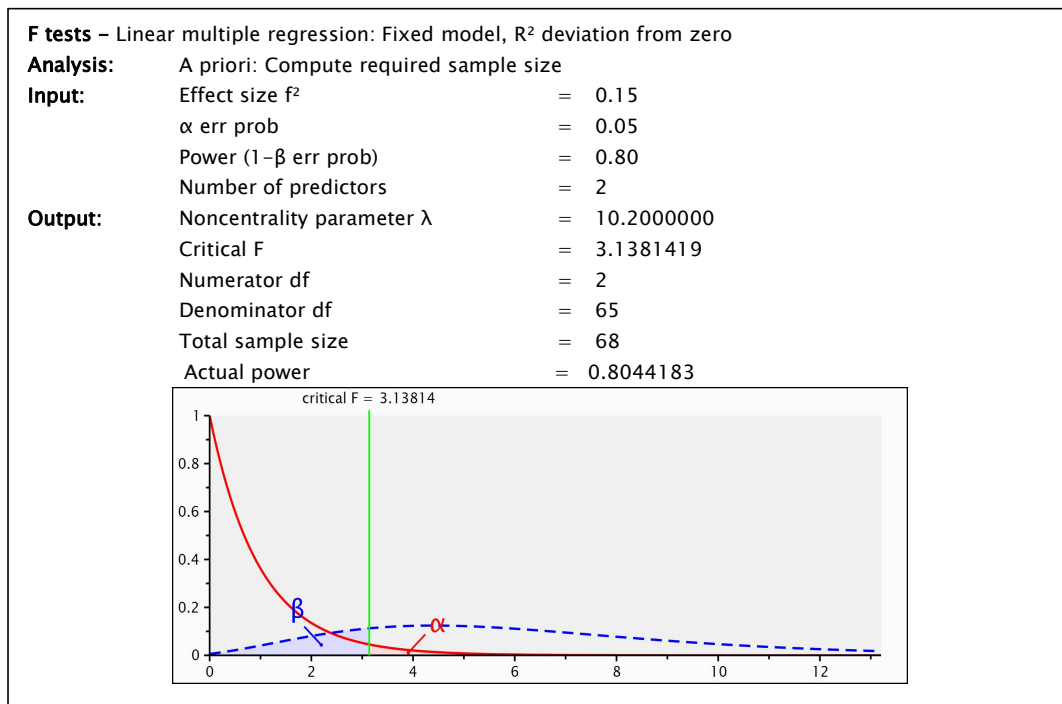
Variables and respective constructs
Perceived Usefulness (PU)
1. Using telemedicine service improves my job effectiveness and performance.
2. Using telemedicine service gives me greater control over my work.
3. Telemedicine service enables me to accomplish tasks more quickly and makes me more productive.
4. Telemedicine services help to get current diagnosis and treatment plans for patients.
Perceived Ease of Use (PEU)
1. Telemedicine services are rigid and not flexible to interact with.
2. Interacting with telemedicine services is often frustrating.
3. Telemedicine services do not require several training to effectively use.
4. Telemedicine services are compatible with the existing clinical workflow.
Attitude Toward Use (ATT)
1. Using the telemedicine service is a good idea.
2. The telemedicine service increases the healthcare service quality.
3. The adoption of telemedicine reduces the risks associated with health.
4. The telemedicine service is valuable.
Behaviour Intention to use (BI)
1. I am glad to present the telemedicine service to my close ones.
2. I will adopt the telemedicine service.
3. I will adopt the telemedicine service based on my close ones' necessities.

Pre-test

Experts in related fields were invited to evaluate the applicability and clarity of each question in the questionnaire to confirm that the questionnaire recognised by external validity. It was crucial to make sure survey questions accurately captured targeted outcomes after creating initial measurement items based on the hypothesis. A pretest was performed to confirm that potential respondents were able to understand the questions and answer them correctly. This is to identify potential survey instrument flaws. The goal of the pilot study was to evaluate the wording, order, and arrangement of the questions.

3.3 Sample Size and Target groups

Since the target population's size is infinitely large and unknown, the research was chooses to compute the sample size using G power 3.1. With the input predictors (TAM model) with power 0.80, α at 0.05 and effect size 0.15, the G-Power 3.1 was used to estimate the sample size (Figure 3.2). This setting parameters are the most generally proposed setting for both social and business science research (Hair et al., 2017). The total input predictor is based on the rule of the maximum arrows pointing to one variable in the model (Memon et al., 2020). The analysis aided in the gathering of at least 68 useful samples (healthcare provider respondents) in order to complete the study at the desired level with the necessary power and effect size. Therefore, 135 samples (50% addition markup from 68 to avoid non-respondents) from healthcare providers for TAM is aimed at this study. Healthcare providers referred a person who provides medical care services. The target groups included doctors, nurses, dietitians, pharmacists, physiotherapists, midwives, ophthalmologists, dentists, etc



The target population for this study are hospitals: Kuching, Sibul, Bintulu, Miri (as in terms of population, healthcare facilities, and economic focus area contribution to Sarawak state) (Table 3.3). The scope of this study is limited to healthcare providers (all health professionals from the private and government sectors) only for TAM approach. The volunteers who participate in this survey are dedicated to selected survey forms: healthcare providers are required to answer sections 1 and 2 (Appendix A).

The questionnaires were distributed and given a one-month duration to be completed. Each questionnaire is attached along with a brief description of the research objective and a declaration of privacy. If there is missing data, a returned back form to the same respondent or receives new respondent.

Table 3.3: Sarawak population distributions

District	Population (Thousand)	rate (%)	District	Population (Thousand)	rate (%)
Kuching	615.5	0.5	Sebauh	27.1	-4
Miri	251.5	0.5	Tebedu	25.2	0
Sibu	247.2	-0.1	Lubok Antu	24.7	-0.1
Bintulu	175.5	-0.8	Kanowit	24.6	-0.3
Samarahan	136.5	2.9	Belaga	23.1	1.5
Serian	85.4	-0.1	Saratok	23	-0.5
Sri Aman	61.1	-0.4	Dalat	21.1	-0.2
Subis	57.7	-1.6	Maradong	20.4	0.4
Bau	53.1	0.3	Selangau	19.9	0.6
Limbang	45.4	0.3	Marudi	19.6	2.2
Sarikei	44.4	0.4	Pusa	19.5	-0.2
Mukah	42.6	-0.6	Daro	19.4	-0.5
Lawas	37.4	1.4	Kabong	18.6	0.4
Simunjan	36.3	-0.2	Telang Usan	17.4	0
Betong	36.3	-0.2	Matu	16.2	-2.2
Kapit	35.9	-0.3	Pakan	15.5	-0.2
Asajaya	33.9	0.3	Julau	15.3	-0.4
Lundu	33.7	-0.1	Bukit Mabong	10.5	1.4
Tatau	32.6	0.7	Song	10	-0.1
Beluru	29.7	1.3	Tanjung Manis	8	-1.3

Table 3.3: Continue

Note: Population estimation based in Sarawak; Bolded district ares: Kuching, Miri, Sibul, Bintulu, are the highest population and with Healthcare specialists

Source: Department of Statistics Malaysia (DOSM), 2022

3.4 Data Analysis

Prior to the PLS-SEM and STATA17 analysis, the obtained data were entered into the SPSS programme for descriptive analyses (mean, standard deviation, frequency and percentage).

3.4.1 Measurement Models

Research data were analysed using partial least-squares structural equation modelling (SmartPLS, v.3.3.2) to evaluate the suggested model. All variables from models and moderators were analyses and tested based on the desired hypotheses. One way of analysing the variance based on the SEM is the PLS.

The model assessment or evaluation (reliability and conditions for convergent validity) for the TAM uses factor loading, Cronbach Alpha (α) (Napitupulu et al., 2017), composite reliability (CR) for internal consistency; for validity test: Average Variance Extracted (AVE) (Alshahrani & Walker, 2017). Therefore, to create a fit model, the Cronbachs Alpha (CA), Average Variance Extracted (AVE), and Discriminant Validity (DV) were assessed. In addition, multicollinearity analysis was performed to calculate the correlation matrix for all the variable to receive the Variance Inflation Factor (VIF) values. VIF score greater than five denotes indicator collinearity (Hair et al., 2017 & Putra, 2022). Cronbach's Alpha was used to perform a reliability check on the scales (evaluating each

construct's internal consistency). The usual range of Cronbach's alpha reliability coefficient was 0 to 1. The factor loading value for reliability for each items being tested. An instrument's internal consistency or reliability can be adequately measured by a value of 0.70 (Taber, 2017).

The AVE values are used as the basis for assessing convergent validity. The construct must explain at least 50% of the variation of the indicators that make up the construct in order for the AVE to be considered acceptable, which must be 0.50 or above (Hair et al., 2022).

A reflective construct should have the strongest correlations with its own indicators, such as comparison with, than any other construct in the PLS path model, according to the discriminant validity evaluation (Hair et al., 2022). In this study, for conceptually different constructs, HTMT <0.85 is the recommended threshold recommended by Hair et al. (2022). Lastly, the common method bias of the Variance Inflation Factor (VIF) recommended a value less than 3.3 to determine the extent of collinearity in PLS-SEM (Kock, 2015).

3.4.2 T-Statistic for TAM

Following the PLS-SEM bootstrapping procedure, statistical significance was assessed once more. As PLS-SEM is a non-parametric statistical method, there is no presumption that the underlying data are statistically distributed; instead, significance is determined by analysing subsamples of the data (Hair et al., 2017). In accordance with advice from Hair et al. (2017), bootstrapping was calculated using the SmartPLS consistent PLS (PLSc) approach with: maximum iterations, complete bootstrapping complexity, Bias-Corrected and Accelerated (BCa) bootstrap as the confidence interval method (0.05), and 5000

samples. Path coefficient are determined with t-value (<1.657) and p-value (<0.05) for hypothesis test. The predictive power, effect size, and predictive relevance/ power were assessed (Magno et al., 2022).

Table 3.4: Summary of data analysis approaches

Model	Software	Methods	Fit test	Purpose for objective
		Description	N/A	i
	PLS-SEM		mean of coefficient and R^2 and Variance Inflation Factor (VIF) (<3.3)	
		Bootstrapping	Factor Loading (>0.7)	i -iv
		T-Statistic:	Cronbachs Alpha (CA) (>0.7)	
TAM		Path coefficient	Average Variance Extracted	
		t-value (>1.67)-	(AVE) (>0.5)	
	PLS-SEM	PLS Algorithm	Composite Reliability (CR)	
		P-value (<0.05)	(>0.7)	
		R^2 value (at least 0.25)-PLS	Discriminant Validity (DV):HTMT (<0.85)	
		Boostraping		

Note:

- i. To determine the demographic characteristic factors (age, gender and education) of healthcare providers attitude toward telemedicine in Sarawak.

Table 3.4: Continue

- ii. To determine the acceptance variables of healthcare providers' attitudes on telemedicine.
- iii. To determine the patterns of association between healthcare providers' perceptions of telemedicine.
- iv. To ascertain the elements influencing the intention to use telemedicine services among the healthcare providers.

3.4.3 Variables' Indicators with Relations

The summary for TAM of inner/ outer indicators are tabulated in Appendix B. Each point-out the hypothesis accordingly for this study.

3.5 Chapter Summary

In this chapter, the researcher focuses on the classifying, defining with formulated the proposed method of conceptual framework to predict the Telemedicine in Sarawak population. This research model consists of 18 hypotheses (TAM) of quantitative approach: data collection approach, questionnaire design, testing and on field study (Table 3.5).

Table 3.5: Summary of methodology

Theory: Questionnaire Variables	TAM: 4 variables
Survey technique:	Google form
Target location:	Kuching, Sibul, Bintulu and Miri
Respondent:	Healthcare providers: referred a person that provides medical care services. This include

Table 3.5: Continue

	doctors, nurses, dietitians, pharmacist, physiotherapist, midwives, ophthalmologist, dentist, etc
Sample size	G-Power: 135 respondents
Period of survey:	3 months
Data analysis	PLS-SEM Measurement model: VIF, CA, AVE, CR, HTMT Structural model: Path coefficient, t-value, p-value and R ² (with explanatory power)

CHAPTER 4

RESULTS AND DISCUSSION

4.0 Introduction

In this chapter, the survey data is examined using descriptive, structure equation technique approaches for the TAM model. This section examines factors that influence the desire to adopt telemedicine based on TAM.

4.2 TAM analysis- Healthcare Providers

4.2.1 Demographics

As the predicted target of 68 samples was determined using G-power, a total of 164 responses from healthcare professionals were collected for this investigation. This means that the data gathered was increased by 50%. Table 4.1 displays the basic demographic information received from the survey.

Among those polled, 61 (37.2 percent) were men, while 103 (62.8 percent) were women. This indicates that females participate in the survey at a higher rate than males. The age group of 27-42 years old has the highest proportion of sampled respondents (67.7 %), followed by the age group of 43-58 years old (29.3%). This review outlines the minimum criteria to working as a healthcare provider with above 27 years old in the healthcare industry.

According to this survey, the respondents in this pool graduated with a bachelor's degree in the majority (48.2%), followed by a diploma (35.4%), a master's degree (9.8%), and a PhD (1.9%). This means that the minimal admission requirements in the healthcare industry are a bachelor's degree or a diploma. The 6.7% figure suggests that additional types of post-basic certification are available in the operational healthcare industry.

Table 4.1: Demographic characteristics

		Frequency	Total	Percent (%)
Healthcare providers - TAM model				
Gender	1 = Male	61		37.2
	2 = Female	103	164	62.8
Age	1 = “< 26 years old”,	2		1.2
	2= “27-42 years old”,	111		67.7
	3= “43-58 years old”,	48		29.3
	4= “59-68 years old”,	3	164	1.8
	5=“69-77 years old”	-		-
	6=“78- Above”	-		-
Education	1=other,	11		6.7
	2=Diploma,	58		35.4
	3=Degree,	79	164	48.2
	4=Master,	16		9.8
	5=PhD	3		1.9

4.2.2 Measurement Models

Before conducting the hypothesis test, verifying the measurement model is conducted. This will help researchers determine whether the model is viable and valid by measuring the measurement model accuracy. This study demands measurement model analysis because the validity of the measurement has a direct impact on the underlying theoretical constructs.

Measurement Model Analysis -TAM

Table 4.2 depicts the mean and standard deviation for the TAM's variable. In the independent variables, the perceived usefulness towards attitude and behaviour intention to use reflect 74.12% respondents based on the mean for the PU among the respondents. Besides, there is 54.57% of respondents are perceived ease of use toward PU, as well the ATT. Furthermore, the ATT of the respondent toward BI is 75.37%. Finally, the dependent variable, behaviour Intention to use telemedicine, is 75.07% among the respondents.

According to the table above, all of the variables' means were less than four, and all of them were within the three-point range, which is considered neutral. While the average for the intention to use telemedicine was demonstrated to be neutral, indicating that even healthcare practitioners intend to use the telemedicine system, but their intention may not be as strong. The variables based on PU, ATT and BI, the mean is shown near approximately four likert scale. It mean that although the telemedicine system was good with the current expectations but however the healthcare providers had perceived not easily to utilize as reflexed in PEU with lowest mean among the other variables.

Table 4.2: Descriptive Study Variables- TAM

Descriptive Study Variables						
Constructs	Items	N	Min	Max	Mean	Std. Deviation
Perceived	PU1	164	1	5	3.848	0.991
Usefulness (PU)	PU2	164	1	5	3.701	1.001
	PU3	164	1	5	3.713	1.035
	PU4	164	1	5	3.561	1.105
				Mean	3.705	
Perceived Ease of Use (PEU)	PEU1	164	1	5	2.701	1.060
	PEU2	164	1	5	2.756	0.988
				Mean	2.728	
Attitude Toward Use (ATT)	ATT1	164	1	5	3.909	0.903
	ATT2	164	1	5	3.756	0.951
	ATT3	164	1	5	3.488	0.953
	ATT4	164	1	5	3.921	0.862
				Mean	3.768	
Behaviour Intention to use (BI)	BI1	164	1	5	3.707	0.910
	BI2	164	1	5	3.774	0.899
	BI3	164	1	5	3.780	0.877
				Mean	3.753	

Note: Two indicators (PEU3 and PEU4) are excluded in order to make the model fit.

The convergent validity, followed by discriminant validity, and then the composite reliability are the three criteria that form the Outer Assessment Model (Measurement Models). Based on the Table 4.3, it represent the desired outer models measurement variables (items) for: Perceived Usefulness (PU), Perceived Ease of Use (PEU), followed by Attitude Toward Use (ATT) and Behaviour Intention to use (BI). The outcome of convergent validity (outer loading) for each indicator mentioned as strong if the correlation point for each latent variable external and endogenous is more than 0.70. In this construct indicators can concluded that the all data is within the threshold level of valid and fit (after eliminate the two items: PEU3 and PEU4), after consideration the threshold adequate measured by a value of 0.70 (Taber, 2017).

This means there are two elements left to reflect the PEU, which is still appropriate for the measuring model. According to Hair et al. (2011), PLS-SEM is acceptable if there are one or two items per factor; and Raubenheimer (2004) clarified that two items per factor are still acceptable with the conditions: more than one factor per scale of study, within the threshold of reliability and validity test. As a result, this PEU factor remains in this study and is fit based on reliability and validity.

The consistency of internal items for the latent variables was assessed using two aspects: first, the value of composite reliability (CR) should be greater than threshold 0.7, secondly is the Cronbach's alpha (α) coefficients should be greater than threshold 0.7. In this constructs shown at Table 4.3, Cronbach's alpha (α) coefficients ranged from 0.768 to 0.941, while overall confidence ranged from 0.895 to 0.962, all of which were greater than the threshold values.

The AVE values are used as the evaluation criterion in the examination of convergent validity. The threshold should be greater than 0.50. We are able to determine from the table 4.3, that the AVE value of PU (0.849), PEU (0.811), ATT (0.781), and BI (0.894) are all significantly higher than the needed minimum threshold level of 0.50. As a result, the measures of the four (4) reflective constructs have good convergent validity.

Table 4.3: Reliability - Measurement Model for TAM

Constructs	Items	Loadings	CA	CR	AVE
Perceived	PU1	0.919	0.941	0.958	0.849
Usefulness (PU)	PU2	0.952			
	PU3	0.926			
	PU4	0.888			
Perceived Ease of	PEU1	0.885	0.768	0.896	0.811
Use (PEU)	PEU2	0.916			
Attitude Toward	ATT1	0.896	0.906	0.934	0.781
Use (ATT)	ATT2	0.910			
	ATT3	0.846			
	ATT4	0.882			
Behaviour	BI1	0.930	0.941	0.962	0.894
Intention to use	BI2	0.963			
	BI3	0.943			

Note: Validity test - Factor loading, AVE and HTMT; Reliability test - composite reliability (CR) and Cronbach Alpha (α); PEU3 and PEU4 (Loading: -0.144 and -0.662, respectively), it below the threshold level < 0.70

Cross-validation is used in discriminant measurement. The outcome of this Cross-Validation said that it will be a legitimate variable provided the loading value into other variables is greater than other variables. All of the indicators in table 4.4 will be considered legitimate as the cross latent variable is larger than the values cross-correlation on the corresponded with other inferred or unobserved variables.

Table 4.4: Cross loading - TAM

	Perceived Usefulness	Perceived Ease of Use	Attitude Toward Use	Behaviour Intention to use
PU1	0.919	-0.286	0.613	0.605
PU2	0.952	-0.300	0.674	0.665
PU3	0.927	-0.326	0.580	0.656
PU4	0.888	-0.328	0.610	0.620
PEU1	-0.252	0.885	-0.336	-0.363
PEU2	-0.347	0.916	-0.340	-0.380
ATT1	0.613	-0.301	0.896	0.594
ATT2	0.601	-0.360	0.910	0.588
ATT3	0.587	-0.324	0.846	0.616
ATT4	0.579	-0.338	0.882	0.700
BI1	0.703	-0.389	0.701	0.931

Table 4.4: Continue

BI2	0.645	-0.398	0.682	0.962
BI3	0.606	-0.383	0.621	0.943

Note: The numeric of capital letters represent the items of respective variables.

Table 4.5 vividly shows that the AVE value squared for each construct is above 0.5. As a result, the divergent validity was obtained. Furthermore, according to the table, all variables have a larger value when compared to other components in terms of their discriminant validity via square root AVE value. Thus, all requirements applying the Partial Test Least Square Structural Equation Algorithm via path measurement model were satisfied in this study.

Table 4.5: Correlation Matrix (Fornell-Larcker Criterion analysis)- TAM

	ATT	BI	PEU	PU
ATT	0.884			
BI	0.709	0.945		
PEU	-0.375	-0.413	0.900	
PU	0.673	0.691	-0.336	0.922

Note: PU, PEU, ATT, BI represent the perceived usefulness, perceived ease of use, attitude, behaviour intention to use, respectively.

A HTMT value below than 0.85 implies the fact of discriminant validity between both constructs scales is valid. While, if exceeding 0.85 suggests the two constructs overlapping considerably and are most likely assessing an identical item. Table 4.6 demonstrates that all constructions were below 0.85. This can concluded that the reflecting construct that has the most powerful associations with its own indications.

Table 4.6: Measurement path via Heterotrait-monotrait ratio of correlations (HTMT)-TAM

	ATT	BI	PEU	PU
ATT				
BI	0.764			
PEU	0.449	0.485		
PU	0.728	0.733	0.391	

Note: PU, PEU, ATT, BI represent the perceived usefulness, perceived ease of use, attitude, behaviour intention to use, respectively.

Lastly, the Variance Inflation Factor (VIF) recommended a value less than 3.3 to determine the extent of collinearity in PLS-SEM (Kock, 2015). This study yielded less than 3.3 of VIF, indicating that there was no collinearity (common method bias) concern (Appendix C).

4.2.3 Structure Model- TAM

The "Bootstrapping Option" is used to establish the path's statistical significance of coefficients and to get the t-values. The hypothesis test findings are shown based on the path coefficient analysis results. t-value (>1.67)- BT Algorithm P-value (<0.05). Table 4.9

displays all of the hypotheses mentioned, as well as the T-numerator value (difference between the two sample set based on mean) corresponding each desired hypothesis. If the desired hypothesis is supported, the T- test value reflected.

Four criteria are used to evaluate structural models. Path of the structural model coefficients (β), explanatory power: R^2 coefficient of determination, effect size (f^2), Predictive significance (Q^2).

The following Figure 4.1 revealed the three variables that framed impulse the behaviour intention to use the telemedicine. The three variables are: perceived usefulness, next is perceived ease of use aspect, and attitude toward use dimension. Each are assessed by indicators: PEU1 and PEU2 are two indicators representing the Perceived Ease of Use; from PU1 to PU4 are four indicators representing the Perceived Usefulness; ATT1, ATT2, ATT3, ATT4 are four indicators for Attitude Toward Use; Lastly, BI1, BI2, BI3 are three indicators for behaviour intention to use.

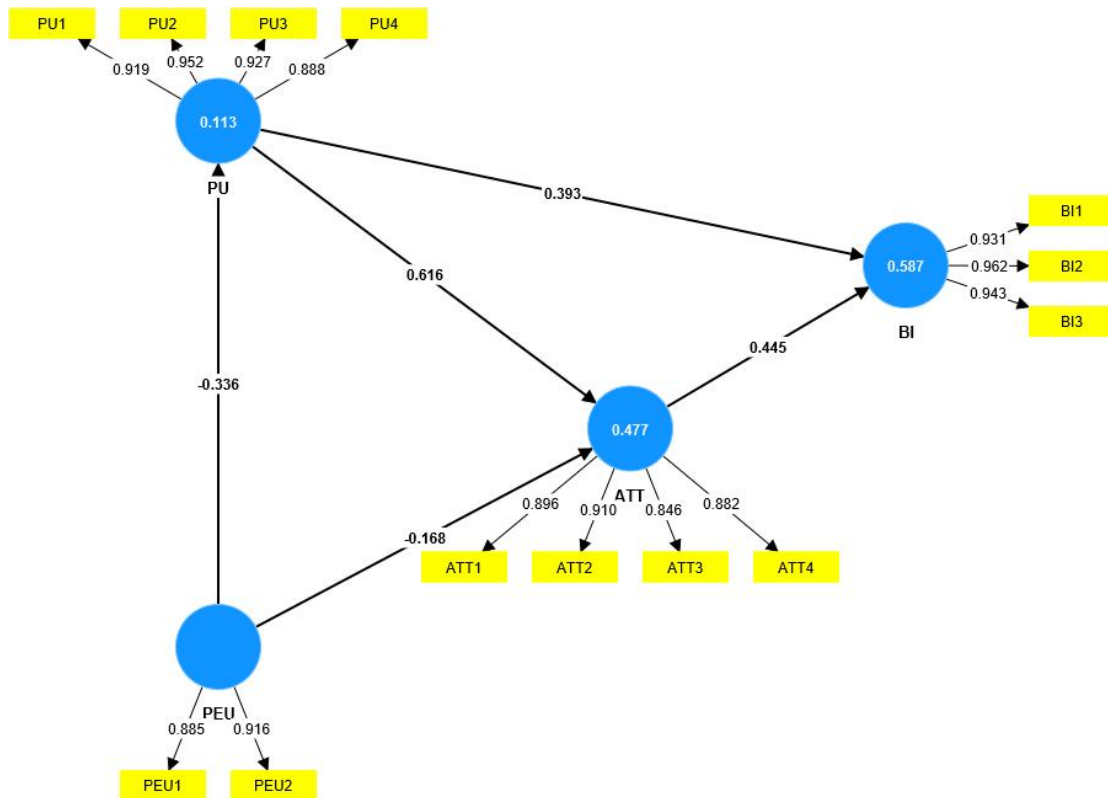


Figure 4.1: TAM - PLS Algorithm- Path relationship among the variable of independent and dependent variables.

Note: Path coefficient (β value); R^2 represents value for any endogenous and predicted latent variable (value in the circle); Blue circle indicate the desired variables: PEU, PU, ATT, BI; Yellow boxes indicate the items

As stated by Hair et al. (2017), the larger the trajectory coefficient value (β), the bigger the bearing of predictor exogenous factors with regard to the endogenous variable. Based on the path coefficient values in Figure 4.1, it indicates that perceived usefulness has the highest path coefficient value of 0.616 towards attitude group. This means that this variable has the strongest influence on attitude toward use of telemedicine. Then, followed by attitude toward use variables with path coefficient value of 0.445 and perceived usefulness with path coefficient value of 0.393 toward behaviour intention to use the telemedicine. However, other groups appear to have little influence by perceived ease of use.

Explanatory power

PLS Algorithm is portrayed, where R^2 is the value of each endogenous and predicted latent variable. In Figure 4.1, PEU is not predicted by some other variables. The R^2 value signals the degree of variance explained via the model's other variables. R^2 ranged from 0 to 1, with a higher value indicating a better path (arrow pointing towards) model projection. Table 4.7 shows the three R-square values. The R-square value of 0.113 for the perceived usefulness variable, the R-square of 0.477 reflected attitude toward use variable and lastly R-square in 0.587 represent the behaviour intention to use variable. This indicates that the three desired variables have an influence on perceived usefulness of 11.3%, attitude towards use has an effect of 47.7%, and behaviour intention to use has an influence of 58.7%. This is similar to the study from (Harst et al., 2019), which revealed that the TAM model has greater explanatory power in healthcare providers with ($R^2=0.63$). This means that the desired model to assess the acceptance is valid.

The purpose of effect size (f^2) is to determine whether the omitted external construct has a significant impact on the endogenous structure (Hair *et al.*, 2017). According to Cohen (1988), three impact sizes with three values: 0.02, 0.15, and 0.35 indicates modest, medium, and substantial contributions associate the corresponding predicting (exogenous) variable to the model. Behavioural intentions are predicted in this study by attitude toward use and perceived usefulness toward telemedicine. As a result, the predictive (exogenous) constructs' relative effect sizes (f^2) were determined and are displayed in Table 4.7. In terms of predicting behavioural intentions, the perceived usefulness variable as well the attitude toward use variable, both within a medium effect size.

The predictive relevance (Q^2) technique is used to determine the strength of each exo-genous and endogenous link. It shows the results of PLSPredict, which was used to test the predictive power/ to legitimacy of the model. Furthermore, as shown in the Table 4.7, Q^2 predict values should be greater than zero. The model's predictive power can be determined by comparing SEM_RMSE with LM_RMSE (Table 4.8). From the findings, most of measurement items in PLS-SEM_RMSE values are lower than those in LM_RMSE values. Hence, this could be the model's predictive power is regarded as moderate (Shmueli *et al.*, 2019).

Overall, the explanatory power assessed the strength of the TAM path model's claimed causal links.

Table 4.7: TAM- Goodness of fit test, effect sizes and Q^2

	R-square	R-square adjusted	f² (BI)	Q²
Perceived Usefulness (PU)	0.113	0.107	0.204	0.097
Attitude Toward Use (ATT)	0.477	0.471	0.263	0.127
Behaviour Intention to use (BI)	0.587	0.582	-	0.151

Table 4.8: Predictive power of a model using PLSPredict- TAM

	Q²	PLS-SEM_	PLS-SEM_	LM_	LM_
	predict	RMSE	MAE	RMSE	MAE
ATT1	0.078	0.873	0.699	0.879	0.702
ATT2	0.117	0.899	0.731	0.904	0.734
ATT3	0.093	0.914	0.746	0.921	0.751
ATT4	0.100	0.824	0.668	0.827	0.672
BI1	0.130	0.856	0.708	0.860	0.703
BI2	0.137	0.841	0.681	0.846	0.687
BI3	0.127	0.826	0.674	0.831	0.682
PU1	0.065	0.965	0.785	0.969	0.789
PU2	0.073	0.970	0.798	0.973	0.804
PU3	0.091	0.992	0.804	0.993	0.800
PU4	0.094	1.058	0.851	1.053	0.845

Hypothesis tests - TAM

Table 4.9 displays the six hypotheses of the project: first and secondly, perceived usefulness -> attitude toward use, as well towards the behaviour intention to use, third and fourthly, perceived ease of use -> perceived usefulness, as well towards the attitude toward use, next the attitude toward use -> behaviour intention to use, and lastly the age on the perceived usefulness are significant because the t-value of difference sets comparison is greater than threshold 1.645 ($P < 0.05$). All of the remaining hypotheses were not

supported at the same time. Noticeable, there are two variables indicated the negative influence the PU and ATT by the PEU.

Table 4.9: Path Model Coefficient Significance- TAM

Path	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T-value	P-value	Decision
PU>ATT	0.616	0.621	0.077	8.037	0.000	Supported
PU>BI	0.393	0.392	0.137	2.862	0.004	Supported
PEU>PU	-0.336	-0.337	0.090	3.743	0.000	Supported
PEU>ATT	-0.168	-0.163	0.084	2.001	0.043	Supported
ATT>BI	0.445	0.445	0.143	3.106	0.002	Supported
External variables						
Age -> PU	0.165	0.163	0.073	2.258	0.024	Supported
Age -> PEU	0.043	0.043	0.082	0.520	0.603	Not Supported
Gen -> PU	-0.206	-0.206	0.151	1.366	0.172	Not Supported
Gen -> PEU	-0.137	-0.130	0.162	0.847	0.397	Not Supported

Table 4.9: Continued

Edu -> PU	-0.107	-0.107	0.076	1.413	0.158	Not Supported
Edu -> PEU	-0.107	-0.108	0.086	1.248	0.212	Not Supported

Note: “->” represent path coefficient direction

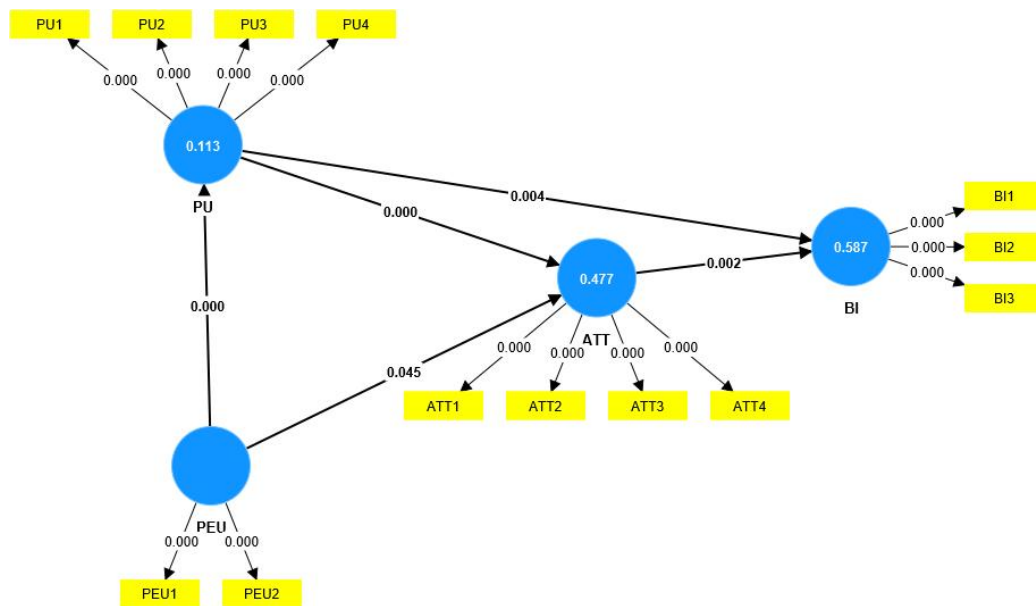


Figure 4.2: TAM- output hypothesis testing with bootstrapping analysis result

Note: P-value for the dependent and independent variables paths; Blue circle indicate the desired variables: PEU, PU, ATT, BI; Yellow boxes indicate the items

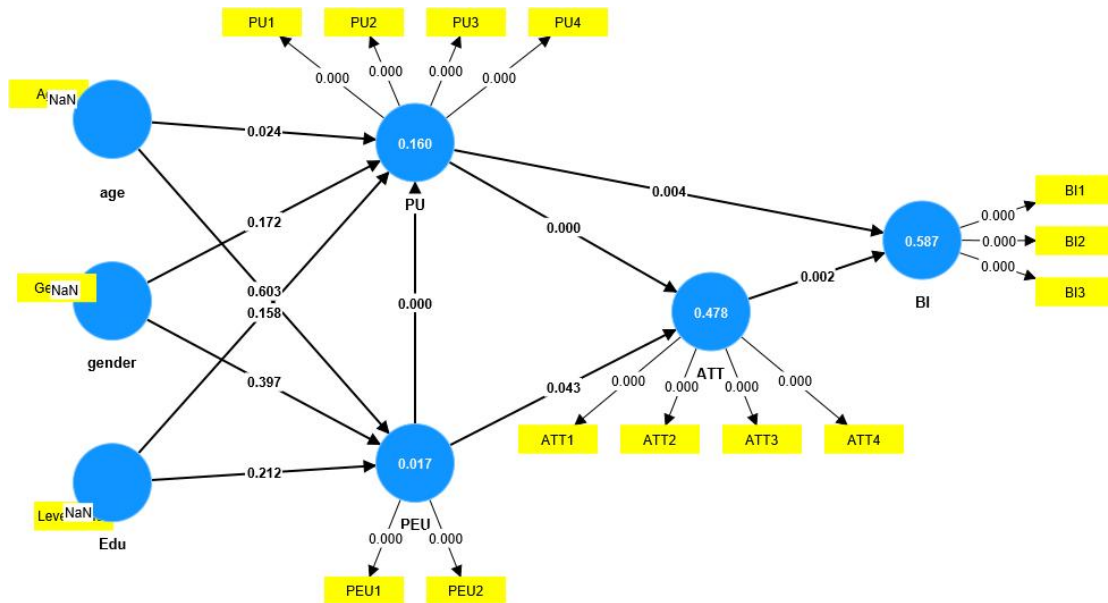


Figure 4.3: TAM- output hypothesis testing with bootstrapping analysis result with external variables

Note: P-value among the dependent variables, independent variables and moderation variables; Blue circle indicate the desired variables: PEU, PU, ATT, BI; Yellow boxes indicate the items

Hypothesis statements:

Perceived ease of use relationship with perceived usefulness of telemedicine

Hypothesis PEU (H₁): Healthcare Provider's ease of use has a positive and significant impact on Perceived usefulness of telemedicine

As observed from the study, there was a negative affect on how people view telemedicine to be easy to use and useful while looking for medical consultations. The researcher discovered that an individual's perceived ease of use dimension had a direct negative influence on the aspect of perceived usefulness. In other words, if an individual perceives

telemedicine to be easy, they will regard the telemedicine system to be valuable for searching medical consultations.

Perceived ease of use and attitude towards of using telemedicine relationship

Hypothesis PEU (H₂): Healthcare Provider's ease of use has a positive and significant impact on attitude toward using telemedicine consultation

Based on the Table 4.9, perceived ease of use has a negative link with the attitudes towards utilising. This negative relationship's beta coefficient is 0.168, showing that 16.8% of healthcare professionals say telemedicine is difficult to use and has no influence on their decision to adopt it.

Relationship between perceived usefulness and attitude towards of using telemedicine

Hypothesis PU (H₃): Healthcare Provider's perceived usefulness has a positive and significant on attitude toward using telemedicine consultation

According to the results of the study, from the dimension of perceived usefulness has a favourable link with attitudes towards telemedicine use. According to the analysis, 61.6% of healthcare providers believe that telemedicine systems are useful and have positive attitudes towards using them.

Correlation between perceived usefulness and behavior intention towards using telemedicine

Hypothesis PU (H₄): Healthcare Provider's perceived usefulness has a positive and significant on behaviour intention toward using telemedicine consultation

The outcome demonstrated that there exists a beneficial association. The correlation between the construct of perceived usefulness dimension and intention to use point of view of telemedicine system. The more the perceived utility, motivation to use telemedicine system is impulsing. According to 39.3% of healthcare providers, perceived usefulness has an impact on their plan to employ a telemedicine system.

Relationship between attitude and behaviour intention towards using telemedicine

Hypothesis ATT (H₅): Healthcare Provider's attitudes has a positive and significant on intention toward using telemedicine consultation

The findings revealed that the attitudes towards use have a favourable link with the intention to use telemedicine system. 44.5% of healthcare providers believed that attitudes towards adopting telemedicine had a direct impact on their intention to use the system.

Mediator relationship of attitude between perceive usefulness and behaviour intention towards using telemedicine

Hypothesis ATT (H_{5i}): Healthcare Provider's attitudes has a positive and significant mediating the perceived usefulness toward behaviour intention of using telemedicine consultation

The findings revealed that the attitudes mediate the relationship between the perceived usefulness and behavior intention to shaping the consumer cognitive toward telemedicine utilization.

Mediator relationship of attitude between perceived ease of use and behaviour intention towards using telemedicine

Hypothesis ATT (H_{5ii}): Healthcare Provider's attitudes has a positive and significant mediating the perceived ease of use toward behaviour intention of using telemedicine consultation

The findings revealed that the attitudes mediate the relationship between the perceived ease of use and behavior intention to shaping the consumer cognitive toward telemedicine utilization.

Relationship between external variables and perceived usefulness towards of using telemedicine

Hypothesis E (H₆₋₈): External factors (age, gender and education) has a positive and significant on perceived usefulness of telemedicine

Except for the age variable, the results reveal that there is no significant association between external variables (gender and education) and perceived usefulness towards utilising. 16.5% of healthcare providers, age has an positive impact on perceived usefulness of telemedicine as for their daily medical practices.

Relationship between external variables and perceived ease of use towards of using telemedicine

Hypothesis E (H₉₋₁₁): External factors (age, gender and education) has a positive and significant on perceived ease of use of telemedicine

The results reveal that there is no significant association between external variables (age, gender and education) and perceived ease of use towards telemedicine.

4.2.4 Discussion of findings

Hence, this TAM model was established and verified in this study to measure the influencing aspects of the adoption of telemedicine in the healthcare business among healthcare providers. The data revealed that telemedicine attitude and from the aspect of perceived usefulness had a substantial favourable effect on intention to utilise telemedicine. Furthermore, the variables PU and PEU are determinants of intention to adopt telemedicine. This applies to the study's key question: What are healthcare providers' opinions regarding telemedicine in the Sarawak healthcare system. Again, to enhance the justification with the updated article (beside in Chapter 2) this model was decided to assess

the acceptance among the healthcare providers in Sarawak, as this model is the most frequently used to perform the assessment (Garavand et al., 2022).

However, perceived ease of use had a negative impact on two dimensions the attitudes as well the perceived usefulness. This could be because the technological complexity of the telemedicine model is a more relevant influencing element for healthcare professionals. People's attitudes will improve if it is easier to utilise. This, in line with the concept of being easy to install and learn to use, is the main criteria for improving acceptance of adoption (Xiong et al., 2020). In the Malaysia context, less than 50% of clinics with teleconsultation are used by healthcare providers (Ng et al., 2022). According to the results of this poll, this negative impact may be attributed to prior experience (75.61%) with telemedicine, most notably on the WhatsApp platform (48.78%) (Appendix D). This is due to the feature constraint that was not designed (like patient database history) for the telemedicine platform. Besides, this could be owing to all healthcare providers being unable to reach the device with one gadget in one department during their opportune turn. According to Ng et al. (2022), despite the fact that most telemedicine is self-funded and donated, it is underutilised by Malaysian healthcare providers.

In contrast, perceived usefulness has a positive impact on attitudes towards using telemedicine, which is supported by previous research, which discovered that the majority of respondents (68.4%) perceived WhatsApp as beneficial during clinical practice in Malaysia (Ganasegeran et al., 2017). Healthcare providers in Sarawak believe the telemedicine platform will help them with medical consultations with patients. This is especially important when interacting with patients who do not have access to

transportation, rescheduling follow-up, and etc. According to the study (Haleem et al., 2021), telemedicine improves access to underserved areas by making it easier for patients to book and keep appointments. This similarity with this study data suggests various reasons to use telemedicine: Fast (43.64%), Cost-saving (10.91%), Simple (7.27%), Logistical (5.45%), Follow-up (4.24%), Convenient (3.64%), and Other Reasons (24.24%) (Appendix D).

Furthermore, this study reveals that the external variable of age on perceived usefulness has a significant effect. This can be explained by the fact that the current study is based on a certain age cohort (major in 27-42 years old) (Table 4.1), specifically young healthcare practitioners with degree holders in the majority, that serve in Sarawak's healthcare industry. Besides, in this study, among the healthcare providers, status of seldom and frequent use of telemedicine was 61.59% (Appendix D) and within these age cohorts, it might be explained that telemedicine is useful for them. This outcome is consistent with the findings of the study (Abushaar & Ismail, 2018), 91.1% of participants were between the ages of 30 - 39, although 39% of this age group refused Tele-consultation. They discovered that, with P value of 0.05, doctors who perceived the value of Tele-consultation outperformed doctors who did not perceive the usefulness of Tele-consultation.

With the above positive reason to adopt telemedicine, it relates to the following discussion. The role of attitude (R² value of 0.477) in mediating the PU and PEU to the behaviour intention to use telemedicine. This enables us to comprehend an individual's cognitive judgement of belief. This suggests that the factors PU and PEU are essential in shaping attitudes towards telemedicine. According to the study (Ahadzadeh et al., 2023), if the BI

to use mHealth is triggered by connected circumstances, it is facilitated by positive attitudes towards health technology in Malaysia context.

External variables based on gender and education are not significant in this study. Both gender and education have no impact on ease of use and usefulness factors. This might be due to the fact that gender and education in the healthcare profession are similar in terms of handling, and they are working under the management facility provided. This is consistent with the recent discovery that age and gender had no effect on attitudes towards digital cognitive rehabilitation in health centres (Van Der Ham et al., 2020). In this study, among the healthcare providers with prior experience (124, 75.61%), male and female stand for 47 and 77 (Appendix D), respectively. There are two platforms that are used the most by them, which are WhatsApp (48.78%) and BookDoc (14.02%). There is no impact on PU and PEU due to the facilities provided in their working environments. They mostly utilised WhatsApp and BookDoc because these platforms were provided by their management (Ganasegeran et al., 2017) and cooperation with the Ministry of Health Malaysia (Kong, 2020), respectively.

Finally, the overall acceptance among Sarawak healthcare professionals was 72% based on the weightage measurement items in the TAM model (Appendix E). The data imply that telemedicine adoption is the result of a combination of factors. This discovery has significant practical implications for creating a product development plan. With this proportion of acceptability, the above-mentioned elements should be considered to be examined, in order to improve telemedicine services in Sarawak.

4.3 Summary

The purpose of this study was to empirically examine the parameters of acceptance of telemedicine. Participants from healthcare providers responded to a survey to accomplish this study. The results of the quantitative analysis of the demographics, the measurement and structural model, and the hypotheses are presented in this chapter. SmartPLS software version 4 was used to run PLS-SEM analysis on the data, which produced measures that supported the validity and reliability of the measurement and structural model, as well as the significance and implications of path coefficients in the models. Six hypotheses were supported by this data analysis, while five were not. Figure 4.4 represents the overall output acceptance among healthcare providers. Four indicators are pinned from the TAM model that are significant towards the intention to use telemedicine.

	Acceptance =	PU	+	PEU	+	ATT	+	BI	TAM model
Explanatory powers	f ² =	0.204	+	n/a	+	0.263	+	n/a	Medium effect ¹
	R ² =	0.107	+	n/a	+	0.477	+	0.587	Good ²
	Q ² =	0.097	+	n/a	+	0.127	+	0.151	Moderate ³
	Paths sign =	PU->ATT PU-> BI Age->PU	+	PEU->PU PEU->ATT (both “- sign”)	+	ATT->BI	+	n/a	Accepted hypothesis
	Significant Indicators =	yes	+	yes	+	yes	+	yes	Guidances
	Weightage measurement = items	72%							Overall Good

Note: 1: 0.02, 0.15, and 0.35 represent modest, medium, and substantial contributions (Cohen,1988)

2: TAM model has greater explanatory power in healthcare providers with (R2=0.63)similar to the study from (Harst et al., 2019)

3: PLS-SEM_RMSE values are lower than those in LM_RMSE values (Shmueli et al., 2019).

Figure 4.4: Summary of acceptance among healthcare providers

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter summarises the statistical analysis, the study's findings, implications, and suggestions. The study's conclusions are based on data analysis, which was covered in the previous chapter. Implications make some recommendations to players in the healthcare industry. Some recommendations are made in order to provide information as well as guidance for future research on the same topic or issue. Finally, these recommendations address the issues influencing telemedicine acceptance in Sarawak.

5.1 Summary of objectives

The goal of this study was to evaluate the acceptance criteria from healthcare professionals in order to provide the greatest overall input for healthcare industry business players. It became required to leverage the prerequisite goals in order to achieve that aim. Determining what generalised telemedicine entails and how that ideal is related to healthcare sector practices and user acceptance is needed, with a literature review as the foundation for this dissertation. As part of that effort, it became vital to get a grasp of telemedicine literacy. To allow for the possibility of a research model that reflected the human behaviour of perceptions and measurement as a valid component of these philosophical conceptions, it was necessary to create a model capable of incorporating the entirety of the technology acceptance relationship with humans. This research might move forward if these key steps were completed.

Two versions of a survey instrument were developed and reviewed by experts in technology programs. Data were obtained using the survey instrument designed for this study, which met the research problems outlined in the first chapter of this dissertation.

5.2 Conclusions

This study investigated healthcare providers' perspectives on the intention to use telemedicine. In particular, the study seeks to identify the factors and strategies employed to enhance the adoption of telemedicine. As described in the previous chapter, the TAM model of acceptance is composed of four factors. With the validity acceptance range, all variables are significantly assessed. A total of 164 healthcare providers were polled, regardless of whether they work in the private or public sector.

Based on the findings, the effect of the healthcare providers' tendency to value telemedicine adoptions reflected interaction from: perceived usefulness, followed by perceived ease of use, then the attitude and intention to use, was determined in response to research questions one and two. Given the considerable impact, it is not viable to address the issue of low adoption by improving the variables.

Figure 5.1 depicts the overall outputs from the PLS-SEM approaches. Acceptance among the healthcare providers with the three variables (significant) is obtained. Noticeably, the attitude variable among healthcare providers is dominant and significant. The two determinant factors are observed to generate attitude among healthcare providers. Pinned the PEU variable is the main factor among healthcare providers who have withdrawn their acceptance of telemedicine.

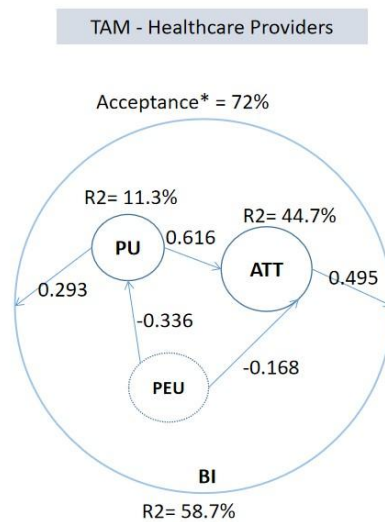


Figure 5.1: Summary of outputs analysis from TAM.

Note: The size might not accurately represent the values that indicated.

5.3 Recommendations

Based on the above three major analyses, the market potential emphasises the necessity for investment in telemedicine development. Telemedicine offers consulting services to society, particularly as an option for medical follow-up for patients. As a result, the recommendations are in the following section.

According to the researcher's findings, there is a substantial negative association between perceived ease of use, attitude towards use, and perceived utility of telemedicine. This could be because most people do not utilise a specific telemedicine platform and instead rely on WhatsApp, which is not meant to have features like medical data. Furthermore, there is a barrier to accessing a single device with several users. To increase their intention to use telemedicine, the platform can use some advertisements to attract healthcare providers. The healthcare industry can promote telemedicine systems through media and

online channels such as Facebook, radio, and others. The management can also set up technical groups to guide users to healthcare providers.

Based on its perceived usefulness, healthcare providers in Sarawak believe the telemedicine platform will help them with medical consultations with patients. If the qualities of telemedicine are consistent with medical operating practice, they will believe that applying telemedicine is beneficial to them. To maximise the whole vital criteria for healthcare providers, the telemedicine developer may consider designing and upgrading the system with some outline features such as patient database records, multi-users without interruption, and so on.

With these two variables, improvement will definitely have a positive impact on attitudes towards using telemedicine. This allows us to comprehend a person's cognitive judgement of belief. Furthermore, in this study, young healthcare providers in Sarawak are willing to accept telemedicine. As a result, acceptance will be more noticeable if other aspects are taken into account concurrently.

The cascade impact of elements is interconnected and impulsive in its own area, as well as inter-mutual understanding and acceptance within the same context of the telemedicine platform. Figure 5.2 displays the variables and acceptability in terms of the predicted period of telemedicine adoption. Which reflect the ideal, desirable outcomes when the interventions are carried out. The TAM was used to determine these factors. The higher the curve, the more elements are unfavourable to users and require a longer period of time to accept telemedicine. To put it another way, the greater the curve, the more difficult it is to

roll up to promote acceptance. The existing acceptability is based on a variety of users who do not have access to a specific telemedicine platform. Based on the preceding recommendations, the ideal curve (flatten factors) of less curve-up to lessen resistance to acceptance and duration of adoption. The focus of determinants must not be limited to one of the two key variables. When delivering health care through telemedicine, all variables require a more comprehensive approach. If one of the variables lacks focus, efforts will be lost owing to a lack of push or pull momentum between them to generate values that make the entire operation useful to each other. The most realistic way to reach goals appears to be the effectiveness of intervention strategies (Meinhardt et al., 2023).

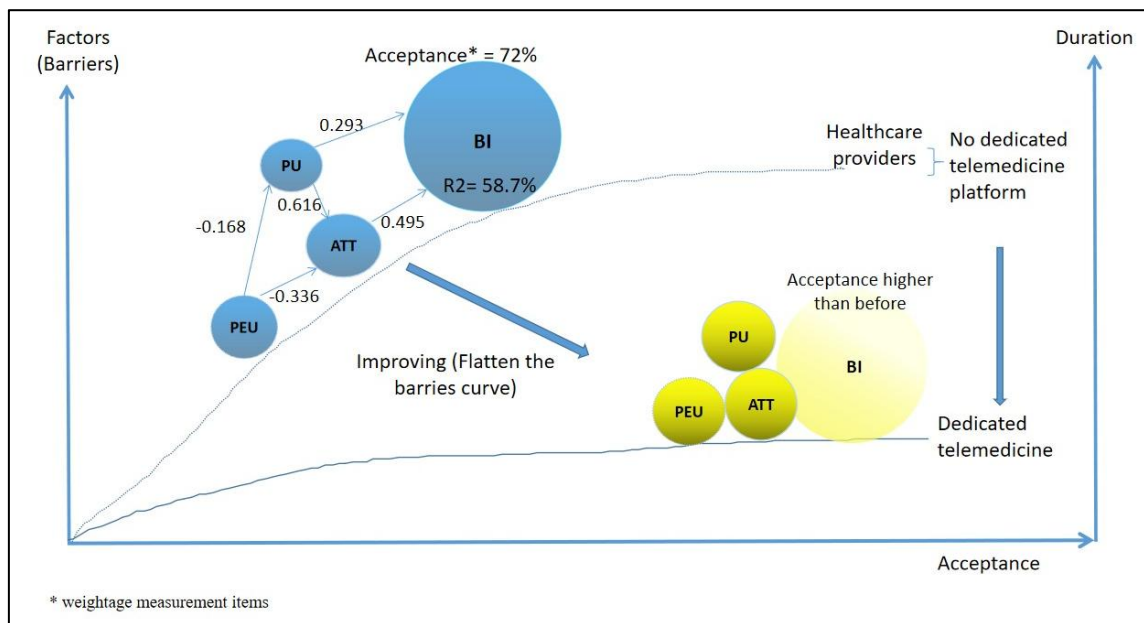


Figure 5.2: Desired results based on healthcare provider perspectives expectation.

Note: The size of the circle not actual represent the R2 values; Thin arrows shows the path coefficient indicated with significant; higher curve: blue color represent the healthcare provider; lower curve: yellow color represent the intervention/ improvement increase in R2 and path coefficient; Plotted circle on the curve only estimation.

5.4 Implication and limitations of study

The general contributions of this study portray consumer behaviour perceptions and assessments of the industrial research sector in the context of telemedicine. Theoretically, it increased the applicability and prediction capacity of the body of information through the cumulative outcome of past studies. The outcome is consistent based on the method's repetition in diverse locations and populations within the context of healthcare sector. As a result, the empirical perspective on TAM was reviewed significantly, although it was interrelated based on the study questions produced from the four main variables. This has demonstrated how industry sector patterns developed from the empirical perspective on TAM concepts. This resulted in a methodological perspective in which four dimensions were used by healthcare providers to contribute to the flow of value creation based on the contemporaneous capture of situations within the telemedicine environment.

Nevertheless, there are limitations to this study. First, this study may not be thorough enough by categories of healthcare segments (medical specialties), as it does not examine the variety of their acceptance in the commercial or public sectors; this study also does not cover the public categories (outpatient status of follow-up medication), as it does not examine the variety of their acceptance and willingness to pay in the commercial or public sectors. Second, the sample process did not cover all of Sarawak's districts. Based on this study, this does not represent the acceptance of other districts. A total of another 36 district areas do not reflect the acceptance status of telemedicine.

The author has only 11 weeks to complete this study. This may present significant challenges for the author because the investigator may require more time to collect data,

analyse it, and run it in order to obtain more precise results. This is because the investigator is from the medical supply sector and is new to using PLS software. Because the researchers had no prior expertise with this software and needed to spend more time and effort learning it.

5.5 Future research

The study evaluated acceptance among healthcare providers (regardless of medical specialties) and the general population (regardless of health status). This study serves as the foundation for the data because there is no database based in Sarawak. As a result, no criteria were used to exclude respondents from all categories. Therefore, future research will specify the criteria based on the medical specialties and health status of healthcare providers and the public, respectively.

More variables in the theoretical aspect can be considered that capable of capturing a wider range of factors and determinants for the sake of understanding Sarawakian consumer behaviour. Finally, the status of real and non-users for the specific telemedicine platform system in Sarawak is unknown. Still, investigate the acceptance status among actual use respondents yet explored by any researchers so far.

5.6 Summary

In essence, the goal of this study is to review the elements that induce healthcare practitioners' adoption of telemedicine systems. The association was examined using four variables correlation within the TAM in the context of telemedicine. Throughout the study, three variables were shown to have a significant link in the TAM (6 hypotheses accepted

out of 11) model. Researchers identify significant variables related to the intention to use telemedicine systems to assist healthcare business stakeholders in understanding how potential users embrace and adopt such a system. As far as this study is concerned, the initial data shows the reflected status of acceptance of telemedicine in Sarawak. Furthermore, the researchers offered several constraints and recommendations for future studies to consider to refine the research directions.

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Appendix A

Definition: Telemedicine - practice of medicine using the audio mode, visual mode and data communications to link the participants (Patients and Healthcare providers) in the healthcare system.

Purpose: To evaluate the acceptance of telemedicine among healthcare providers, public/patients (For section 2 and 3); To evaluate the willingness to pay of telemedicine among public/patients (for section 4).

The survey should take about 5 minutes to complete. Only aggregated findings will be presented, and the material submitted will be utilised purely for academic study. Your responses will be kept strictly and completely confidential.

Section 1 Respondent's Demographic

Kindly provide general information about yourself by ticking the respective boxes or fill in the blank where applicable below:

1. Age

"< 20 years old", "21-30 years old", "31-40 years old", "41-50 years old", "51-60 years old"

2. Gender

"Male" and "Female"

3. Level of education

"Diploma", "Degree", "Master", "PhD", Others

4. Income/ month

"<1500", "1501 - 2000", "2001 - 3000", "3001 - 4000", "4001 - 5000", ">5000"

5. How often do you use telemedicine service?*

"None", "some time", "most of the time"

6. Do you have prior experience with using telemedicine services?*

"Yes", "No"

7. Which type of the following telemedicine services you used before?*

"WhatsApp", "Doc2u", "DocOnCall", "BookDoc", "GetDoc", "Email", "Zoom", "MicrosoftTeam", "Webex", etc

8. What are the reasons for adopting the telemedicine?

*With clue description- eg: WhatsApp, Doc2u, DocOnCall, BookDoc, GetDoc, Email, Zoom, MicrosoftTeam, Webex, etc

9. Healthcare positions: #This question for the section 2 (Healthcare providers only)

Nurse, Physician, Medical assistant, Health administrator, Physiotherapist, Pharmacist, Radiologist, Others

Remark: Question 1-8, applicable for section 3 and 4.

Section 2 of TAM model's questionnaires

QUESTIONNAIRE FOR THE EVALUATION OF HEALTHCARE PROVIDERS OF TELEMEDICINE ACCEPTANCE

(1 = Strongly Disagree; 2 = Disagree; 3 = Neutral; 4 = Agree; 5 = Strongly Agree)

Perceived Usefulness (PU)					
Using telemedicine service improves my job effectiveness and performance.	1	2	3	4	5
Using telemedicine service gives me greater control over my work.	1	2	3	4	5
Telemedicine service enables me to accomplish tasks more quickly and makes me more productive.	1	2	3	4	5
Telemedicine services help to get current diagnosis and treatment plans for patients.	1	2	3	4	5
Perceived Ease of Use (PEU)					
Telemedicine services are rigid and not flexible to interact with.	1	2	3	4	5
Interacting with telemedicine services is often frustrating.	1	2	3	4	5
Telemedicine services do not require several training to effectively use.	1	2	3	4	5
Telemedicine services are compatible with the existing clinical workflow	1	2	3	4	5
Attitude Toward Use (ATT)					
Using the telemedicine service is a good idea.	1	2	3	4	5
The telemedicine service increases the healthcare service quality	1	2	3	4	5
The adoption of telemedicine reduces the risks associated with health	1	2	3	4	5
The telemedicine service is valuable	1	2	3	4	5
Behaviour Intention to use (BI)					
I am glad to present the telemedicine service to my close ones	1	2	3	4	5
I will adopt the telemedicine service	1	2	3	4	5
I will adopt the telemedicine service based on my close ones' necessities.	1	2	3	4	5

Google form link:

<https://forms.gle/Mxji19efCpcUezsN8>

https://docs.google.com/forms/d/e/1FAIpQLSfDrY7ZuwpUbSv5CmF-orD8fsSE63tMgto_US2mPPS2ifv2zA/viewform?usp=sf_link

Appendix B

Variables' Indicators with Relations

The following table 1 summary the TAM's inner and outer indicators. Each pint-out the hypothesis accordingly for this study. Four construct derived several indicators and external factors to reflected the seven hypothesis for TAM model.

Table 1: TAM variables with indicators and coding

Construct	Indicators	Coding	Hypothesis	Relation
E	E _{Age}	1 = "< 26 years old",	H6	--> PU
		2= "27-42 years old",	H7	E--->PEU
		3= "43-58 years old",		
		4= "59-68 years old",		
		5="69-77 years old"		
		6="78- Above"		
	E _{Education}	1=other,		
		2=Diploma,		
		3=Degree,		
	E _{Gender}	4=Master,		
		5=PhD,		
		1= Male; 2= Female		
PEU	PEU1, PEU2, PEU3, PEU4	1=scale 1; 2=scale2; 3=scale3;	H1	PEU--->PU
		4=scale4; 5=scale5	H2	PEU--->ATT
PU	PU1, PU2, PU3, PU4	1=scale 1; 2=scale2; 3=scale3;	H3	PU--->ATT
		4=scale4; 5=scale5	H4	PU--->BI
ATT	ATT1,ATT2, ATT3, ATT4	1=scale 1; 2=scale2; 3=scale3; 4=scale4; 5=scale5	H5	ATT--->BI
BI	BI1, BI2, BI3	1=scale 1; 2=scale2; 3=scale3; 4=scale4; 5=scale5		

Appendix C

VIF test for TAM model:

	VIF
ATT -> BI	1.827
PEU -> ATT	1.127
PEU -> PU	1
PU -> ATT	1.127
PU -> BI	1.827

Appendix D

Experience use of telemedicine (Among Healthcare providers)

Use experience		
	Qty	Percentage
Yes	124	75.61%
No	40	24.39%
Total	164	100.00%

	use experience (gender based)			frequency use			
	No	yes	Total	not at all	seldom	often	Total
male	14	47	61	26	18	17	61
female	26	77	103	37	25	41	103
	Total		164	Total			164

(Among Healthcare providers)

Frequency to use telemedicine			
no	1	63	38.41%
mild	2	43	26.22%
most often	3	58	35.37%
Total	164		100.00%

(Among Healthcare providers)

Type of telemedicine use				Gender	
				male	female
WhatsApp	1	80	48.78%	31	49
Doc2u	2	1	0.61%	0	1
DocOnCall	3	1	0.61%	0	1
BookDoc	4	23	14.02%	10	13
GetDoc	5	0	0.00%	0	0
Email	6	3	1.83%	1	2
Zoom	7	7	4.27%	2	5
MicrosoftTeam	8	0	0.00%	0	0
Webex	9	3	1.83%	0	3
google meet	10	4	2.44%	1	3
none	0	42	25.61%	16	26
		164	100.00%	61	103

(Among Healthcare providers)

Reason to adopt telemedicine		
fast	72	43.64%
convenient	6	3.64%
cost	18	10.91%

follow	7	4.24%
logistic	9	5.45%
appointment	1	0.61%
easy	12	7.27%
others	40	24.24%
	165	100.00%

(Among Healthcare providers)

Appendix E

Acceptance level among Healthcare provider

	PU1	PU2	PU3	PU4	PEU1	PEU2	ATT1	ATT2	ATT3	ATT4	BI1	BI2	BI3
1	4	4	4	4	26	19	2	4	4	2	3	3	3
2	8	13	16	17	38	41	7	9	13	4	9	8	6
3	47	51	46	47	67	72	42	48	75	44	54	47	49
4	55	56	55	55	25	25	66	65	43	69	65	71	72
5	50	40	43	36	8	7	47	38	29	45	33	35	34
Total	164	164	164	164	164	164	164	164	164	164	164	164	164
Weight item*	3.848	3.701	3.713	3.642	2.701	2.756	3.909	3.756	3.488	3.921	3.707	3.774	3.780

Total of weight items = 46.696

Average weight measuring items, $46.696 / 13 \text{ items} = 3.592$

Percentage of acceptance, $3.592 / 5 \text{ scale} \times 100\% = \mathbf{72\%}$

*Note: Total of (scale x scale items) divided with total respondent