STUDY TO INVESTIGATE THE ADOPTION OF WIRELESS TECHNOLOGY IN THE AUSTRALIAN HEALTHCARE SYSTEM

by

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Dedicated to my beloved late father,
Professor M. A. Majeed

Abstract

Due to technological developments, consumer expectations and the competitive business environment, healthcare providers are constantly under pressure to provide higher quality services; but their resources remain limited. One possible solution to meet the increasing demands on healthcare is the adoption and utilisation of new information and communication technologies. These were clearly recognised in an Australian Department of Health and Ageing[1] report of 2005, which states that the adoption of new technologies is crucial in addressing these issues. In recent years some Australian healthcare providers have started using wireless technology to provide services at the point of care, to reduce costs involved in providing data access at point of care, and to reduce transcription errors. However, it appears that in many Australian healthcare organisations, wireless technology is still being used only as pilot projects, employed on a trial and error basis, without proper planning, without proper strategic integration to existing legacy systems, with limited support from top management, and without proper training. These issues have been highlighted by previous studies.

While prior studies agree that wireless applications[2] have the potential to address the endemic problems of healthcare, only limited information can be found about the drivers and inhibitors of such applications. Further, it appears that there is no guiding framework for implementing wireless technology in healthcare agencies. This study has identified this aspect as a major issue and posited the following two overarching research questions.

Research Question 1: What are the determinants for the use of wireless technology in the Australian healthcare environment?

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1 www.doha.gov.au
2 This research study only concentrated on the wireless handheld devices adoption, such as PDA's, Handheld PC's, Pam computers and smart phones for adoption in healthcare setting. No particular applications associated with the healthcare setting was tested in this research study

Research Question 2: What factors constitute a framework for the adoption of wireless technology in the Australian healthcare setting?

The rationale for asking these questions stemmed from the fact that in order to understand the processes at work in the adoption of wireless technology, and the intentions of healthcare workers to use it, there was a need to identify factors that are critical for such adoption. In identifying these factors of adoption as applicable in Australian healthcare settings, this study employed a mixed-method methodology, where the qualitative component (focus group sessions) guided the quantitative component (formal survey questionnaire). A unique feature of the mixed method employed in this study was to develop the quantitative instrument from focus group interview transcripts so as to ensure the relevance of the instrument used.

In addition to using standard regression models, this study also employed structural equation modelling (SEM) to identify interactions between determinants. A total of 374 responses were analysed in the quantitative component of the study so that meaningful assertions can be made in terms of factors that determine adoption.

This study established five specific determinants for wireless technology adoption in the Australian healthcare environment. These were *Clinical practices*, *Social context*, *Technical readiness*, *Organizational readiness* and *Compatibility*. Further, SEM established that there are strong direct relationships among three of these: *Clinical practices*, *Social context* and *Compatibility*. The study also established that the determinants *Technical readiness* and *Organisational readiness* have no direct effect on the dependent variable *Intention to use*. Furthermore, *Social context*, *Perceived readiness*, *Organisational readiness*, and *Technical readiness* indirectly influence the variable *Intention to use* wireless technology.

The main implication of the study is that organisations can benefit by considering these determinants while developing their ICT strategies so that wireless technology can be properly implemented in healthcare settings. The assertion that there is strong direct relationship between determinants *Clinical practices*, *Social context* and

Compatibility indicate that organisations can benefit from providing an environment that fosters these determinants. Healthcare organisations will also benefit by understanding the *Compatibility* determinant in order to help with the uptake of adoption; participants in this study clearly nominated this aspect as being crucial for the adoption of wireless handheld devices[3].

The study was conducted in the south-west region of Queensland, including the metropolitan areas. The results of this study may have limited applicability to other healthcare settings in Australia, as state regulations and procedures greatly influence the way technology is used and adopted. Consequently, the study concludes with suggestions about how future researchers might extend aspects that were not possible in this study. In this way, results can be made applicable to healthcare settings in other locations.

3 In this research, abbreviations such as WHD and WHT are used interchangeably. Wireless handheld technology (WHT), has been changed to wireless handheld devices (WHD).

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Statement of original authorship

This is to certify that the ideas, experimental work, results, analysis, conclusion, and recommendations reported in this dissertation are entirely of my own effort, except where otherwise acknowledged. I also certify that the work is original and has not been previously submitted for any other award, except where otherwise acknowledged.

Signature of candidate

Abdul Hafeez-Baig **Date**

ENDORSEMENT

Signature of principal supervisors

Professor Raj Gururajan **Date**

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(Associate supervisor)

List of publications produced during this research study

Grist, S., Hafeez-Baig, A., Gururajan, R. & Khan, S. (2007). Clinical usefulness is the key common determinant of adoption of wireless technology in healthcare for India and Australia. In *6th International Conference on the Management of Mobile Business* (ICMB 2007), 9-11 July 2007, Toronto, Canada.

Gurney, T., Hafeez-Baig, A. & Gururajan, R. (2009). Wireless handheld devices in a clinical setting: A Queensland case study. *Proceedings of Conference on Information Science, Technology and Management*, Gurgaon, India.

Gurney, T., March, J., Hafeez-Baig, A. & Gururajan, R. (2009). PDAs and the advantages in patient safety. *Proceedings of Nursing Informatics Australia Conference.* Canberra, Australia. [Received Moya Conrick Prize Best Paper Award.]

Gururajan, R., Gurney, T., Hafeez-Baig, A. & Gururajan, V. (2009). *A report on improving nursing decision making using wireless handheld devices (PDA)*. Submitted to Queensland Health, The Office of the Chief Nurse.

Gururajan, R., Hafeez-Baig, A. & Gururajan, V. (2008). Clinical factors and technological barriers as determinants for the intention to use wireless handheld technology in healthcare environment: An Indian case study. In *16th European Conference on Information Systems* (ECIS 2008), 9-11 June 2008, Galway, Ireland.

Gururajan, R., Hafeez-Baig, A. & Kerr, D. (2007). Reactions and perceptions of healthcare professional towards wireless devices in healthcare environment in the developing world: a case of Pakistan. In *ACIS 2007 18th Australasian Conference on Information Systems: The 3 Rs: Research, Relevance and Rigour – Coming of Age*, Dec 2007, Toowoomba, Australia.

Gururajan, R., Hafeez-Baig, A. & Kerr, D. (2008). Reactions and perceptions of healthcare professional towards wireless devices in healthcare environment in the developing world: A case of Pakistan. *electronic Journal of Health Informatics*, *3*(2), e13.

Gururajan, R., Hafeez-Baig, A. & Moloney, C. (2005). Adoption of wireless handheld technology: A case of Queensland healthcare. *Proceedings of the Fifth International Conference on Electronic Business*, ICEB Hong Kong.

Hafeez-Baig, A. & Gururajan, R (2009). Organizational, technical, & perceived readiness as adoption factors for wireless technology in healthcare: An Australian case study. In HIC, August 19–21, Canberra, Australia.

Hafeez-Baig, Abdul and Gururajan, Raj and Mula, Joseph M. and Lin, Meng Kuan (2009) Study to investigate the determinants for the use of wireless technology in healthcare setting: A case of Pakistan. In: 4th International Conference on Cooperation and Promotion Resources in Science and Technology (COINFO'09), 21-23 Nov 2009, Beijing, China.

Hafeez-Baig, A. & Gururajan, R. (2004). Current status of wireless solutions in the Australian health information systems: A review. *Enterprise Value from e-Business*, Edith Cowan University, CD-ROM, 229–237, Perth, WA.

Hafeez-Baig, A. & Gururajan, R. (2008). Time management, improved patient expectations and added value contributing to the perceived acceptance of in using wireless handheld devices in the Indian healthcare. *ACIS 2008 Conference*, Christchurch, New Zealand.

Hafeez-Baig, A. & Gururajan, R. (2009). Exploratory study to understand the phenomena of adoption of wireless handheld devices in the Australian healthcare. *Journal of Systems and Information Technology, 11*(1), 43-56.

Hafeez-Baig, A., Grist, S. & Gururajan, R. (2007). Technology management, data management, improved outcomes, efficiency and software limitation influencing the use of wireless technology for healthcare in Pakistan. In *6th IEEE/ACIS International Conference on Computer and Information Science* (ICIS 2007), July 2007, Melbourne, Australia.

Howard, A., Hafeez-Baig, A., Howard, S. & Gururajan, R. (2006). A framework for the adoption of wireless technology in healthcare: An Indian study. In S. Spencer & A. Jenkins, (eds.). *Proceedings of the 17th Australasian Conference on Information Systems* (ACIS 2006), Australasian Association for Information Systems.

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List of abbreviations and definitions

Acronyms

A	Attitude
ACIS	Australian Conference of Information Systems
ACSPRI	The Australian Consortium for Social and Political Research Incorporated
AMOS	Analysis of moment structures
ANOVA	Analysis of variance
AQNL	Association of Queensland Nursing Leaders
ATB	Attitude towards behaviour
C	Compatibility
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CP	Clinical Practices
CPOE	Computerised Physician Order Entry
C-TAM TPB	Combined Technology Acceptance Model and Theory of planned behaviour model
CVI	Content Validity Index
DM	Data management
DV	Dependent Variables
ECIS	European conference of information systems
EE	Effort Expectancy
EFA	Exploratory Factor Analysis
ERM	Electronic Record Management
GFI	Goodness-of-Fit index
GP	General Practitioners
GPS	Global Positioning Systems
GUI	Graphical User Interface
HC	Health Care
HCT	Health Care Technologies
HF	Healthcare Factors
HIS	Healthcare Information Systems
ICC	Interclass Correlation Coefficient
ICT	Information and Communications Technology
IDT	Innovation Diffusion Theory
IS	Information Systems
IS/IT	Information Systems/Information Technology
IT	Information Technology
ITU	Intention to Use
IV	Independent Variables
LAN	Local Area Network

MANOVA	Multivariate analysis of variance
MM	Motivational Model
MPCU	Model of PC Utilisation
MR	Management Readiness
NFI	Normed Fit index
OF	Organizational Factors
OR	Organizational Readiness
PDA	Personal Digital Assistance
PE	Performance Expectancy
PEOU	Perceived Ease of Use
PLS	Partial Least Square
PR	Perceived Readiness
PU	Perceived Usefulness
QIP/AGPAL	Quality in Practice/Australian General Practice Accreditation Limited
RMR	Root Mean square Residual
RMSES	Root-Mean-Square Error of Approximation
SC	Social Context
SCT	Social Cognition Theory
SD	Standard Deviation
SEM	Structural Equation Modelling
SMC	Square Multiple Correlation
SN	Subjective Norm
SPSS	Statistical Package for the Social Sciences
TAM	Technology Acceptance Model
TLI	Tucker-Lewis Index
TPB	Theory of Planned Behaviour
TR	Technical Readiness
TRA	Theory of Reasoned Action
USQ	University of Southern Queensland
UTAUT	Unified Theory of Acceptance and Use of Technology
VIF	Variance Inflation Factor
WD	Wireless Devices
WHT	Wireless Handheld Technology
Wi-Fi	Wi-Fi is the trade name for a popular wireless technology used in home networks, mobile phones, video games and more

Definition

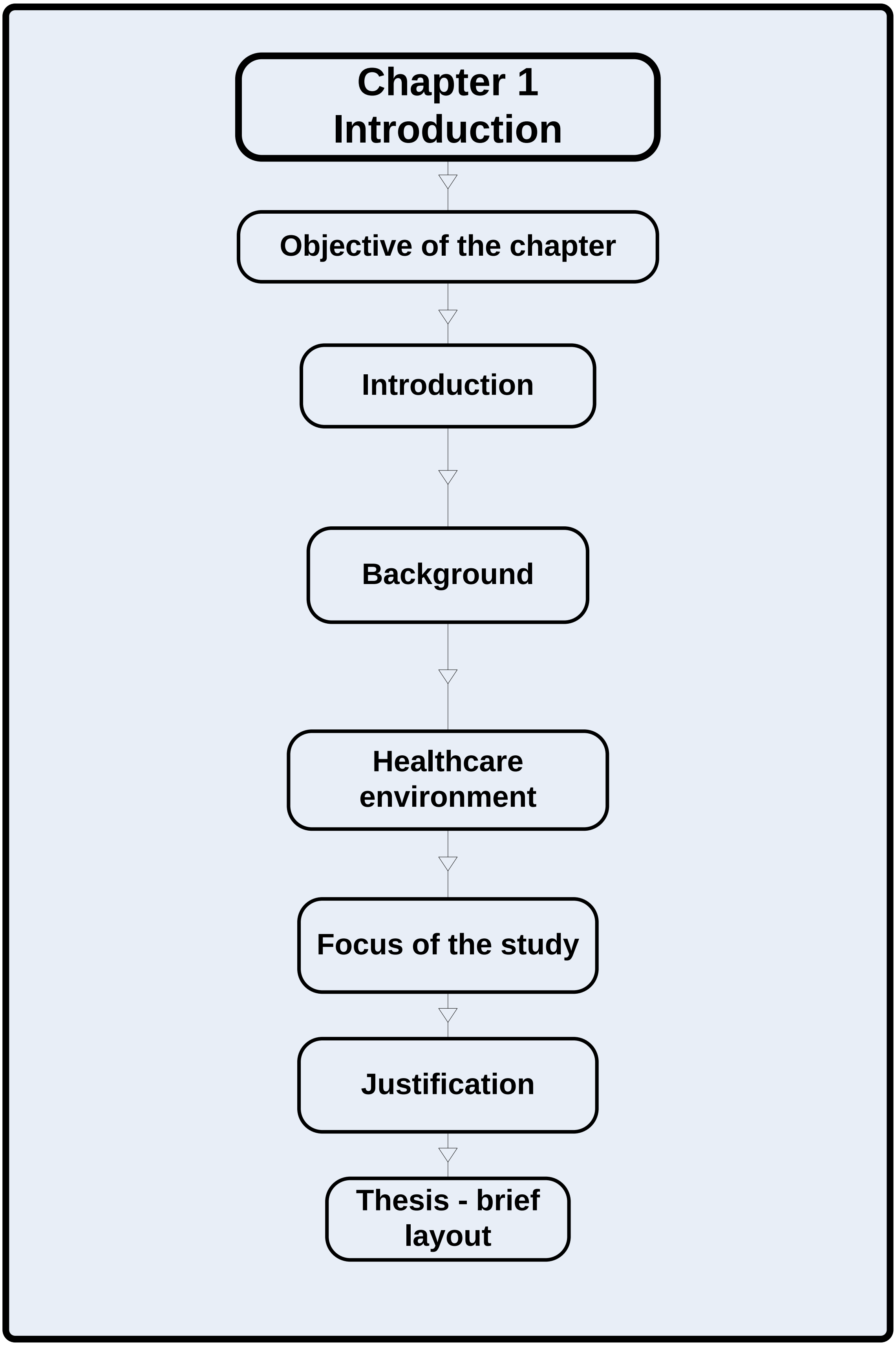
The abbreviation Wi-Fi stands for wireless fidelity and refers to wireless local area network technology for home, office, and transient users.

Chapter 1 – Introduction

1.1 Chapter overview

This chapter provides an overview of research undertaken into the problems of adoption of wireless technology in a healthcare environment and of the structure of this thesis. It also provides preliminary information about the healthcare environment and the role of technology in healthcare, and gives a brief explanation about the focus of the study. Finally, there is a brief summary of each of the chapters included in this thesis.

A graphical layout of the structure of the chapter is shown below.


Chapter 1
Introduction
Objective of the chapter
Introduction
Background
Healthcare environment
Focus of the study
Justification
Thesis - brief layout

1.2 Introduction

Over the last three decades, investment in information and communication technology (ICT) has had dynamic effects on various industries, including healthcare. This has resulted in increased productivity, higher quality of services and development of new processes. However, the healthcare industry has not enjoyed all these benefits as it has always operated with limited resources. Recently, the stakeholders of healthcare have become aware of the potential of information communication technology (ICT) and realised an opportunity to address some of the problems the healthcare sector is facing. It has been suggested that ICT has the potential to address issues such as reducing costs, errors and shortages of human resources; and improving funding, quality of care and satisfaction levels among customers and employees (Gururajan, Hafeez-Baig & Gururjan, 2008).

An example of ICT in healthcare would involve a hospital patient issued with electronically readable code, and hospital staff using wireless devices that can enter critical information directly into the hospital's data network. Through wireless devices, the patient's body could be connected to various hospital equipments to record medical data such as blood pressure and heart function. These could be directly monitored, recorded and analyzed by doctors located within the hospital or externally. Through wireless networks, doctors could order tests, prescribe medicines, and request other services generated direct from the bed side of the patient.

The use of wireless devices for data management is becoming increasingly common in the Australian healthcare system. In recent months a variety of healthcare applications has emerged as the cost of the wireless devices has decreased and their capabilities have improved. The use of wireless devices has also become popular among end users, as such devices are considered tools that improve both efficiency and productivity (Chousiadis & Pangalos, 2003). Even though the future of wireless devices and their usability looks promising, due to the distinct nature of the data, information and working environment in healthcare, the adoption of these devices remains a complex process.

Various studies have indicated that wireless applications[1] using hand-held devices can provide significant advantages such as cost reduction, reduction in data entry errors, and up-to-date data access for healthcare professionals; and can provide solutions to a range of existing problems. Specific advantages of healthcare professionals using these devices include reduction in transcription errors arising from paper-based documents (Sausser, 2003), data collection at point-of-care (Simpson, 2003), considerable reduction in the amount of paper work (Sparks, Faragher & Cooper, 2001), administering medications by having text-based alerts using handheld devices (Dyer, 2003), and remote monitoring of patients and connecting to other systems dealing with patient care (Yacano, 2002).

Previous studies have clearly demonstrated that technological solutions alone will not solve the problems encountered in healthcare. For example, access to basic services is more critical than just reducing costs by automating or deploying some technology (Anogeianaki et al., 2004). Here, "access" can be defined as access to basic medical information at an affordable cost. Bensink, Armfield, Russel, Irving. and Wotton (2004) also concluded that deploying the latest technology alone will not solve the problems of the healthcare industry; it is also important to understand the adoption phenomena of a technology.

There are several reasons that adoption of wireless technology has not been successful in some Australian healthcare systems. One is that it has not been a management priority; another is that users have not been properly trained. Therefore, it can be argued that while technological advancements facilitate solutions to existing problems, the successful implementation of the solutions depends upon proper IS (information Systems) developmental procedures. Evidence that management of solutions is a major concern in healthcare is to be found in the many studies in healthcare literature.

1 Wireless applications are also called: Mobile Software, Wireless Software, and Wireless Apps Software

Goldberg and Wickramasinghe (2003) state that healthcare is one of the largest service industries in Australia, and every individual throughout the course of life would have some sort of regular interaction with it. The healthcare industry is very localised: each state has its own systems and these are dynamic and changing in response to factors such as population growth, culture, customs, payment mechanisms, traditions, distribution of population, and expectations.

While prior studies have highlighted the advantages of wireless technology and its handheld applications, they have not yet ascertained factors that influence their adoption. Once the factors promoting adoption are ascertained, healthcare providers can enjoy the benefits of appropriate applications of this technology by providing solutions to problems such as short staffing (Davis, 2002), managing the increasingly complex information challenges (Yacano, 2002), complying with the rigorous regulatory framework (Wisnicki, 2002), reducing medication errors (Turisco, 2000) and generating affordable applications that allow for greater mobility (Athey & Stern, 2002). In addition to these, wireless applications would also provide benefits to healthcare practitioners due to the applications' flexibility and mobility, their better data management capabilities (Wisnicki, 2002), including complex patient data requirements (Davis, 2002), proper integration of data with existing systems (Craig & Julta, 2001), and improved access to data from anywhere at any time (Stuart & Bawany, 2001).

The Australian National Office of the Information Economy (NOIE, 2000) identified Australia as being well positioned to benefit from the emerging information economy. Australia is among the leading nations on a number of metrics such as adoption of electronic commerce, internet infrastructure and adoption of other technological developments. However, in the field of healthcare the adoption of wireless technology is relatively slow. Researchers in this area have identified various reasons for this slow rate of adoption, including, lack of management involvement, type and nature of data involved, perceived lack of suitability for the healthcare provider, complexity involved, cost, resistance to change, existing infrastructure, and nature of the healthcare industry itself (Gururajan, 2007; Lee, 2004; Lu, Xiao, Sears & Jacko, 2005; Schaper & Pervan, 2004).

In the Australian healthcare system, wireless technology has started making some inroads into healthcare applications due to its mobility and flexibility. Presently, many healthcare providers use wireless technology to provide solutions to 'local' problems where ad-hoc solutions are provided at departmental or unit levels. Examples of these wireless solutions can be found in Fremantle hospital in Perth, Government hospital in Western Sydney and Base hospital in Toowoomba, Queensland. Most of these standalone or ad-hoc solutions are very much localised with very limited scope; they were started by individuals or groups of individuals to use the innovative technology, without any long-term strategy or plans for future integration with other systems.

The study reported here concentrates on the determinants for the adoption process for the use of wireless technology in a healthcare setting. This research investigated various factors influencing the adoption of wireless devices and applications. In order to successfully implement and use these devices and applications, outcomes of the research have focused on the identification of adoption factors for wireless devices and applications and their potential use by healthcare professionals. The outcomes of the research helped to identify critical determinants, their interrelationships, and their implications for the successful integration and adoption of wireless devices for data management in the Australian healthcare system.

1.3 Background

The healthcare industry has been greatly influenced by the explosive growth of computing technology and communication networks. The goal of using these developments in the medical environment is to improve the overall quality of healthcare services at an affordable cost (Koutkias, Meletiadis & Maglaveras, 2001). It appears that the Australian healthcare service providers predominantly use a paper based approach to collect and process clinical information. The applicability of wireless devices for data management is particularly suitable to situations where time, accuracy of information and patient history are critical, and service providers need to act quickly and precisely. The wireless devices can play a significant role in an environment where, on a regular basis, customer information needs to be updated.

Sandrick (2002) conducted a study of surgeons using PDAs in the United States. PDAs were found to be useful for day to day operations such as keeping and accessing patient records and consulting pharmaceutical references manuals. Furthermore, the surgeons were also able to look at related diagnoses and trends relating to characteristics of individuals suffering from specific diseases. Importantly, surgeons were able to add and remove notes from the records. Holzman, May and June (1999) also studied the use of wireless devices in terms of user interface in emergency and intensive care environments. The main focus of the study was to capture and retrieve the information at the point of care. Holzman et al.'s study provided details of a user interface that doctors and paramedics could use to view and review information about their patients.

Cramp and Carson (2001) have suggested that in the future, healthcare delivery will clearly be predicated on two factors: provision of an infrastructure based on ICT, and availability of healthcare and other professionals who are able to utilise such infrastructure in order that healthcare shall be delivered in the best possible way.

Wisnicki (2002) discussed the implications of wireless technology to the healthcare industry and argued that it would improve patient care, make it more personalised, and provide analytical information to the medical practitioner that would allow for better decision making. Wireless healthcare systems could increase productivity and reduce costs, thus providing benefits for physicians, patients, healthcare professionals and insurance providers. Wisnicki also identified factors like learning processes, device acceptability, control and changing roles of doctors as potential difficulties in the adoption of this technology.

Yampel and Esenazi (2001) studied the implications to healthcare of Graphical User Interface (GUI) technology with respect to wireless devices. The developments in GUI tools not only reduced timelines for the adoption of new applications, but also reduced overall costs and had positive implications for insurers and government agencies. These authors identified that resistance to adoption of existing GUI and existing limitations of the wireless devices for healthcare applications were the main barriers to the adoption of wireless devices in the healthcare industry.

Turisco (2000) identified features such as screen size, memory, slow data transfer rates, lack of single connectivity and storage capabilities can have a limiting effect on the use of wireless devices. His view was that the use of wireless devices would improve workflow and efficiency in professional healthcare settings.

Alexander (2003) argued that current paper-based processes are costly and time consuming. He suggested that a transformation from paper-based systems to electronic systems would allow evidence-based healthcare data to be integrated with clinical and research data collected at the point of care.

Consequently, it can be seen that healthcare organizations could greatly benefit by the use of modern technology. This observation prompted the study reported here, which aimed to investigate and examine the influence of internal and external factors on acceptance of wireless technology (i.e. its usage) and how such acceptance could contribute to the higher quality of care.

1.4 Wireless technology healthcare environment

In healthcare literature, the concept of wireless technology[2] has been widely studied (Wisnicki, 2002; Dyer, 2003; Simpson, 2003; Sausser, 2003; Hu, Chau & Liu Sheng, 2002). For example, Wisnicki (2002) provides details of how broadband technology, a component of wireless technology, can be used in healthcare. He discusses the high cost of setting up wireless technology in a healthcare setting, improvements to patient care using wireless technology and the potential for cost-effective quality of service to patients. Sausser (2003) provides information on how to improve clinical quality using wireless technology, including challenges for maintaining security and privacy. Sausser also discusses the concept of portable devices for data collection purposes by providing an argument on benefits that can be realized using these devices. Simpson (2003), while critiquing the nursing domain, stresses the need for the innovative use of IT to improve patient care. He points out that new wireless technologies can help

2 In the context of this study, wireless technology encompasses wireless applications as well.

to address some of the chronic problems encountered, including saving nurses' time, skilled nursing care and home healthcare. Dyer (2003) on the other hand, provides details of how text messaging using wireless devices can be effectively used to remind patients of their appointments. He reported this idea as part of a radically new system of managing patient care in conjunction with modern telecommunication applications using wireless devices to improve the quality of patient care. Common to all these studies is the use of emerging wireless technology in healthcare and the potential benefits that can be achieved.

While many other studies in the healthcare literature echo similar sentiments, Limited studies have examined the potential challenges of using wireless applications. It appears that almost all studies have taken this crucial aspect for granted, and have not researched, for example, the impact of factors such as compatibility, integration, support and training, configuration and security. While some studies have indicated existing problems in collecting patient data and provided some theoretical solutions, these studies have seldom analysed the changing nature of information systems using wireless technology and its applications. For instance Sausser (2003) mentions the advantages of using mobile technology in collecting patient data, but does not provide an in-depth analysis of its strengths, weaknesses and influences, or how critical these factors are for the successful implementation and usage of wireless technology.

David and Spell (1997) observed that by using Computerised Physician Order Entry[3] it was possible to reduce the error rate by up to 55%. Ying (2003) identified that wireless applications for end-users in healthcare can save time and improve productivity through the use for prescription writing, laboratory order entry, results reporting, clinical documentation, alert messaging, clinical decision support, medication administration and in-patient care solutions. Ying also stressed that for the successful adoption of wireless technology, substantial user training would be essential.

What can be realised from this brief review is that the majority of the studies have focused on the 'hardware' or 'physical' component of wireless devices, as this

3 CPOE refers to 'a variety of computer-based systems of ordering medications, which share the common features of automating the medication ordering process' (Kaushal & Bates, 2001, p 59).

appears to be a focal point of interest to many authors. Other studies refer to the 'implementation' or 'management' of wireless technologies in healthcare organisations, as cost appears to be a determining factor in such implementations. Studies reviewed appear to have examined the 'usage' aspects of wireless applications on limited scale. While studies such as those of Davies, Bagozzi and Warshaw (1989) examined 'technology acceptance' in organisations and derived a model for such acceptance, the outcomes of such studies cannot be generalised for wireless applications as the technology is radically different from the traditional desktop technology. With desktop technology, users interact with data by accessing data using wired and fixed devices. On the other hand, in wireless technology, the data come to the users via the hand held devices, and this new paradigm gives users greater mobility and hence easier access to data.

Baker (2002) pointed out that wireless networking involves use of radio signals instead of physical connections to communicate between computers or other devices. In wireless networking, each device is equipped with a radio transceiver known as a wireless LAN adapter, which can send and receive radio signals.

Therefore, it was determined that this study would investigate the factors and underlying determinants for wireless technology. By doing so, this study would fill a gap in the literature, and provide insights into those factors that need to be given priority for using wireless technology in a healthcare setting. It was also expected that the outcome of this study would enhance clinical procedures, improve the availability of information on the move and assist in making better decisions in the healthcare environment by healthcare professionals; it would also realise significant cost and time savings. In terms of its overreaching aim, this study was designed to explore and identify the internal and external factors of adoption of wireless technology in the healthcare industry for data management.

Wireless devices like personal digital assistants (PDAs) have some fundamental differences from desktop computers. They have less processing power and storage capabilities, smaller displays, and more-restricted power consumption; also, their input devices that are different from those of desktop computers. Furthermore, wireless networks have limitations such as less bandwidth, more latency, less connection stability and less predictable availability (Chousiadis & Pangalos, 2003; Jormalainen & Laine, 2001). It is possible for a PDA to have secure assess to a system such as a healthcare database system with reasonable performance (Chousiadis & Pangalos, 2003).

1.5 Focus of the study

Through the initial literature review, it was found that there is no specific or confirmed model for the adoption of wireless technology in the healthcare environment for healthcare professionals. It appears that some healthcare facilities have adopted the wireless applications suitable to their own environment and requirements, but with characteristics whose scope is limited to that environment. A major implication of such narrow adoption is lack of understanding of how wireless applications are 'adopted' in healthcare. The purpose of this study, therefore, leads to the following specific research objectives:

1. To review the main theories and models for the adoption of wireless technology
2. To establish why existing adoption theories and models are insufficient or inapplicable in the healthcare domain
3. To provide a research framework that will support the development of the initial adoption model for the wireless technology in healthcare environment
4. To test the adoption model that best describes the Australian healthcare environment for wireless technology.

1.6 Justification

This study is expected to contribute to adoption phenomena in general, and specifically, to the adoption of wireless devices in the Australian healthcare industry. It is also expected to lead to further research and add to the existing literature by addressing the following aims:

1. To understand the adoption of technology in a healthcare environment, and the perceptions of healthcare professionals about wireless technology in the healthcare environment

2. To identify the determinants for the adoption of wireless technology in the Australian healthcare system
3. To contribute to the adoption knowledge in the context of wireless technology.

1.7 Thesis – brief layout

This research study consists of 11 chapters. A brief description of these chapters is provided below.

Chapter 1 – Introduction

This chapter provides introductory information about the use of wireless technology in a healthcare environment. The chapter also briefly discusses the wireless technology itself, and introduces information about the focus of the study, the data analyses undertaken, ethical considerations, and expected outcomes from the study. The key outcomes of this chapter are that it provides an overview of wireless technology in the context of healthcare, and an overview of the thesis.

Chapter 2 – Literature review

This chapter provides a review of information related to uses of wireless technology in the healthcare domain. It provides a synthesis of the adoption phenomena and the gaps existing in the literature in the context of wireless technology. The chapter concludes with a research question to address the gaps identified through the literature review. The key outcome of this chapter is the statement of the research questions for this study.

Chapter 3 – Review of adoption theories

The literature review clearly identified nine different adoption theories or models (TRA, TPB, TAM, MM, C-TAM-TPB, PC Utilization, MPCU, IDT, and SCT) that are used to explain phenomena of adoption in the domain of information systems. This chapter also reviews the most recent adoption theory by Venkatesh et al. (2003) as the Unified Theory of Acceptance and Use of Technology (UTAUT). Furthermore, this chapter provides an analysis of each of these theories or models in the context of wireless technology in the domain of healthcare. The key outcome of this chapter is that the review of adoption theories and models reveals their inability to fully explain the adoption phenomena of wireless technology in a healthcare environment.

Chapter 4 – Research methodology

The methodology chapter provides detailed information about the techniques and methods adopted in this research study to address the research questions. This chapter also provides a detailed theoretical rationale and justifications for selecting a particular technique or methodology. The key outcome of this chapter is a detailed plan on how to find answers to the research question

Chapter 5 – Qualitative data collection

This chapter provides detailed information about, and justification for using, the focus group technique employed to collect the qualitative information. This chapter clearly outlines the processes and procedures followed to conduct the focus group, sessions and the limitations associated with using the focus group techniques. The key outcomes from this chapter are the determination of the processes, procedures and justifications for the qualitative techniques used in this study.

Chapter 6 – Qualitative data analysis

The qualitative data analysis chapter covers aspects on how the analyses were conducted, and the process used to extract factors and themes from the qualitative data. The key outcome of this chapter is an overview of wireless technology in the context of healthcare, and its relationship to the thesis.

Chapter 7 – Initial framework development

This chapter provides detailed information on how the initial framework for the adoption of wireless technology in a healthcare environment was further developed and refined on the basis of the qualitative data analysis. The key outcome of this chapter is the conceptual framework for the adoption of wireless technology in a healthcare setting.

Chapter 8 – Quantitative data collection

A quantitative data collection technique was used to confirm the refined adoption model developed through qualitative methodology. This chapter provides detailed information on how the instrument was designed, developed and tested in this research. Furthermore, this chapter describes how the survey was administered. The key outcomes of this chapter are the determination of the processes, procedures and justifications for the quantitative techniques used in this study to address the research question.

Chapter 9 – Quantitative data analysis

This chapter covers information about various techniques used to analyse the quantitative data collected in the previous chapter. This chapter includes how normality and other pre-conditions were validated before conducting the factor analysis and multiple regression analysis to test the hypothesis developed in this research. The key outcome of this chapter is the acceptance or rejection of the hypotheses.

Chapter 10 – Discussion and SEM analysis

This chapter presents the interpretations and analyses of the qualitative and quantitative data collected during this study. Furthermore, this chapter also provides structural equations modelling to identify and test the direct and indirect effects of determinants on the dependent construct. The key outcomes of this chapter are the interpretations and implications of the research study, and the actual adoption model for wireless technology with direct and indirect interactions.

Chapter 11 – Contributions, limitations, conclusions and recommendations

This is the final chapter of the thesis. It provides information about the limitations of this study, information about the research contribution to the domain of information systems and, specifically, adoption in the context of wireless technology in a healthcare environment. This chapter also provides conclusions and recommendations from the findings of the study. The key outcomes of this chapter are recommendations arising from the study, and possible future directions for the research in the domain of wireless technology.

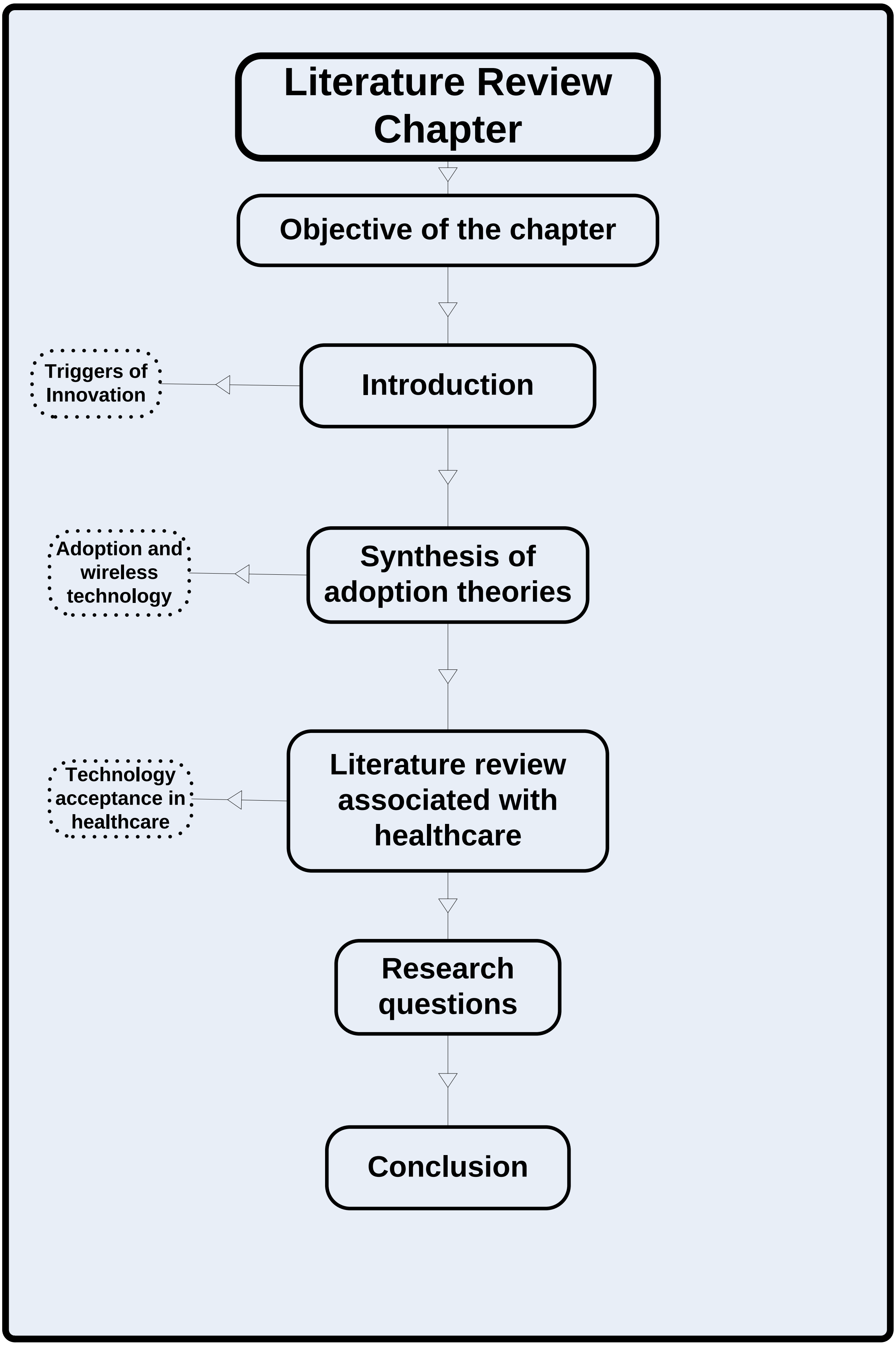
The next chapter provides a literature review in the domain of adoption and wireless technology in the field of information systems.

Chapter 2 – Literature Review

2.1 Chapter overview

The previous chapter provided an introduction and background information about the research study, the Australian healthcare industry and wireless technology. It can be inferred from the previous chapter that the Australian healthcare industry is a very dynamic industry and operates with increased competition, high customer expectations, limited resources, ever-increasing government regulation and controls to ensure that efficient and high quality healthcare services are delivered to people, increasing costs and uncertain future directions. Researchers in the domain of Information Systems (IS) have demonstrated that the technological developments of the 21st century can help to address some of these challenges. For example, use of wireless handheld devices can help to improve the quality of care, reduce errors in healthcare data, reduce costs in clinical communication, provide efficient workflows and improve quality of decision making (Carroll, Saluja & Tarczy-Hornoch, 2001; Spigel, 2004; Wilcox & Whitham, 2003; Williams, 2001). Therefore, for optimal benefits it is critical to understand the phenomena of adoption of wireless handheld technology in the healthcare environment.

This chapter provides an overview of research conducted in the domain of adoption – and specifically the adoption of wireless technology – in the healthcare environment. In addition to this, various other adoption theories will be discussed. Firstly, a brief introduction is provided of the healthcare environment. Secondly a widely accepted adoption definition is introduced. Thirdly, IS as well as healthcare related adoption theories are revisited for definitions and descriptions. Fourthly, an analysis of adoption theories is provided along with their limitations. Finally, this section describes the implication of adoption theories with the adoption of wireless technology in the Australian healthcare environment. The chapter concludes with an identification of gaps. These gaps then lead to research questions for this study.


Literature Review Chapter
Objective of the chapter
Introduction
Triggers of Innovation
Synthesis of adoption theories
Adoption and wireless technology
Literature review associated with healthcare
Technology acceptance in healthcare
Research questions
Conclusion

2.2 Introduction

Despite the need to provide high quality care, and to adopt the technological developments in the Australian healthcare sector, there has been very little empirical research into the adoption of wireless technology in the healthcare setting. Although there is a growing interest dedicated to the analysis of technical and operational aspects of wireless devices, there is little research on factors that would lead to the successful adoption of wireless devices. An understanding of factors that determine wireless device adoption in Australian healthcare can provide insights so as to address the relevant issues and move ahead in the area of wireless technology and healthcare.

High expectations, technological developments, intense competition, and effective as well as efficient and reliable services have taken the healthcare industry to a new era of expectation. Latest trends in the Australian healthcare sector involve the design of a more flexible and efficient service provider framework (Koutkias, Meletiadis & Maglaveras, 2001). By using wireless devices, it is possible to provide a flexible yet efficient service. Due to the decreasing cost of hardware devices, a variety of healthcare applications, such as glucose monitoring data management, are already emerging in healthcare. Further, the use of wireless devices will be popular among end users, as these are considered as tools to improve the efficiency and productivity of data access (Chousiadis & Pangalos, 2003). The future utility of wireless devices looks promising; however, because of the distinct nature of the data and working environment, adoption of these devices is a complex process and is yet to be fully comprehended.

Acceptance of Information Systems/Information technology (IS/IT) is perceived differently at two levels: organizational and individual (or group). Enterprises (or organizations) see the adoption of IS/IT and its reasoning for doing so at an enterprise level; individuals (or groups) see the adoption of IS/IT from the point of view of the individual user (Venkatesh, Morris, Davis & Davis, 2003). The term *adoption* can be defined in various ways. According to the Oxford dictionary, it is “the act of taking up and treating as one's own; acceptance, espousal”. Rogers (1984) defines the *adoption process* as a mental process involving various stages through which an individual passes before final adoption. Rogers also defines the related term *diffusion* as a process by which innovation is communicated among the members of a social system (Rogers, 1983).

2.2.1 Triggers of innovation and adoptions

The factors that trigger the adoption of a particular technology are part of a complex process, and this area has been researched widely (Ajzen, 1980, 2006; Bandura, 1986; Benamati & Rajkumar, 2002; Davies (1989), Bagozzi & Warshaw, 1989; Davis, 1986; Igbaria, Parasuraman, & Baroudi, 1996; Rogers, 1983; Taylor & Todd, 1995b; Venkatesh et al., 2003). In general terms, the drivers that trigger the adoption of information and communications technologies (ICT) are the motivators based on individual beliefs, perceptions, expected benefits and social influence. Poon and Swatman (1997) have studied the process of adoption and have identified five factors for the adoption of ICT: (1) new ways of marketing, (2) strong relationships with other businesses and/or partners, (3) increased ability to reach new customers, (4) improved customer services and (5) reduced communication costs (Poon & Swatman, 1997). Engsbo, Saarinen, Salmi and Scupola (2001) also studied this phenomenon and identified five triggers which explain the factors that cause the adoption of ICT in small to medium sized enterprises: (1) strategic opportunity, (2) strategic necessity, (3) force decision, (4) reactive adoption and (5) just-by-chance (Engsbo et al., 2001). Scupola (2002) on the other hand, argues that adoption of ICT is often a casual matter in family-style businesses. Thus, it can be seen that adoption can vary from individuals to organizations. This study focuses on adoption at organizational levels, and the literature has been reviewed with this scope in mind. Various adoption theories applicable to this study are discussed in the next section.

2.3 Synthesis of adoption theories

Individual and institutional levels of adoption have attracted strong research interest from researchers from a wide community (Venkatesh et al., 2003). Both of these areas of research have also been found to be important in information systems (Venkatesh et al., 2003) to understand why individuals adopt new information technology by employing *intention* or *usage* as dependent variables to acceptance of technology. Research in the domain of information systems is rich in building the theories that explain the processes and determinants for the acceptance/adoption of new innovations (Dillon & Morris, 1996; Gatignon & Robertson, 1989; Prescott & Conger, 1995). Particularly since the invention of computers, researchers have studied the phenomena of adoption for different aspects of computer technology, including software applications. Recently, IS researchers have examined the adoption phenomena related to electronic commerce by small to large enterprises (Dillon & Morris, 1996; Pavlou & Fygenson, 2006).

In recent decades, various studies have provided some sort of theoretical framework for the adoption of information technology and information systems. (Ajzen, 1985; Ajzen, 1991; Ajzen & Driver, 1992; Ajzen & Fishbein, 1980; Ajzen & Madden, 1986; Ajzen, Timko & White, 1982; David & Spell, 1997; Davis, 1989a; Davis, Bagozzi & Warshaw, 1989a, 1989b; Davis, 1989b; Davis, Bagozzi & Warshaw, 1992; Mathieson, 1991b; Mathieson, Peacock & Chin, 2001; Moore & Benbasat, 1991, 1996; Taylor & Todd, 1995a, 1995b). Each of these studies has made its own contribution towards understanding the adoption process and user acceptance of information technology. Most of the theories try to explain intention or usage behaviour (Venkatesh et al., 2003). One of the most widely researched models for adoption in information systems is the Technology acceptance model (TAM). TAM is derived from Rogers' (1995) Innovation diffusion theory (IDT). IDT explores the individual perceptions about using innovations. Davis's (1989) technology acceptance model explores the individual's intention and perception about innovations. Ajzen and Fishbein's (1980) theory of reasoned action (TRA) and Ajzen's (1991) theory of planned behaviour (TPB) explore the relationship between user beliefs, attitudes, intentions and actual use of innovations. Most of these works have concentrated on the adoption of a particular technology or a particular product in a commercial environment. However, in the combined domains of wireless technology and healthcare, limited research appears to have been conducted. This is even more valid in an Australian context (Gururajan, 2007b; Short, Frischer & Bashford, 2004).

Most adoption and diffusion research has concentrated on general aspects of the process of adoption and diffusion of information technology or information systems in organisational social systems. Many of these theories draw on socio-psychology models for the adoption of IT/IS. Examples of these theories include the Technology Acceptance Model (TAM) (Davis et al., 1989a; Davis, 1989a), Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975), Theory of Planned Behaviour (TPB) (Ajzen, 1991), Innovation Diffusion Theory (IDT) (Rogers, 1983) and Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003).

According to the TAM, belief about usefulness and ease of use are the main determinants of IT/IS adoption. Davis and co-workers based this mainly on the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975). TRA proposes that belief influences attitude, which in turn leads to intention and then to generating a particular behaviour. The Theory of Planned Behaviour (TPB) was an extension of TRA (Fishbein & Ajzen, 1975). This theory attempted to address the limitations of TRA; TPB introduces the control variable to address the perceived behaviour control.

TRA is drawn from social psychology, and its core constructs are Attitude towards behaviour (ATB) and Subjective norm (SN). TAM helps in understanding usage and acceptance of information technology; its core constructs are Perceived usefulness (PU) and Perceived ease of use (PEU). TPB extends TRA with the construct Perceived behavioural control, an additional determinant of attention and behaviour. TRA/TPB’s Subjective Norm was missing from TAM. TAM extended to TAM2 to include the “Subjective norm”. Motivational Model (MM) is derived from motivation theories to explain acceptance and usage behaviour. Its two main constructs are Extrinsic and Intrinsic motivation. The combined Technology acceptance model and Theory of planned behaviour model, C-TAM_TPB, of acceptance unites the constructs of TAM and TPB to provide a hybrid model for understanding user acceptance of technology. The Model of PC utilisation MPCU is derived from the theory of human behaviour in conjunction with TRA and TPB to predict PC utilization. This theory helps in the understanding of individual acceptance and use of information technologies. The core constructs of MPCU are Job-fit, Complexity, Long-term consequences, Affect towards use, Social factors, and Facilitating conditions. IDT has been used to understand adoption and usage in a variety of innovations. The main constructs of IDT are Relative advantage, Ease of use, Image, Visibility, Compatibility, Results demonstrability, and Voluntariness of use. Social

Cognition Theory (SCT) is an attempt to predict human behaviour of acceptance and usage of computer technology. The five main constructs are Outcome expectations (performance), Outcome expectations (personal), Self-efficacy, Affects, and Anxiety.

Clearly, user acceptance of technology is a complex process, and various theories and models have been proposed in attempts to explain it. These attempts have centred on the context in which users have used the technology (Venkatesh et al., 2003). Thus it can be inferred that user acceptance is heavily context-dependent. The literature in the domain of information systems claims that Davis's Technology Acceptance Model (TAM) is one of the most widely cited models, with variations, to predict user intentions to adopt the information technology and information systems (Igbaria et al., 1995; Mathieson, 1991b). TAM has been equally criticized for its inability to produce determinants that are not totally clear, or which are sometimes inconsistent (Burton-Jones & Hubona, 2005; Riemenschneider, Harrison & Mykytyn, 2003; Venkatesh et al., 2003; Venkatesh & Brown, 2001). In terms of criticism, Hu et al. (2000) have highlighted that TAM has been validated through users who have limited exposure to ICT tools and functions, or limited exposure to professional settings (Hu, Chau & Liu Sheng, 2002; Hu & Bentler, 1999). Therefore, the domain of adoption appears to be incomplete.

The most recent adoption model in the domain of information systems is the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003). This model claims to have incorporated various constructs from all the other major adoption theories. Despite this strength, there appears to be a need for further validation of its applicability in other research domains (Venkatesh et al., 2003). Some studies have tested the applicability of UTAUT and have found that this model is reasonably successful in explaining the technology acceptance phenomena at an institutional level (Carlsson, 2006; Cody-Allen & Kishore, 2006; Lubrin, Lawrence, Zmijewska, Navarro & Culjak, 2006; Robinson, 2006).

Both TAM and UTAUT models try to explain and describe the adoption phenomena at organizational levels, whereas this research is concentrating on the adoption of wireless handheld devices at the level of a specific healthcare environment. Such a setting is very different from that of wireless handheld technology (Carlsson, Hyuonen, Repo & Walden, 2005; Carlsson, Carlsson, Hyvönen, Puhakainen & Walden, 2006). There is evidence in the literature to suggest that UTAUT has been tested in a healthcare domain. For example, a study conducted by Carlsson and his colleagues clearly recommended the applicability of the UTAUT model for the acceptance of mobile devices and services; they concluded that the UTAUT model does not support all the cases that the original UTAUT hypothesized (Carlsson et al., 2006). Burley, Sacheepers and Fisher (2005) stated that UTAUT specifically concentrates on the organizational environment and would thus not be as useable as a diffusion of innovation model. Therefore, the applicability of the UTAUT model for wireless technology in the healthcare domain appears to be limited.

2.3.1 Adoption and wireless technology

The limited studies that are available on the potential of wireless technology and smart phones (Durlacher, 2001; Pagani, 2004) appear to have ignored the crucial aspect of individual behaviour towards wireless technology in a healthcare environment. In information systems, there are several studies that have investigated relationships between user beliefs, attitudes, intentions and the actual use of IS (Adams, Nelson & Todd, 1992; Davis, 1989a; Davis et al., 1989a; Haendrickson & Collins, 1996; Mathieson, 1991a; Pagani, 2004; Szajna, 1996). In these studies there is support for the constructs titled *Perceived usefulness* and *Perceived ease of use* as identified by TAM in predicting user behaviours. Further support for these constructs can be found in other domains, such as e-commerce (Holak & Lehman, 1990; Labay & Kinnear, 1981; Ostlund, 1973; Plouffe, Vandenbosch & Hulland, 2001; Rogers, 1995a). However, as stated earlier, it appears that in the field of healthcare, the above aspects pertaining to wireless technology adoption are not explained in depth.

In this research, one of the objectives is to identify the determinants for the adoption of wireless technology in an Australian healthcare environment. This is to be done by exploring the existing adoption theories and so identify an adoption framework for the healthcare environment. The following table provides an outline and brief analyses of adoption theories in the domain of IS.

Table 2.1: Brief summary of major adoption theories/models (developed for this study)

	Theory/model name	Abbreviation	Analysis level	Year published	Brief analysis
1	Theory of reasoned action	TRA	Individual	(Ajzen & Fishbein, 1975)	Origin of the theory/model relates to psychology in attitudes; RTA tries to explain individual's behaviour through intention to perform a particular behaviour. This theory defines intention as a function of attitude towards a particular behaviour and subjective norms.
2	Motivational model	MM	Individual	(Igbaria et al., 1996)	This model for the acceptance of individual behaviour for usage/acceptance of information technology is based on the general motivation theories to explain this particular behaviour. Microcomputer usage is influenced by effects on perceived usefulness and it is proposed that perceived usefulness, perceived fun/enjoyment, and social pressure would motivate increased use of microcomputers by professionals and managers.
3	Theory of planned behaviour	TPB	Individual	(Ajzen, 1985; Ajzen & Madden, 1986)	This theory/model builds on the "Theory of reasoned action" and extends the theory to include the perception of individual behaviour towards ease or difficulty.
4	Combined TAM and TPB	C-TAM-TPB	Individual	(Taylor & Todd, 1995a)	This theory/model attempts to provide a hybrid model by combining the "Perceived usefulness" construct from TAM with the three constructs of TPB (Attitude toward behaviour, Subjective norm, and Perceived behavioural control).
5	Model of PC utilization	MPCU	Individual	(Thompson et al., 1991)	This model has its basis on the theory of human behaviour and tries to explain the actual use of the innovation rather than the intention of the individuals to use the

					innovation.
6	Social cognitive theory	SCT	Individual	(Bandura, 1986)	This theory concentrates on changing human behaviour and explains human behaviour as interactions of personal factors. SCT helps the understanding of individual and group behaviour and tries to explain which behaviours can be changed.
7	Technology acceptance model	TAM 1 TAM2	Individual/ organizatio nal	(Davis et al., 1989a; Davis, 1989a)	One of the more widely researched theories/models in the information domain. It was built from TRA and TPB theories. The main two constructs of this model are "Perceived usefulness" and "Ease of use". This model has been tested with different extensions.
8	Innovation diffusion theory	IDT	Group, organizatio n, industry, society	(Venkatesh & Davis, 2000)	This theory/model tries to establish that adoption is a sequence of events or processes, which include learning about the innovation, being persuaded about the merits of the innovation, making decisions about the innovation, implementing the innovation, and confirming the decision to adopt the innovation.
9	Unified theory of acceptance and use of technology	UTAUT	Individual/ organizatio nal	(Rogers, 1962; Rogers & Shoemaker, 1971; Rogers, 1983; Rogers, 1995b)	The UTAUT model tries to combine all the prominent models of adoption into a unified approach. UTAUT states that in addition to variables such as performance expectancy, effort expectancy, social influence, and facilitating conditions, there are adoption/use processes that are also influenced by moderating factors such as age, gender, experience and voluntariness of use.

Common to these theories is that they all explore the phenomena of acceptance and usage of technology at organizational or individual level; however, all the theories differ in the contexts of theoretical structure, determinants, constructs and their relationships. Wireless technology and its application are relatively new areas, and adoption of such technology in a healthcare environment is unique. Bearing this in mind, this study attempts to identify the drivers and inhibitors of the adoption of wireless technology specific to the healthcare environment. As indicated, in the area of wireless technology and handheld devices, limited research appears to have been conducted. Thus it is relatively difficult to understand the acceptance and usage, especially in the area of the healthcare environment (Gururajan, 2007a; Hu et al., 2002; Hu et al., 1999). Pagani (2004) also concluded that adoption of wireless technology for health services is less prominent.

Clearly, it is not yet valid to claim that these adoption aspects can be associated with adoption of wireless technology (though such a claim can be made in the domain of IS). Consequently, a review was conducted, specifically in the healthcare literature, to explore whether studies have been conducted on this topic. The following section provides a brief analysis of this review of healthcare-specific literature.

2.4 Literature review associated with healthcare

The concept of wireless technology in healthcare is discussed in many studies (Dyer, 2003; Hu et al., 2002; Sausser, 2003; Simpson, 2003; Wisnicki, 2002). For example, Wisnicki (2002) provides details of how broadband technology, an essential component of wireless technology, can be used in healthcare. While prior studies agree that wireless applications have the potential to address the endemic problems of healthcare, very limited information can be found about the determinants of such applications (Gururajan et al., 2004; Gururajan et al., 2005). In general, the majority of the works reviewed are descriptive about the benefits of wireless handheld devices in healthcare in general, and medicine in particular. There is only a small number of studies that provide evidence-based information concerning these devices in healthcare (Fischer et al. 2003; Sax et al. 2005). Furthermore, five major studies in the area of healthcare (evaluated by Spil & Schuring, 2006) that tested the

Technology Acceptance Model (TAM) produced findings which were inconsistent with the body of knowledge in non-healthcare settings. With 'Perceived ease of use' and 'Perceived usefulness' as the major TAM attributes, these studies found that in the health environment, 'Perceived usefulness' is an important attribute in technology adoption, while 'Perceived ease of use' was found to have no effect (Spil & Schuring, 2006). This is different from findings reported in non-health IS studies, where both attributes were found to be reliable technology adoption predictors. Therefore, further empirical investigation is required to explain the reasons for this variation in healthcare. In addition, there is a need to explore whether further attributes exist which may influence the adoption of wireless applications in the healthcare environment.

Hripcsak et al. (1999) observed the use of wireless technology in conjunction with a health information network that co-ordinated tuberculosis care. Home-care nurses were fitted with wireless pen-based computers. They found that wireless computing led to better information access for both nurses and physicians, but did not help in reducing the workload. They also observed that innovative technologies can improve and facilitate the coordination of patient quality of care in the healthcare industry.

Succi and Walter (1999) conducted a survey on methodology, and concluded that TAM may not be a good predictor of the attitudes of physicians towards the new technology. However, they suggested that an extension of TAM with “perceived usefulness” could play an important role for professional users. They also suggested employing strategies such as addressing physicians’ fear-related attitudes about their professional status, and establishing greater communication and cooperation between physicians and non-physicians. These strategies, they argued, could help healthcare professionals to influence physicians’ attitudes toward use of new technology.

Turisco (2000) identified limitations such as screen size, memory, slow data transfer rate, lack of single connectivity and storage capabilities that can have an effect on the use of wireless devices. It is anticipated that the use of wireless devices will not only provide professional healthcare, but will improve the workflow and efficiency as well.

Yampel & Esenazi (2001) studied the implications of graphical user interfaces (GUI) for healthcare with respect to wireless devices. The developments in GUI tools not only reduce the timeline for the adoption of new applications but also reduce overall costs and have positive implications for insurers and government agencies. They concluded that existing GUI and existing capabilities of wireless devices for healthcare applications are some of the main barriers to the adoption of wireless devices in the healthcare industry. Basic capabilities identified by them include:

1. Developing the interface using drag-and-drop capabilities,
2. Passing data from screen to screen with global variables,
3. Using background keyboard macros to automate data entry,
4. Performing arithmetic operations,
5. Copying, resizing, and moving existing screen objects,
6. Creating new labels and text fields,
7. Creating buttons, checkboxes, frames, lists, radio buttons and
8. Creating screen templates that can automatically convert similar host screens to a specified format on the wireless devices.

Wisnicki (2002) discussed the implications of wireless technology to the healthcare industry and argued that it increases the quality of patient care and provides personalized care in addition to the analytical information for the medical practitioner for better decision making. Wireless healthcare systems can increase productivity and cost savings for physicians, patients, healthcare professionals and insurance providers. Potential inhibiting factors included learning processes, device acceptability, control, and the changing role of doctors.

Chau and Hu (2002) examined physician acceptance of the technology through a questionnaire sent to 400 physicians, and suggested that TAM may be appropriate from TPB theory to understanding physician acceptance of technology. They found that healthcare professionals appeared to be pragmatic, concentrating on the usefulness of the technology rather than on its ease of use; the decision making processes by healthcare professionals in this regard was independent of the opinions or suggestions of others.

Rosensenthal et al. (2003) identified the use of wireless technology for monitoring patients, and argued that it would not only solve the staff shortage problems but would also enable more-effective and efficient services.

Littlejohns et al. (2003) reported that major reasons for the failure of computerized health information systems were inadequate infrastructure, functionality and system implementation. They used qualitative and quantitative methods to establish that the reasons for failure were similar to those in computer projects, and recommended that evaluations of the hospital information systems be multidimensional, covering various aspects beyond just technical functionality.

Newbold et al. (2003) reported that wireless technology would not only improve patient safety by reducing medication errors, but would also help to provide better service and care for patients. Nurses and physicians would have access to data about interdisciplinary consultations, electronic orders and diagnostic test results, patient histories, progress notes, assessments, nursing and medical reference databases, protocols, prescription generation and insurance information, whenever and wherever it was needed. They also identified several factors and issues that management should consider seriously before implementing a wireless system. These included security, device selection, communication services, applications and user interface.

Tsekouras and Grantham (2003) studied mobile technology, and stated that it had the potential to improve quality of patient care, where information and communication technologies had failed in recent years. They identified utilization of wireless technology in healthcare in the area of improved efficiency of procedures and processes, increased effectiveness of medication, improved logistics for patients, and support for independent living by the elderly.

Steve and Wickramasinghe (2003) identified factors that would provide an environment where adoption of the m-commerce[4] or wireless solutions would be ideal in healthcare; these included leading edge technology, better cures, early

4 M-COMMERCE, refers to mobile commerce and defined as the use of wireless devices to conduct both business to business and business to consumer transactions over the internet

detection, better practice management, escalating costs, regulations and accountability, and effective and efficient practice management. The major challenges for healthcare management were identified as escalating costs, an informed and empowered consumer, e-health adaptability and prevention of diseases. The solution to these lies in the adoption and use of information systems and information technology in healthcare management. These authors believed that the healthcare organization of tomorrow must consider a wireless delivery platform as a strategic necessity if it is to survive and thrive in this challenging environment. On this basis they proposed a mobile e-health model to accelerate healthcare delivery improvements, and suggested that this would help to improve patient care, reduce transition costs, increase healthcare quality, and enhance teaching and research.

Chau and Turner (2004) studied the implementation and evaluation of wireless devices in Tasmania at an aged care facility. They used a qualitative interview technique to analyze the efficiency and effectiveness of services provided in the healthcare setting. They observed that social-technical aspects of using handheld devices were positive, and not only helped professionals to enhance the quality of care, but also improved the overall quality at an operational level. It was also reported that computer literacy and size of the PDA were of no concern among the end-users, as most of them were quite comfortable with them after a few weeks.

Yu and Comensoli (2004) conducted an exploratory literature review and, using structured and unstructured interviews, found that there were barriers at individual and organizational levels, especially management and cultural factors, to the adoption of IT in the Australian aged care sector. Further, they identified six major factors as barriers: (1) lack of management/ stakeholder support, (2) cultural resistance to IT adoption, (3) cost considerations, (4) staffing issues, (5) work practices and (6) the capacity to manage change. They also highlighted the need for effective IM/IT strategies and procedures essential to increasing efficiency and effectiveness of wireless technology.

Smith et al. (2004) believed that, irrespective of the type of computer technology employed in a healthcare environment, healthcare agencies must have common goals. These goals are (a) maximizing the clinician's time in clinical care, (b) user friendliness, (c) increasing patient safety, (d) producing positive outcomes and (e) meeting the goals of the organization's strategic and business plans. They also suggested a matrix that would help in evaluating the variables of each proposal regarding Health Care Technologies (HCT) to make intelligent decisions, and argued that nursing administrators should have a direct role in the selection, implementation and analysis of outcomes of HCT. Five criteria identified by them were (a) to improve patient safety, (b) to support the delivery of effective patient care, (c) to facilitate the management of chronic conditions, (d) to improve efficiency and (e) to evaluate the feasibility of implementation.

Vouri et al. (2004), identified a conceptual framework for the security and privacy requirements of wireless technology. They categorized this in two dimensions: security related to transmission of information between two points, and security related to the access to information. They argued that security of transmission of information is a well researched area and well established standards have already emerged. The security related to access of information is an under-researched area. Their conceptual framework suggested a multilevel approach in this regard, and divided the information into three categories: public access information, confidential information and sensitive information. Further, they suggested that each category of information could be subdivided into multilevel access by utilizing a combination of hardware and software technologies.

2.4.1 Technology acceptance in healthcare context

In healthcare literature, the discussion on wireless technology falls into three periods. Studies prior to and including 2000 discussed the status of wireless technology and the possible role the technology can play in healthcare. Studies between 2000 and 2003 discussed how wireless technology can be deployed in healthcare and the potential benefits the technology can bring to healthcare. (It should be noted that these studies were only 'discussion' studies, most of which provided no empirical evidence about the use or acceptance of wireless technology in healthcare domains.) Studies from 2004 to the present have collected data to establish the usefulness of wireless technology in healthcare. These studies have, to some extent, focused on the

PDAs, as these devices have been found to be useful in the nursing domain for clinical data management.

The studies between 2000 and 2003 examined a number of potential uses of wireless technology in clinical domains. Wisnicki (2002) discussed how broadband technology can be used in healthcare; Davis (2002) outlined the ability of wireless technology to address prevailing healthcare staff crises by adopting intelligent solutions that can identify needs, and match the needs with available resources in a timely and efficient manner; Wisnicki (2002) highlighted how better compliance with the rigorous regulatory framework was achievable; Turisco (2000) discussed how a reduction in medication errors should provide benefits that can be realised; Athey and Stern (2002) portrayed how the technology provided greater flexibility and mobility of healthcare workers in performing their work; and Stuart and Bawany (2001) discussed aspects of effective management of the increasingly complex information challenges and improved access to information from anywhere at any time. My review clearly identified that all these studies were only implying the potential of wireless technology and provided no empirical evidence.

While these studies agreed that wireless applications have the potential to address the endemic problems of healthcare, only limited information can be found about the determinants of such wireless applications for establishing the adoption of technology in a given healthcare context (Gururajan et al., 2005; Gururajan et al., 2004). During the period 2004–2006, studies emerged in the area of technology acceptance, specifically focusing on the acceptance of wireless technology in healthcare domains. These studies were empirical in nature and were testing the available models of technology acceptance, or a variation of it, in order to ascertain whether previous models hold good for a new technology in a specific domain. These studies were reported in 'E-Health Systems Diffusion and Use, The Innovation, the User and Use IT Model, a book complied by Spil and Schuring and published by IDEA group', (Spil & Schuring, 2006). Five of these studies are summarized below.

1. Predicting Internet Use: Applying the Extended Technology Acceptance Model to the Healthcare Environment (Chismar & Wiley-Patton, 2006) – This study

empirically established that only perceived usefulness is significant and ease of use was not significant.

2. The dynamics of IT adoption in a major change process in health delivery (Lapointe et al., 2006) – This study established that TAM, as devised by Davies et al. (1989), is not adequate for health systems because adoption/resistance factors may be group-related as opposed to the fundamental basis of TAM which is individualistic, and influenced by intra- and inter-organizational factors, linkages to cultures, environmental factors as well as the complexity of the environment.

3. Introducing electronic patient records to hospitals: Innovation adoption paths (Suomi, 2006) – This study found that relative advantage, strong network externalities available, and rich availability of information through different communication channels are key factors for innovation and adoption. It should be noted that these are not discussed in the TAM models.

4. User acceptance and diffusion of innovations summarized (Spil & Schuring, 2006) – This summary established that perceived usefulness is a predictor of technology acceptance in healthcare. Ease of use was not found to be significant.

5. Understanding physicians' use of online systems: an empirical assessment of an electronic disability evaluation system (Horan et al., 2006) – This study found that in order to diffuse technology in an organization, it is important to ascertain physicians' behaviour, their workflow practices and their perceptions about the value of specific information systems.

In essence, the recent studies appear to be indicating that the current models of technology acceptance or its derivatives are not suitable to predict the adoption factors of wireless technology in the healthcare environment. Strong support can also be derived from three specific studies that have tested TAM models in healthcare. The first study, conducted by Jayasuriya (1998), established that ease of use was not significant in a clinical domain. The second study, by Chau and Hu (2002), echoed similar sentiments. The third study, by Hu et al. (1999), reported similar findings. From these studies it is clear that a detailed empirical study is required for the development of a framework to identify the determinants for the adoption of wireless handheld technology in the healthcare setting.

Studies conducted by Howard et al. (2006) also established that ease of use was not significant while determining factors of adoption in a clinical domain in regard to wireless technology. Further, Ivers and Gururajan (2006) also found that there are other factors beyond the TAM models influencing the acceptance of technology.

Interviews conducted with Queensland nursing staff members by Gururajan, Moloney et al. (2005) revealed that clinical usefulness of wireless technology is far more significant than the ease-of-use factor as established in TAM. Another focus group discussion with the Western Australian senior health managers by Gururajan, Quaddus et al. (2005) also indicated that aspects of clinical usefulness such as integration of clinical data may be more significant than the ease-of-use factor. Howard et al. (2006) also identified that clinical usefulness is far more influencing than ease of use while determining factors of adoption of wireless technology in the Indian healthcare domain. It was also shown that most of the studies in the wireless and healthcare domain lack empirical evidence to justify the determinants for the adoption of wireless technology in the healthcare environment.

However, the recent findings that the ease-of-use factor was not showing strong significance in the healthcare domain for determining wireless technology adoption warrants explanation, as this is different from many other reported studies in the generic IS domain, where both attributes (ease of use and perceived usefulness) were reported to be reliable predictors.

The effect of technical and non-technical factors on the adoption of mobile devices was examined by Whang et al., (2004) through an internet survey. They identified usefulness, enjoyment and social influence as having positive effects, and personalization as having a negative effect on the adoption of mobile devices. Whang et al. (2004) also noted that factors associated with technical aspects such as capacity for Internet connection, sound, display, design, text messaging, and external appearance have positive effects on the adoption of mobile devices. They examined the technical factors by integrating them into an existing TAM model. Their research suggests that the scope of the existing TAM does not cover the technology attributes of mobile phones, and establishes that technological factors play an important role in the adoption of mobile phones.

The characteristics of mobile games and their use were studied by Sung-su and Jae-young (2003). The specific construct in their model was customer satisfaction, and this was tested in terms of the relationship between dependent (usage) and independent variables (quality of service, accessibility, device characteristics, quality of device, and customer satisfaction). They used an online survey technique on teenagers who had previous Internet knowledge to test the relationship. They asserted that quality of service and quality of device make a significant difference in enhancing customer satisfaction. Further, in addition to these factors, they found content and accessibility to be contributing towards enhanced customer satisfaction.

The technologies available to reduce and control the risk associated with the use of wireless technologies were studied by Whang et al., (2004). Their study focused on the processes of generating various financial reports in terms of reliability, security and integrity of computer systems. Due to the wireless nature and use of radio waves for transmission of data in a Wi-Fi[5] environment, Whang found that data are vulnerable to unauthorized use of services, wireless equivalent privacy, frame spoofing, denial of service, traffic analysis and disruption. They suggested improving management awareness and response to wireless networks, and identified features like confidentiality, authority integrity, and availability as contributing factors in reducing the risk.

Tarasewich, Nickerson and Warkentin (2002) studied the legal and contractual relationships between network providers, customers and third parties, and concluded that this is a complex process and becomes even more complex when international boundaries are involved with respect to wireless devices for business transactions.

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5 Wi-Fi is the trade name for a popular wireless technology used in home networks, mobile phones, video games and more.

Thus, in order to synthesize existing studies in the domain of wireless and healthcare, this review focused on studies that are either concentrated on specific outcomes, products, a particular service or associated objectives. It was found that the studies reviewed concentrated on a specific issue with limited validity and methodological depth. For example, the ability of wireless handheld devices to improve quality of care, better communication, data management and error reduction appear to be the focus of many studies reviewed. The studies appear to be lacking depth in terms of their analysis in establishing the determinants for the adoption of wireless handheld devices in a healthcare setting. In fact, only very limited information can be found on first or second order regression modelling employed in these studies. The studies appear to be predominantly expressing opinions, but without rigorous qualitative data analysis. Even the studies that employed quantitative methods appear to have ignored major validity and reliability issues (Bates & Gawande, 2003; Guadagno et al., 2004; McAlearney et al., 2004; Van Dinter, 2002).

2.5 Synthesis of literature

Prior studies indicate that wireless applications[6] using handheld devices can provide significant advantages such as cost reduction, reduction in data entry errors, and up-dating data access for healthcare professionals by providing solutions to some of the existing problems. Specific advantages to healthcare professionals include reduction in transcription errors arising from paper-based documents (Sausser, 2003), data collection at point-of-care (Simpson, 2003), reduction in the amount of paper work (Sparks et al., 2001), administering medications by having text-based alerts using these handheld devices (Dyer, 2003), remote monitoring of patients and connecting to other systems such as patient care (Yacano, 2002).

While earlier studies have highlighted the advantages of handheld applications, they have not yet ascertained factors that influence the adoption of such applications. The outcomes of this study would achieve this. Once the factors promoting adoption are

6 Wireless applications are also called: Mobile Software, Wireless Software, and Wireless Apps Software

ascertained, healthcare providers can enjoy the benefits of appropriate applications of this technology by providing solutions to the short-staffing crisis encountered (Davis, 2002), managing the increasingly complex information challenges (Yacano, 2002), complying with the rigorous regulatory framework (Wisnicki, 2002), reducing medication errors (Turisco, 2000), and generating affordable applications that allow for greater mobility (Athey & Stern, 2002). In addition to these, wireless applications would also provide benefits to healthcare practitioners due to their flexibility and mobility in better data management (Wisnicki, 2002), including complex patient data requirements (Davis, 2002), proper integration of data to existing systems (Craig & Julta, 2001), and improved access to data from anywhere at any time (Stuart & Bawany, 2001).

To understand the issues associated with using wireless applications, information technology studies were also reviewed. The review indicated that this area has not been fully researched. For example, Redman (2002) states that wireless technology is in its infancy, and warns of the potential pitfalls if IT providers rush to implement the technology. Shah 2001) warns of the slower speed of wireless networks compared with those of desktop computers, and highlights the potential problems that could be encountered in healthcare situations. The relatively high costs to initially set up these wireless networks is mentioned by Shroeder (1999). The lack of real-time connectivity due to the mobility of the device and the problems associated with such mobility are highlighted by Stevenson (2001). The size of the screen and hence the problems that may be encountered in displaying data due to screen size while capturing data is stressed by Toms (2000). The problems that may be encountered due to the lack of provision for high quality graphic display on wireless devices is highlighted by Atwal (2001). Bevan (2001) discusses the potential problems of capturing data using wireless devices due to the 'difficult to see on the display screen' of these wireless handheld devices. In addition to mentioning the problems that could be encountered while using wireless applications, these studies also indicate that the usage capabilities of these wireless applications are growing and hence these hardware related problems will disappear in a few years time.

What can be realized from this review is that most of the studies have focused on the 'hardware' or 'physical' component of wireless devices, as this appears to be a focal point of interest to many authors. Other studies refer to the 'implementation' or 'management' of these wireless technologies in healthcare organizations, as cost appears to be a determining factor in such implementations. Studies reviewed appear to have examined the 'usage' aspects of wireless applications on limited scale. While studies such as those by Davies et al. (1989) examine the 'technological acceptance in organizations and derive a model for such acceptance, the outcomes of such studies cannot be generalized for wireless applications as the technology is radically different from the traditional desktop technology. With desktop technology, users access data using wired and fixed devices. On the other hand, in wireless technology, the data come to the users via the handheld devices, and this new paradigm gives users a lot of mobility and hence access to data.

This variation requires further investigation in order to explain the reasons behind this variation specific to healthcare. Therefore, there is a need to identify attributes that assist in the adoption of wireless applications in the healthcare environment. This research argues that the initial validity of some of the technology acceptance models was predominantly established by testing the models with students as surrogates in a generic software application domain. This environment is very different from the healthcare environment, where skills are at different levels. Further, the healthcare environment is complex, sensitive and time-critical. These could be some of the reasons for TAM not performing as expected in healthcare settings.

In addition, in UTAUT (the recent variant of TAM) Venkatesh et al. (2003) reviewed eight prominent models of user acceptance and managed to create a unified view. The unified model comprised seven constructs. The first four – performance expectancy, effort expectancy, social influence and facilitating conditions – were theorized to be direct determinants. The last three – attitude towards technology, self efficacy and anxiety – were theorized to be indirect. All seven constructs were found to be significant determinants of technology usage. For example, in terms of attitude, Venkatesh et al. (2003) defined it as an individual's overall affective reaction to using a system. The model depicts four constructs relating to this determinant – attitude towards behaviour, intrinsic motivation, affect towards use and affect. Spil and Schuring (2006) verified that in three cases the relation between attitude and behavioural intention was significant. Therefore, this determinant cannot be indirect.

If there is significance between attitude and behaviour intention, then there is a direct relationship.

Therefore, there appears to be a basis to identify factors that contribute to the adoption of technologies in healthcare settings. Given that wireless technologies have started making in-roads in healthcare, the overarching purpose of the research is to identify the factors that influence the adoption of wireless technology in the Australian healthcare system. However, the initial review of available literature indicated that this area is under-researched. Collectively, these aspects clearly identified that there is a gap in the literature in the context of "determinants for the adoption of wireless technology in the healthcare domain". This study will be an investigation into the factors influencing adoption of wireless handheld technology in a healthcare environment. By doing so, the study will fill a gap in the literature and provide insights into those factors that need to be given priority for using wireless applications in a healthcare setting. It is also expected that the outcome of this study will enhance the data collection procedures in healthcare by nurses, realizing significant cost and time savings. The overarching aim of this study is to explore and identify the determinants of adoption of wireless applications in the Australian healthcare industry. This has prompted the formulation of the following research questions for this study.

Research question 1: What are the determinants for the use of wireless technology in the Australian healthcare environment?

Research question 2: What factors constitute a framework for the adoption of wireless technology in the Australian healthcare setting?

2.6 Conclusion

This chapter has provided a review of the existing literature in the domain of adoption in the context of healthcare and wireless technology. Prominent adoption models/theories have been indentified and analyzed with the view to utilizing their constructs for the adoption of wireless handheld devices in a healthcare setting. Finally, a comprehensive discussion has been provided to establish that there is clear scope for a detailed research study to identify the determinants for the adoption of wireless handheld devices in the healthcare domain. This has resulted in the formulation of two specific research questions for this study.

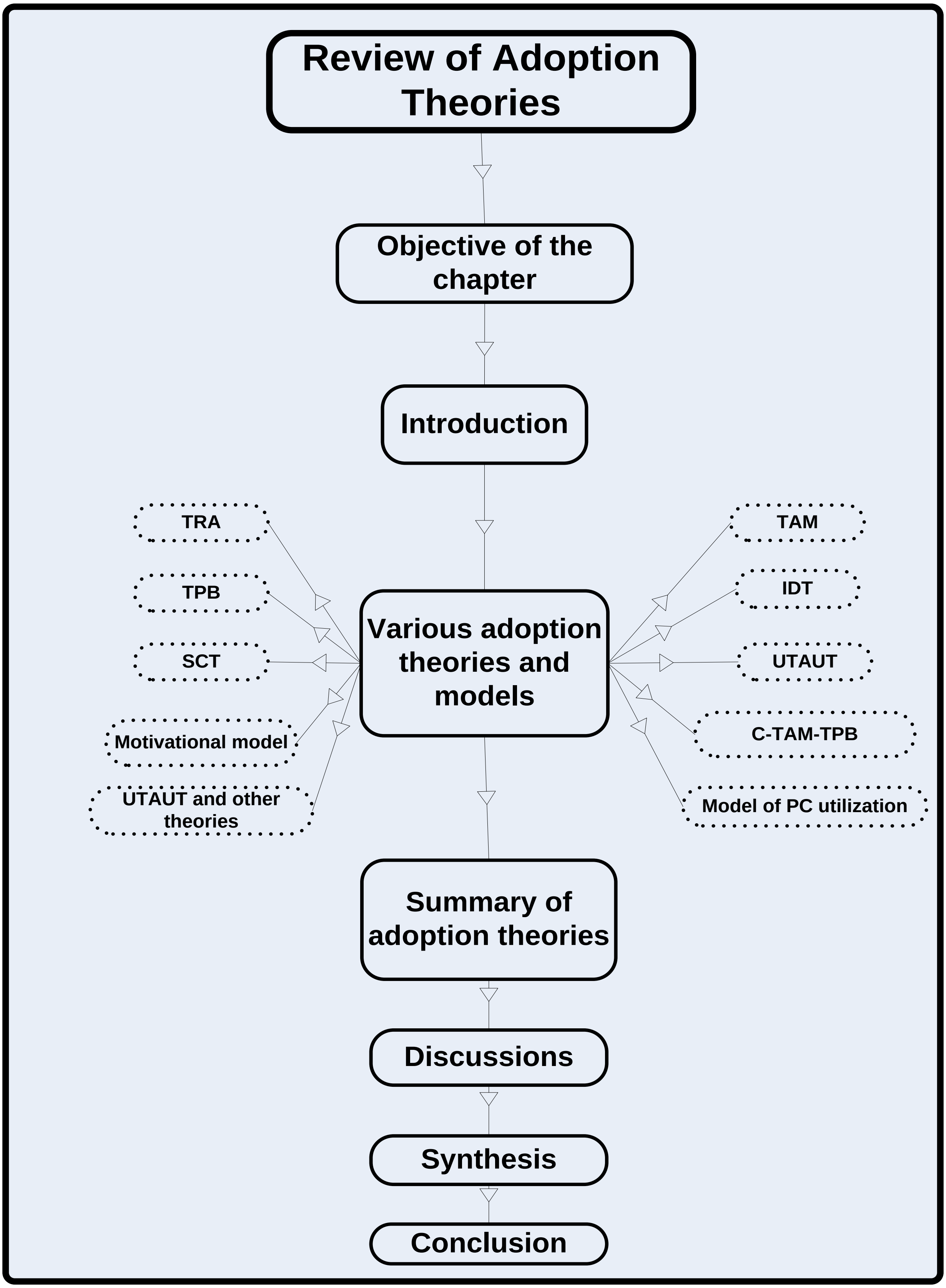
The next chapter will provide the preliminary framework for the adoption of wireless handheld devices in the healthcare setting (this framework will be refined further after each data collection stage as mentioned in the research methodology chapter).

Chapter 3 – Review of Adoption Theories

3.1 Chapter overview

The previous chapter provided an overview of the literature on research conducted in the domain of healthcare in the context of technology. Researchers in the domain of information systems demonstrated that the technological developments of the 21st century can help to address some of these challenges. For example, use of wireless handheld devices can help to improve the quality of care, reduce errors in healthcare data, reduce costs, improve workflow efficiencies, and improve quality of decision making (Chau, 2002; Chismar & Wiley-Patton, 2006; Gururajan, 2004; Hu et al., 2002). From the literature it could be inferred that research in the domain of healthcare and wireless technology is limited, and there is a need to understand the variables that influence the adoption and uses of wireless technology in a healthcare environment. In order to understand the applicability of these variables and their influences on this research study, various healthcare studies were summarised before the research questions for this study were formulated.

This chapter provides a detailed review of nine major adoption theories; namely, Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), Motivational Model (MM), Theory of Planned Behaviour (TPB), Combined TAM and TPB (C-TAM-TPB), Model of PC Utilization MPCU), Innovation Diffusion Theory (IDT), and Social Cognitive Theory (SCT). These nine theories help to explain the phenomena of user intentions and behaviour related to the adoption of a particular technology. These are discussed in the following sections.


Review of Adoption Theories
Objective of the chapter
Introduction
TRA
TPB
SCT
Motivational model
UTAUT and other theories
Various adoption theories and models
TAM
IDT
UTAUT
C-TAM-TPB
Model of PC utilization
Summary of adoption theories
Discussions
Synthesis
Conclusion

3.2 Introduction

Researchers in the domain of information systems have concentrated for the past 3-4 decades on explaining and understanding the phenomena of adoption behaviour. One of the common objectives among the theories is to explain and understand the usage and intention to use information technology. Each information technology theory has contributed to this domain and a critical analysis of the prominent theories will provide a sound understanding and background for developing a framework that could explain the adoption phenomena for wireless handheld devices in a healthcare setting.

3.3 Various adoption theories and models

The sections below provide a review and analysis of the nine main adoption theories and models in the domain of information systems.

3.3.1 Theory of Reasoned Action (TRA)

Ajzen and his colleagues developed a behavioural theory called Theory of Reasoned Action (TRA). This has been associated with the phenomena that individuals make rational decision and try to explain attitude behaviour relationships (Ajzen & Fishbein, 1975, 1980). This theory has been used widely in the business domain to explain the relationships between attitude and behaviour (Magee, 2002).

The theory of reasoned action (TRA) was derived from social psychology to explain intended behaviours (Ajzen & Fishbein 1980; Fishbein & Ajzen 1975). According to TRA, individual behaviour is determined by a person's behavioural intention (BI) to perform the behaviour, and BI is jointly determined by the individual's attitude (A) and subjective norms (SN) concerning the behaviour in question (Ajzen & Fishbein, 1980; Al-Gahtani & King, 1999; Leach et al., 2001). Figure 3.1 shows the basic TRA model.

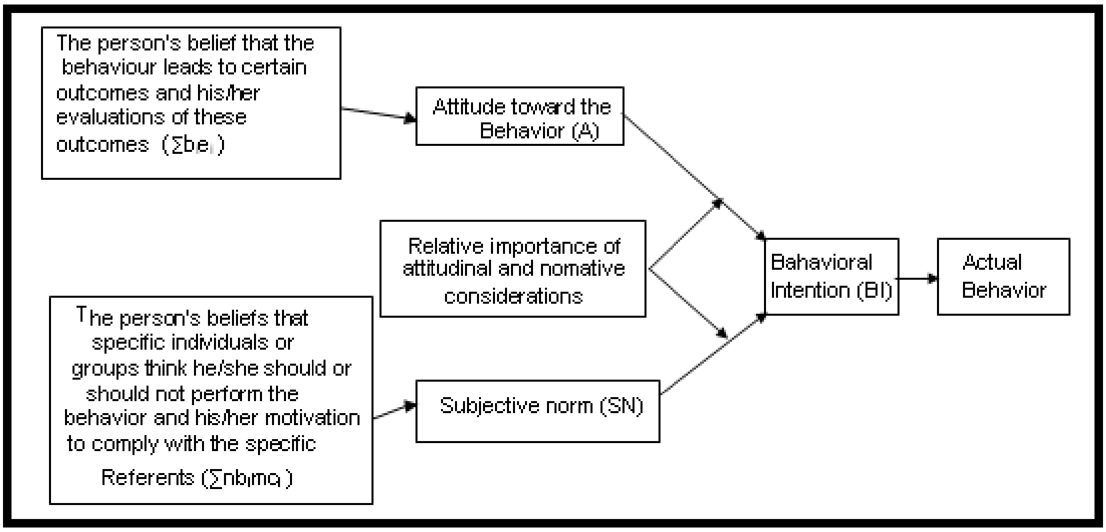


Figure 3.1: The Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980, adopted from Davis et al, 1989)

As can been seen from Figure 3.1, TRA has two determinants, *Attitude towards behaviour* and *Subjective norms* for the outcome *Behavioural intention*. Ajzen and Fishbein's (1980) theory (TRA) is an intention model which has been useful for explaining and predicting behaviour in many fields of study (Davis, Bagozzi & Warshaw, 1989). The use of TRA in terms of explaining human behaviour has also been commented on by Ajzen and Fishbein (1980). Therefore, this could be appropriate for modelling the adoption of PDA-based e-health solutions. The TRA has broad applicability in diverse disciplines and has gone through rigorous testing to establish its robustness in predicting intentions and behaviour (Bagozzi, 1981; Bagozzi, Baumgartner and Youjae, 1992; Davis, Bagozzi & Wdaarshaw, 1989; Manstead, Proffitt & Smart, 1983; Sheppard, Hartwick & Warshaw, 1988).

People consider the implications of their actions before they decide to engage or not to engage in a given behaviour. The TRA is built on the assumption that human beings are usually rational and make systematic use of information available to them (Ajzen & Fishbein, 1980).

The theory views a person's intention to perform (or not to perform) a behaviour (e.g. intention to adopt a PDA) as the immediate determinant of the actual action. Further, a person's beliefs or perceptions about the characteristics of the target system (e.g. PDAs) are antecedent to behavioural intent to adopt and use the system (Agarwal &

Prasad, 1997). Even though it is possible that intention can change with the passage of time, research has shown that these are good predictors of actual future use (Davis, Bagozzi & Warshaw, 1989).

Based on the theory of reasoned action, a person's intention is a function of two basic determinants, one “personal” in nature and the other reflecting “social influence”. The personal factor is the individual's positive or negative evaluation of performing the behaviour, which is called "attitude toward the behaviour" and refers to attitudinal factors. The second determinant of intention is the person's perception of the social pressure put on him/her to perform or not to perform the behaviour in question. This factor is termed "subjective norm" – which deals with perceived prescriptions, and relates to normative considerations (Ajzen & Fishbein 1980).

The relative weight of the two determinants of intention is the solution for the situation of conflict between attitude towards the behaviour and subjective norm. As a result, it is possible to predict and gain some understanding of a person's intention by measuring his/her attitude toward performing the behaviour, his/her subjective norm, and the relative weights.

In TRA, attitudes and subjective norms are a function of beliefs. A person's attitude toward behaviour is determined by his/her salient beliefs that performing the behaviour leads to certain outcomes and by his/her evaluations of those outcomes. In the same way, a person's subjective norms are determined by his/her beliefs that specific salient referents think that he/she should (or should not) perform a given behaviour and by his/her motivations to comply with those referents. In other words, the individual’s decision about adoption is influenced by the surrounding social systems. Attitudes towards behavioural and subjective norms are both considered to be a function of the weighted sum of the appropriate beliefs (Ajzen & Fishbein 1980).

TRA is a general model and does not accommodate the beliefs that are operative for a particular behaviour. TRA proposes that beliefs influence attitudes, which in turn lead to intentions and then to a particular behaviour. TRA is very general, particularly in its ability to explain much of human behaviour (Ajzen & Fishbein 1980) and therefore is appropriate to study the attributes of the behaviour of computer users (Davis et al., 1989a).

TRA was drawn from social psychology. It is one of the fundamental theories of human behaviour and has been used to predict behaviour in a broad range of dimensions. Davis originally applied TRA to individual acceptance of technology and found that the variance explained was largely consistent with studies that had employed TRA in the context of other behaviours (Venkatesh et al., 2003a). Researchers in the domain of information systems use this theory to understand the adoption of IT innovation (Han, 2003). TRA has been employed in education (Fedrick & Dossett, 1983), automation in manufacturing (Farhoomand et al., 1990), and in Internet banking (Tan & Teo, 2000).

TRA alone is not sufficient for understanding the determinants for the adoption of wireless handheld devices in a healthcare setting. In 1990, Azjen developed another theory, the “Theory of Planned Behaviour” (TPB) to address some of the limitations of the TRA theory (Ajzen, 1991b). This is discussed below.

3.3.2 Theory of Planned Behaviour (TPB)

The Theory of planned behaviour (TPB) is an extension of TRA. In this theory the construct of *Perceived behavioural control* was added to understand intention and behaviour. Perceived behavioural control was defined as perceived ease or difficulty of performing a particular behaviour (Ajzen, 1991b) and in relation to information systems, means perception of internal and external constraints on behaviour (Taylor & Todd, 1995a).

This theory was developed to overcome the criticisms on TRA (Ajzen, 1985, 1991b; Ajzen & Madden, 1986). Perceived behavioural control was considered as an additional determinant of intention and behaviour. TPB has been successfully applied to the understanding of individual acceptance and usage of many different technologies (Harrison et al. 1997; Mathieson 1991; Taylor & Todd 1995). The core constructs of TPB were *Attitude towards behaviour*, *Subjective norms* and *Perceived behavioural control* (Venkatesh et al., 2003a). This theory has been successful in explaining the adoption behaviour on an individual level. However, this theory provides only limited descriptions when the phenomena of adoption are analysed at an organizational level (Ajzen & Driver, 1992; Cheung et al., 1999; Madden et al., 1992; Randall & Gibson, 1991). The theoretical model of TPB is shown in Figure 3.2 below.

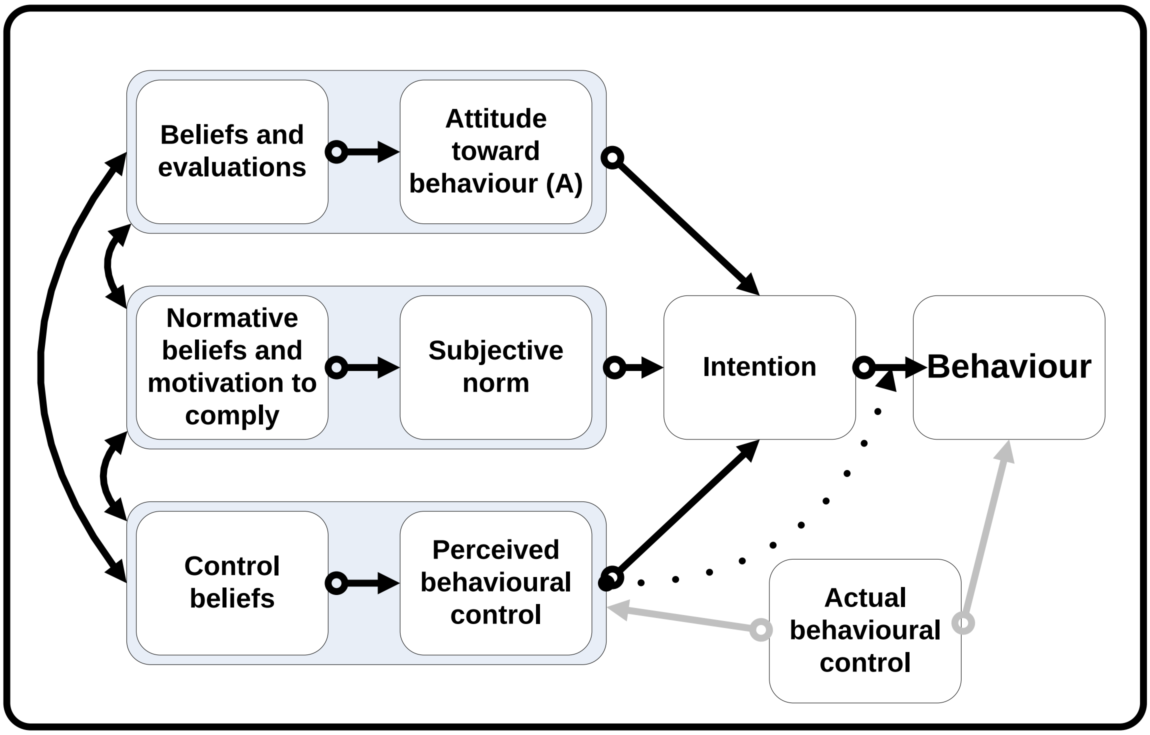


Figure 3.2: Theory of Planned Behaviour (TPB) adopted from Ajzen (2006)

Even though TPB contains an additional determinant, *Perceived behavioural control*, to accommodate deficiency control and resources for a particular behaviour, the behaviour can be deliberate and planned. TPB is considered to be generic as well (Chau & Hu, 2002) and both the theories (TRA and TPB) assume that individuals will use the information available logically with rational decision making. This assumption has been used to understand and explain behaviour across a wide range of domains, such as marketing and consumer behaviour (Berger, 1993), leisure behaviour (Ajzen & Driver, 1992) and waste paper recycling (Cheung et al., 1999). Even though there is evidence that this theory can be used to understand the adoption behaviour for new technologies, there is limited evidence that this can be used to understand the determinants for the adoption of wireless handheld devices in a healthcare environment (Taylor & Todd, 1995b).

3.3.3 Technology Acceptance Model (TAM)

TAM was introduced by Davis (1986) and is a derivative of TRA, which specifically concentrated on the user behaviour for the acceptance of information systems. The main objective of TAM is to provide clarification on user behaviours of acceptance of computer technology. TAM provides the basis for identifying the impacts of external factors on users' internal beliefs, attitudes and intentions. It is tailored to IS contexts. TAM was designed to predict IT/IS acceptance and usage on the job. TAM did not incorporate the attitude attribute to explain intention parsimoniously. Predominantly, TAM presumed that user attitude depends on two factors – *Perceived usefulness* (PU) and *Perceived ease-of-use* (PEOU) – which influence their usage and acceptance (Davis, 1989b; Davis et al., 1989b).

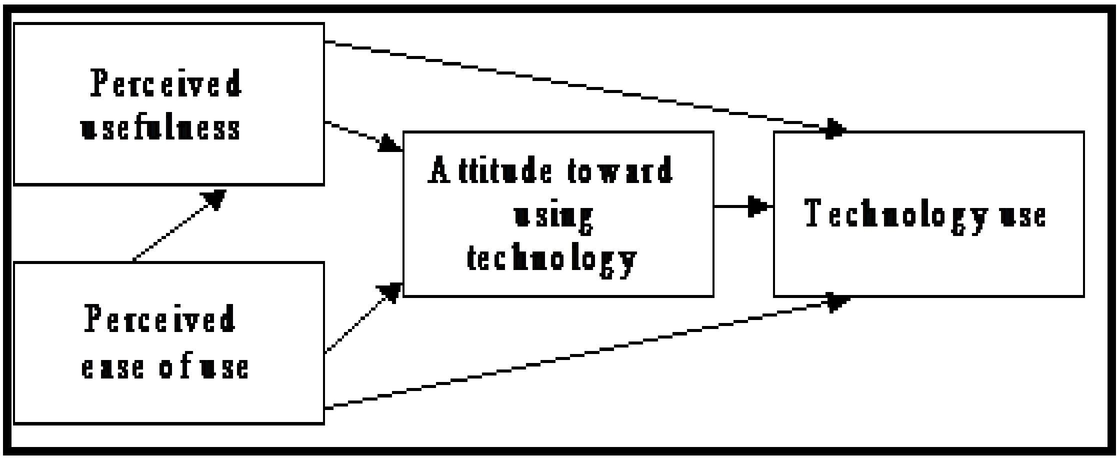


Figure 3.3: Technology Acceptance Model adopted from Dennis et al. (2003)

PU can be defined as the degree to which a person believes that using a technology will enhance their job performance"; PEOU is defined as "the degree to which person believes that using a particular system/technology will be free from effort" (Davis et al., 1989b); and attitude is determined by both PU and PEOU. One assumption in TAM is that using a technology is voluntary, and that intention to use is mediated by PU and PEOU (Davis, 1989b; Davis et al., 1989b; Venkatesh & Davis, 2000).

TAM has been widely researched in the domain of IS/IT and has been tested with a wide range of applications, voice-mail and word processors (Adams et al., 1992; Cain

& Todd, 1995), spreadsheets (Mathieson, 1991), CASE tools (Wynekoop et al., 1992), databases (Nilakanta & Scamell, 1990) and the Internet (Rai et al., 1998). Even though TAM has been widely researched and recognised as a tool to explain IS/IT acceptance, it has not been extended to incorporate the phenomena of changes required to promote greater acceptance (Venkatesh & Davis, 2000). TAM also ignored the phenomena of changes in user perceptions and intentions over time (Agarwal & Karahanna, 2000). Perceived usefulness and perceived ease of use were the original core constructs of TAM, and Subjective norm was included in the TAM2 (Venkatesh et al., 2003a). The TAM model is shown in Figure 3.4.

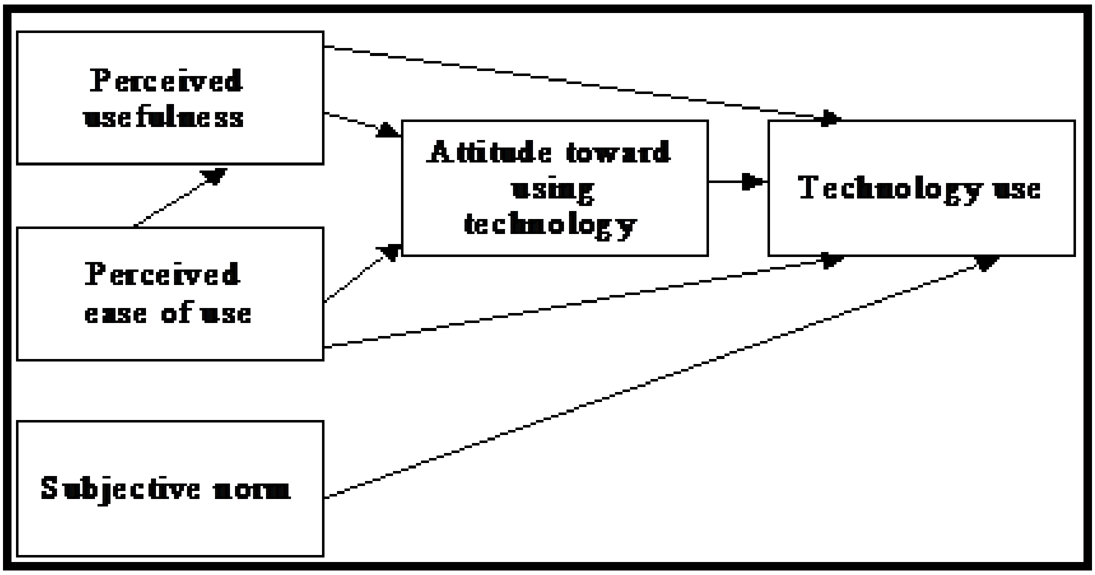


Figure 3.4: Technology Acceptance Model (adopted from Dennis et al., 2003)

Perceived usefulness means the subjective probability of users' perceptions that using a specific application system will increase the users' output within an organizational context. Perceived ease of use relates to the degree of user expectation that the system will be easy to use or error free. According to TAM, these two determinants are the primary determinants for the adoption of IT/IS, and these determinants can lead to understanding the attitudes about using a specific technology or systems; such attitudes become the base for actual usage behaviours.

TAM has received support from researchers through validation and applicability. Many researchers have found similar factors relating to usage and attitude (Davis et al., 1989a; Davis, 1989a; Hauser & Shugan, 1980; Larcker & Lessig, 1980; Swanson, 1974). However, researchers have also criticized the inability of TAM to explain user attitudes about specific systems and applications, and it has been suggested that there is a need to incorporate additional factors to increase its ability to explain determinants of adoption for specific IT/IS. Primarily, TAM concentrated on user acceptance and usage of IT. It did not incorporate the influences of contextual factors such as the healthcare environment, where healthcare professionals are trying to save lives under dynamic conditions.

Another theory which has attracted a lot of support from IS researchers for examining the adoption and usage behaviour for IT/IS is Rogers' (1983) Innovation Diffusion Theory.

3.3.4 Innovation Diffusion Theory (IDT)

Rogers' (1983) Innovation Diffusion Theory explains usage behaviour and intention by concentrating further on specific settings and external determinants which influence IT/IS adoption. IDT has been used since the early 1950s to describe the innovation and diffusion process, and evolved continually until the mid-nineties. This theory asserts that adoption is a process of information gathering and reducing the uncertainties (Rogers, 1995a). Gabriel Tarde adopted the S shaped curve to explain the concept of diffusion (Lunt, 2004). This is illustrated in Figure 3.5. An 'S' shaped curve is used by most researchers to explain innovation and adoption; their only major differences are in the slope of the curve, which represents the rate of adoption, or diffusion rate. For example, some ideas can be diffused relatively rapidly, so that the S-curve for such diffusion will be steep; with slow diffusion the innovation S-curve will be flatter. Most of the initial research with respect to diffusion was in the field of agricultural innovation (Rogers, 1983a). Rogers defines diffusion as a process by which an innovation is communicated through certain channels over time among the members of a social system (Rogers, 1983b).

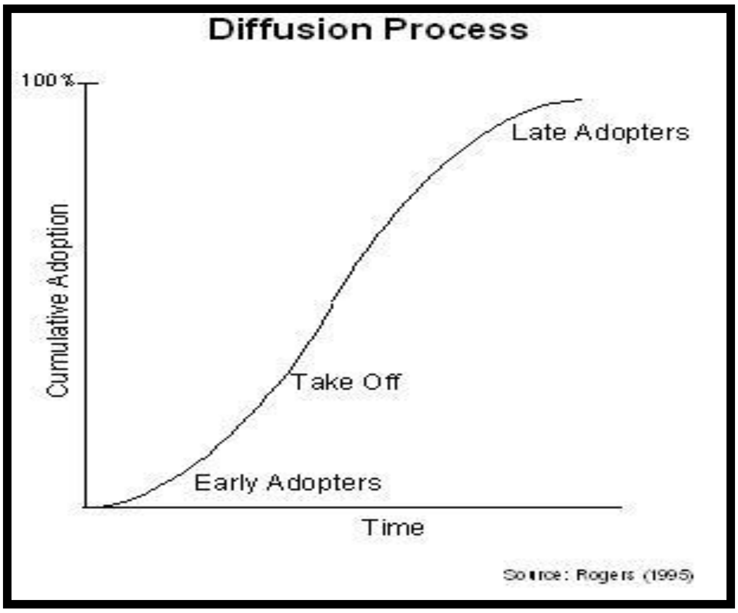


Figure 3.5: Roger's 'S' shaped diffusion curve

The innovation diffusion theory states that an individual will go through a set of stages to arrive at the decision to adopt or reject an innovation. The five stages of the IDT are as follows:

1. Exposure to innovation and acquirement of knowledge
2. Motivation and attitude towards innovation
3. Individual expectation from innovation and decision making
4. Actual use and implementation of innovation
5. Decision to adopt or reject, and perceived understanding about the innovation.

Rogers suggested that an individual perceives the innovation's attributes in terms of relative advantages, compatibility, complexity, trialability and observability with respect to motivational attitude towards a specific innovation (Rogers, 1995a). This theory also provides a theoretical background to explain the concept of innovation inertia. Innovation inertia can be described as an intermediate state in the diffusion process and this occurs when individuals develop a natural attitude towards the innovation regarding its acceptance or rejection. The stages in the IDT are shown in Figure 3.6.

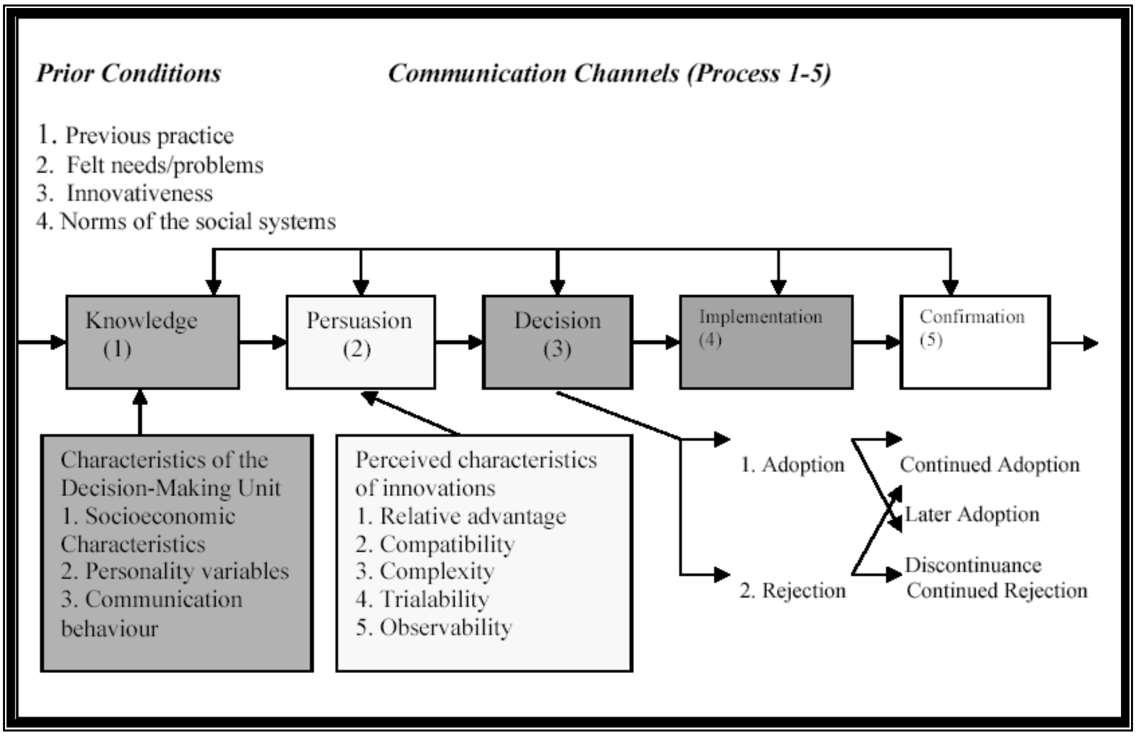


Figure 3.6: Stages in innovation diffusion theory (adopted from Rogers, 1995a)

The diffusion of innovation theory helps researchers to understand how barriers can hinder the successful implementation of IT/IS (Moseley, 2000). This theory tries to explain the diffusion of innovation process without specific reference to technological, organizational or social contexts (Mahajan & Peterson, 1985). The four basic elements that are involved in the process of diffusion of innovation are innovation itself, communication channels, time, and social system. Rogers' theory helps in the understanding of the rate of adoption and the stages through which individuals go before adopting the innovation (Rogers, 1983b, 1995a, 2003). Rogers identified five characteristics for the adoption process; these are *Awareness*, *Interest*, *Evaluation*, *Trialability* and *Adoption*. The main independent constructs are *Compatibility of technology*, *Complexity of technology*, *Relative advantage* (perceived need for technology) and the dependent construct, *Implementation success* or *Technology adoption* (Rogers, 1983b). Rogers' theory perceived that innovation is a process that is being communicated within a specific social system over time. Rogers believed that the process of adoption is spread over time at the rate of individual users' characteristics; generally, it is anticipated that the portion of the population adopting the innovation is roughly normally distributed over time. Rogers further divided this curve into five categories based on individual characteristics and innovativeness: *Innovators*, *Early adopters*, *Early majority*, *Late majority* and *Laggards* (Rogers, 1995a). The normal curve and these categories are shown in Figure 3.7.

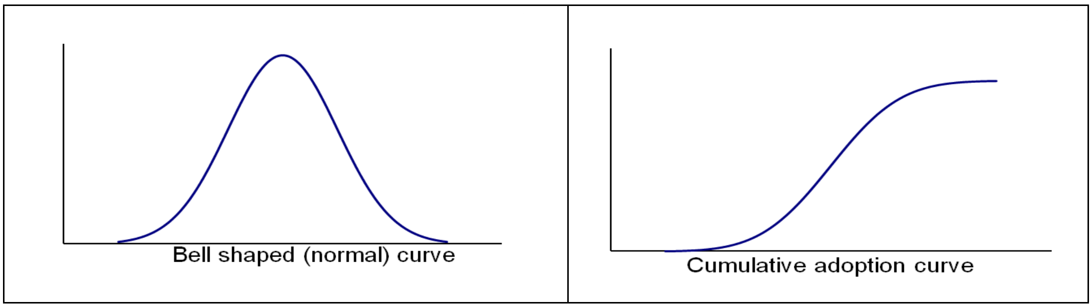


Figure 3.7: Roger's normal distribution. The normal curve (left) becomes an 's' curve (right) when cumulative adoption is used.

Rogers (1995a) also notes that a decision to adopt or reject a particular innovation can rely on the perceptions about the characteristics of the innovation itself. Characteristics about the innovation and their effects on acceptance or rejection have also been identified by other researchers (Davis et al., 1989b; Moore & Benbasat, 1991; Saga & Zmud, 1994).

Diffusion of innovation is not a streamlined stepwise process; rather, it is considered as unstructured and intervened by internal and external forces of the organization, and depends on the nature of the innovation (Baskerville & Pries-Heje, 2001; Van de Ven et al., 1989; Wejnert, 2002). (Rogers, 1983b, 1995a, 2003) identified some independent variables that are related to organizational innovativeness, individual (leader) characteristics, internal characteristics of organizational structure, and external characteristics of the organizations. Relationships among these independent variables and the dependent (organizational innovativeness) variable are shown in Figure 3.8.

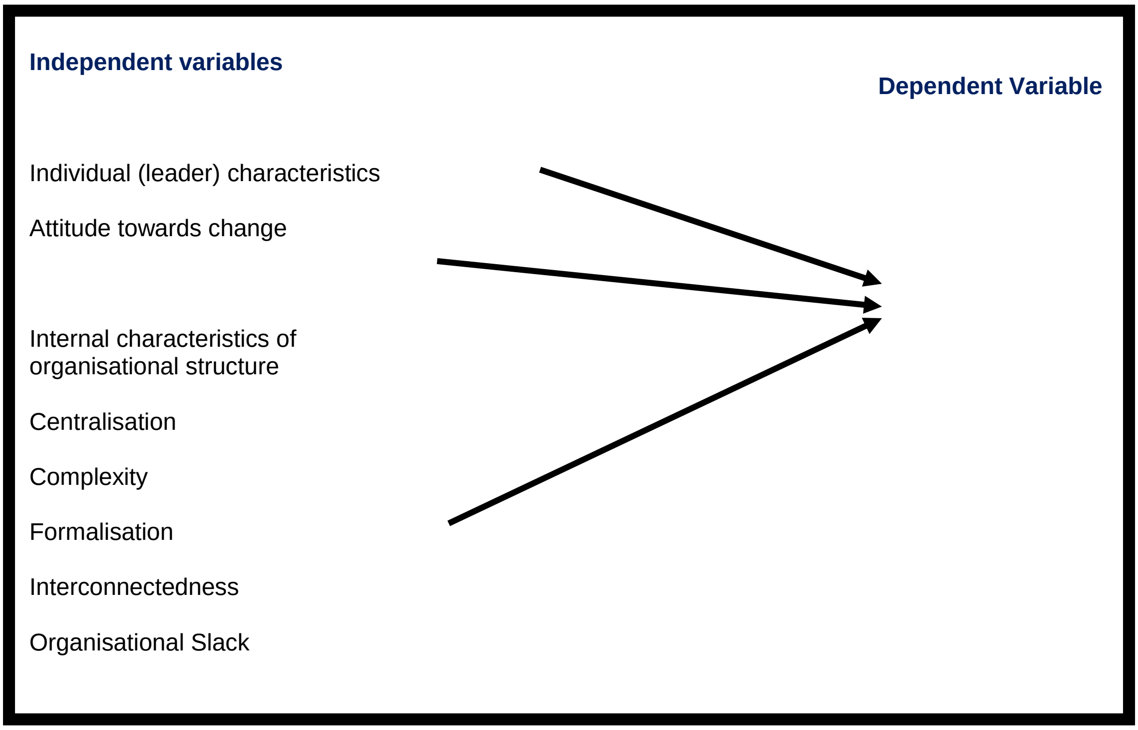


Figure 3.8: Independent variables related to organizational innovativeness (adopted from Rogers, 1983b, 2003)

Wejnert (2002) also mentioned that the adoption process is not uniform, and depends on factors such as the nature of the innovation, organizational environmental factors and the innovation itself. Griffiths et al. (1986) suggested that to enhance the probability of success for the adoption of an innovation, organizations must have certain features. Some of the characteristics highlighted by Wejnert are skill level, experience, management support, leadership, and general approach to risk.

3.3.5 Motivational Model (MM)

The Motivational model combines some of the previous findings and explains that perceived enjoyment, usefulness and social pressures could motivate the usage of microcomputers. Skills, also, play a crucial role (Igbaria et al., 1996).

This model for the effect of individual behaviour on acceptance and usage of information technology is based on the general motivational theories that explain this particular behaviour. The term *extrinsic motivation* refers to the perception that users are able to recognise valued outcomes, and so want to perform a particular activity. On the other hand, *intrinsic motivation* relates to users' perceptions of wanting to perform a particular activity. Researchers in the domain of psychology have held this view; for example, Vallerand (1997) supported the fundamental tenets of this theoretical base. In the information systems domain it has been used to understand the usage and adoption of information technology (Davis et al., 1992; Venkatesh, 1999; Venkatesh et al., 2003b).

3.3.6 Combined TAM and TPB (C-TAM-TPB)

TAM does not incorporate the effects of social and control factors on the behaviour of users' *intention* to use the technology; rather, it is established on the premise that these factors influence the *actual behaviour* of users in using IT (Ajzen, 1991b; Moore & Benbasat, 1991; Taylor & Todd, 1995a). Taylor and Todd (1995a) provided a hybrid model by combining the *Perceived usefulness* construct from TAM with the three constructs of TPB (*Attitude toward behaviour*, *Subjective norm*, and *Perceived behavioural control*). It was hypothesized that a user's prior experience of using a particular IT system would expose different strengths for Combined TAM and TPB (C-TAM/TPB) constructs. This theory helps to predict user behavioural intention. The model is shown in Figure 3.9.

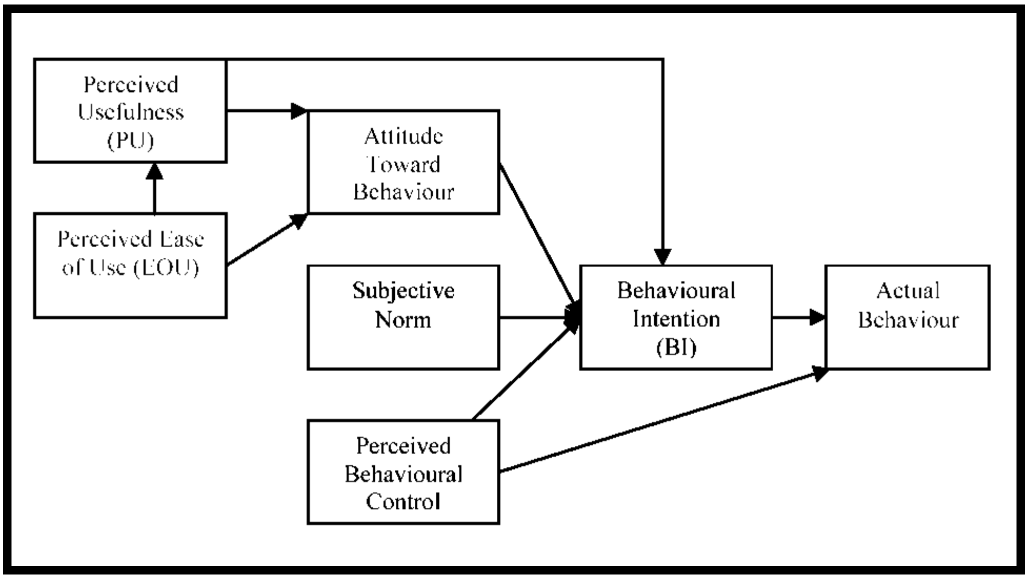


Figure 3.9: Combined TAM and TPB (C-TAM-TPB) (adopted from Taylor & Todd, 1995a)

3.3.7 Model of PC Utilization (MPCU)

This model helps to predict computer usage at an individual level, and explains individuals' behaviour in terms of their habits, social norms and perceived beliefs. It relates to individual characteristics such as genetic factors, personality, habits, attitudes, behavioural intentions and behaviour, all of which help to predict usage of computers. Individual environmental characteristics such as culture, social situation, social norms, facilitating conditions etc. also help to predict individual behaviour for computer usage (Moez et al., 2004; Triandis, 1980).

3.3.8 Social Cognitive Theory (SCT)

Social cognitive theory was introduced by Bandura in examining the social foundation of thoughts and actions (Bandura, 1986). This theory helps to understand the human behaviour stemming from social learning theory. According to SCT, human behaviour is defined as an interaction of personal factors, behaviour and environment (Bandura, 1977). This theory indicates that a person's behaviour is uniquely determined by personal, behavioural, and environmental factors, and that the environment influences the person's thoughts and actions. The dependent constructs are *Learning* and *Change in behaviour*, and the independent constructs are *Personal factors*, *Behaviour*, and *Environment*. Thus SCT theory is helpful in understanding and predicting behaviours for individuals as well as groups. It also helps to identify ways of changing or modifying behaviours. Initially, Bandura named his theory *Social learning*, but later altered it to *Social cognitive theory* to include cognition of particular behaviours. An outline of Social Cognitive Theory is shown in Figure 3.10.

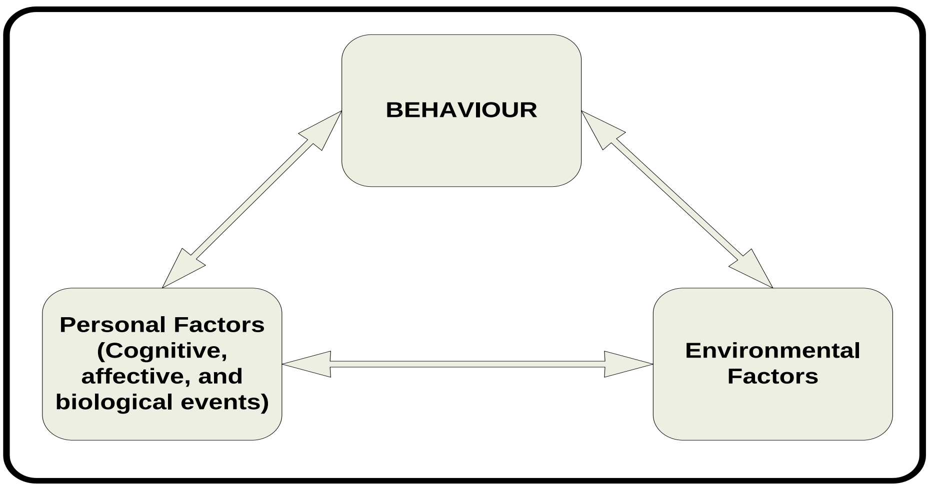


Figure 3.10: Outline of Social Cognitive Theory (adopted from Bandura, 1986)

This theory has been used to study morals and internalisations in children and how children are socialised to accept standards and values of society, whereas technology, especially wireless technology and the healthcare environment, are very different; here we are dealing with the interactions of adults, not children (Bandura, 1977; Bandura & Jourden, 1991; Johnston et al., 1994).

3.3.9 Unified Theory of Acceptance and Use of Technology (UTAUT)

Venkatesh et al. (2003a) reviewed the eight theories discussed in Sections 3.3.1 to 3.3.8 above, and suggested a unified model for adoption. This unified model yielded four core determinants: *Performance expectancy*, *Effort expectancy, Social influence* and *Facilitating conditions*. The authors hypothesized that these would play a significant role as direct determinants of user acceptance and user behaviour. Also indentified were four key moderating variables: *Experience*, *Voluntariness, Gender* and *Age*.

The unified approach leads to a better understanding of the drivers of acceptance of information technology. This in turn helps in the formulation of action plans to influence users who may be less inclined to adopt and use new technology. The unified model also provides insight into how determinants of intention and behaviour evolve; for instance, age does not play a prominent role in TAM, but in UTAUT age has a moderating relationship with all the major determinants of adoption (see Figure 3.11).

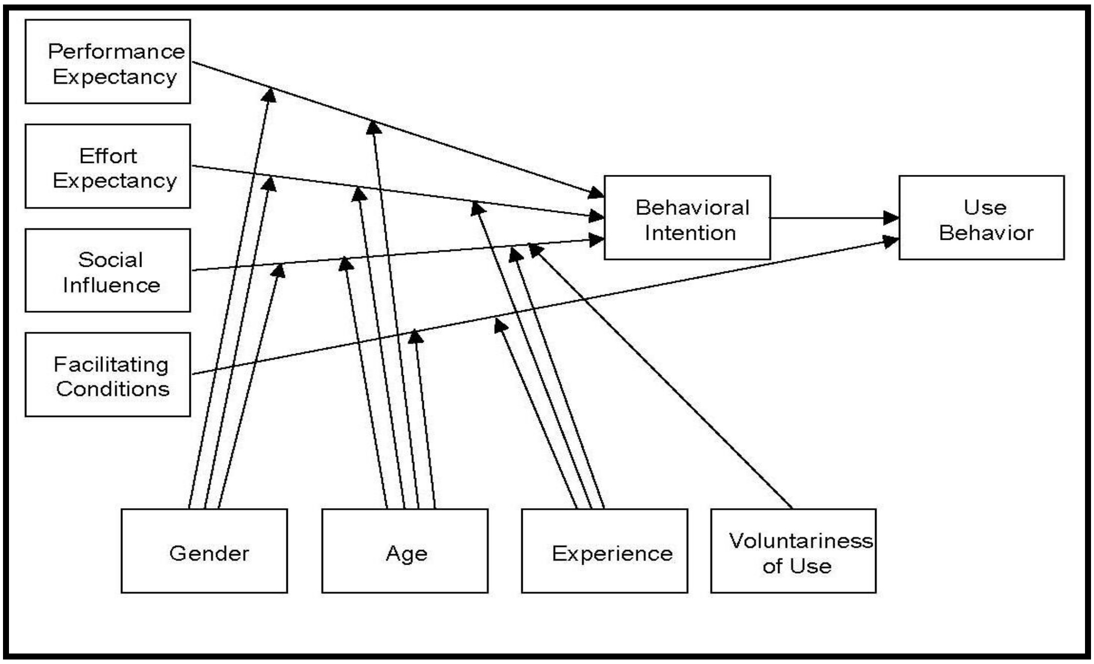


Figure 3.11: The unified approach (adopted from Venkatesh et al., 2003a)

The way in which the models and theories of individual acceptance are interrelated (as viewed by Venkatesh et al.) is shown in Table 3.1.

Table 3.1: Models and theories of individual acceptance (adopted from Venkatesh et al., 2003a)

Theory of Planned Behavior (TPB)	Core Constructs	Definitions
TPB extended TRA by adding the construct of perceived behavioral control. In TPB, perceived behavioral control is theorized to be an additional determinant of intention and behavior. Ajzen (1991) presented a review of several studies that successfully used TPB to predict intention and behavior in a wide variety of settings. TPB has been successfully applied to the understanding of individual acceptance and usage of many different technologies (Harrison et al. 1997; Mathieson 1991; Taylor and Todd 1995b). A related model is the Decomposed Theory of Planned Behavior (DTPB). In terms of predicting intention, DTPB is identical to TPB. In contrast to TPB but similar to TAM, DTPB "decomposes" attitude, subjective norm, and perceived behavioral control into its the underlying belief structure within technology adoption contexts.	Attitude Toward Behavior	Adapted from TRA.
	Subjective Norm	Adapted from TRA.
	Perceived Behavioral Control	"the perceived ease or difficulty of performing the behavior" (Ajzen 1991, p. 188). In the context of IS research, "perceptions of internal and external constraints on behavior" (Taylor and Todd 1995b, p. 149).
Combined TAM and TPB (C-TAM-TPB)		
This model combines the predictors of TPB with perceived usefulness from TAM to provide a hybrid model (Taylor and Todd 1995a).	Attitude Toward Behavior	Adapted from TRA/TPB.
	Subjective Norm	Adapted from TRA/TPB.
	Perceived Behavioral Control	Adapted from TRA/TPB.
	Perceived Usefulness	Adapted from TAM.
Model of PC Utilization (MPCU)	**Core Constructs**	**Definitions**
Derived largely from Triandis' (1977) theory of human behavior, this model presents a competing perspective to that proposed by TRA and TPB. Thompson et al. (1991) adapted and refined Triandis' model for IS contexts and used the model to predict PC utilization. However, the nature of the model makes it particularly suited to predict individual acceptance and use of a range of information technologies. Thompson et al. (1991) sought to predict usage behavior rather than intention; however, in keeping with the theory's roots, the current research will examine the effect of these determinants on intention. Also, such an examination is important to ensure a fair comparison of the different models.	Job-fit	"the extent to which an individual believes that using [a technology] can enhance the performance of his or her job" (Thompson et al. 1991, p. 129).
	Complexity	Based on Rogers and Shoemaker (1971), "the degree to which an innovation is perceived as relatively difficult to understand and use" (Thompson et al. 1991, p. 128).
	Long-term Consequences	"Outcomes that have a pay-off in the future" (Thompson et al. 1991, p. 129).
	Affect Towards Use	Based on Triandis, affect toward use is "feelings of joy, elation, or pleasure, or depression, disgust, displeasure, or hate associated by an individual with a particular act" (Thompson et al. 1991, p. 127).
	Social Factors	Derived from Triandis, social factors are "the individual's internalization of the reference group's subjective culture, and specific interpersonal agreements that the individual has made with others, in specific social situations" (Thompson et al. 1991, p. 126).
	Facilitating Conditions	Objective factors in the environment that observers agree make an act easy to accomplish. For example, returning items purchased online is facilitated when no fee is charged to return the item. In an IS context, "provision of support for users of PCs may be one type of facilitating condition that can influence system utilization" (Thompson et al. 1991, p. 129).

3.3.10 UTAUT and other theories

As mentioned above, acceptance of technology has been researched, and various competing theories and models have resulted, each with its own different set of determinants. According to Bagozzi et al. (1992b), the best model is the one which is the most parsimonious. However, Venkatesh et al. (2003b) argue that the best model could be the one that facilitates understanding of the adoption phenomena, while Taylor and Todd (1995b) believe the best model/theory to be the one that is parsimonious and facilitates understanding. According to Venkatesh and his colleagues, the most prominent eight models (TRA, TAM, MM, TPB, C-TAM, MPCU, IDT, and SCT) of adoption explained only between 17% and 53% of the variance in users' intention to use information technology. For the same data, it was found that the UTAUT model was able to explain 69% of the variance (Venkatesh et al., 2003b). Even though this model is better than the other main adoption models, it still needs further validation (Venkatesh et al., 2003b). The two main constructs of the UTAUT model, *Performance expectancy* (PE) and *Effort expectancy* (EE) are similar to the TAM constructs of PU and PEOU respectively. Li and Kishore (2006) studied the UTAUT model with undergraduate students who belonged to online community systems and found that key constructs of UTAUT have invariant true scores in some cases. Other studies have applied the UTAUT model successfully in explaining the acceptance of IS/IT at an organizational level (Carlsson et al., 2006; Cody-Allen & Kishore, 2006; Lubrin et al., 2006; Robinson, 2006).

Both TAM and UTAUT have been used in attempts to explain and describe adoption phenomena at the organizational level; however, the proposed research is concentrating on the adoption of wireless handheld devices in a healthcare environment at an individual level. Clearly, the healthcare setting is very different from that of the mobile device services described above (Carlsson et al., 2005, Carlsson et al., 2006). Further, Carlsson and his colleagues warned that the applicability of the UTAUT model was expressly related to the acceptance of mobile devices and services, and the model may not support all situations (Carlsson et al., 2006). Burley and colleagues also stated that UTAUT specifically concentrated on the organizational environment and would not be as useable as a diffusion of innovation model for the mobile devices in a healthcare environment (Burley et al., 2005).

3.3.11 Summary of adoption models/theories

Most of the theories and models of adoption can be summarised into three categories as *Characteristics-based, Intention-based,* and *Cognitive*.

1. A characteristics-based model is Rogers' IDT, which concentrates on the user's perceptions and the characteristics of the innovation itself; these affect the adoption/usage phenomena (Moore & Benbasat, 1991; Plouffe et al., 2001; Rogers, 1995a).

2. Intention-based theories are those like TAM and TPB, which demonstrate that adoption is a complex issue involving personal beliefs and attitudes towards the innovation (Davis, 1989b; Davis et al., 1989b; Venkatesh & Brown, 2001; Venkatesh & Davis, 1996, 2000)
3. Cognitive theories such as SCT relate to the social foundation of thoughts and actions (Compeau et al., 1999, Compeau & Higgins, 1991).

TRA, TPB, IDT and TAM are the major adoption theories studied in the domain of information systems. They share some similarities, and exhibit some differences. These theories demonstrate that beliefs lead to attitude and, as a result, lead to behavioural intentions and actual usage of IT/IS. For example, one of the major constructs of TAM is PU, and this is quite similar to the philosophy of relative advantage mentioned in IDT. The situation is not much different with PEU and *Complexity* in TAM and IDT respectively. In TRA and TAM, it is assumed that individuals are free from constraint and will act whenever they have an intention to do so. TPB assumes that user beliefs are specific to the context and environment. For example, the availability of resources and technical expertise can have an effect on the user's beliefs, attitudes and actual usage. In the context of wireless devices in a healthcare environment this could be crucial. Bagozzi et al. (1992, 1992a) found that variables such as age, time, environment and ability can influence individual behaviour of intention and actual usage.

There are other studies that have tested a range of theories as the theoretical basis for their research to explain the phenomena of adoption in different contexts; however, many of these have started by varying the original concepts (Adams et al., 1992; Igbaria et al., 1997; Liker & Sindi, 1997, Lin & Lu, 2000; Szajna, 1996; Tan & Teo, 2000). Even though these adoption theories have been used widely in the domain of information systems to understand and explore the phenomena of adopting IT/IS, there is little evidence in the literature on the use of these theories in the domain of wireless devices in a healthcare environment. Hence, IDT (Rogers, 1983b) and TPB (Ajzen, 1991b) would appear to provide a strong theoretical basis for the development of the framework for this study.

3.4 Discussion

Developments in ICT and the emergence of the concept of mobility, availability and accessibility of resources and information have generated substantial enthusiasm among practitioners and academics. The booming publicity and need for mobility, such as m-communication, m-commerce, and m-collaboration, have generated much speculation about the endless potential of wireless technology. Due to the lack of clear solutions and the evolving nature of wireless technology, manufacturers are producing devices based only on their understanding about what the user might value and desire. What is missing is a clear understanding of the motivations of prospective users, the circumstances in which the wireless devices may be used, and the processes of adoption of these devices. To achieve the full potential of wireless devices, it is critical that these technologies and their applications be widely acceptable. Consequently, there is a clear need to understand how and why users adopt such devices. There are well established theories and models to explain consumer adoption phenomena in general terms (Sarker & Wells, 2003). However, some models of adoption rely on a wide range of miscellaneous theories and try to explain the concept of adoption through a wider, generic view; thus they have focused only on the adoption of products and technology (Pagani, 2004). For example, innovation diffusion theory relies on individual perceptions about using an innovation and on adoption behaviour (Agarwal & Prasad, 1999; Moor & Banbasat, 1991; Rogers, 1995b). Other theoretical models try to explain adoption behaviour through user beliefs, attitudes, intentions and actual system use (Ajzen, 1991a; Davis et al., 1989a; Davis, 1989a; Pagani, 2004).

Studies in information systems have shown considerable interest in theories and models that predict variables to determine acceptance of computer systems. The successful use of any system depends on the acceptability of the system to its users. A developer’s ability to understand these factors and to address them as early as possible in the design and implementation process is crucial to ensuring acceptance. The process of understanding why people accept or reject a particular computer technology is becoming more popular in the field of information systems research. Various studies (DeSanctis 1983; Fuerst & Cheney 1982; Ginzberg 1981; Ives, Olson & Baroudi 1983; Lucas 1975; Robey 1979; Schultz & Slevin 1975; Srinivasan 1985;

Swanson 1974, 1987) have investigated the impact of user beliefs and attitudes and how these internal factors are influenced by external factors in order to understand acceptance. Intention models from social psychology, such as the theory of reasoned action (TRA) are well researched and have proven successful in describing user behaviour (Davis et al., 1989a).

In the last three decades, various studies have provided theoretical frameworks for research in the adoption and acceptance of information technology and information systems (Ajzen, 1985, 1991; Davis, 1989; Davis et al., 1989; Mathieson, 1991; Moore, 1987; Taylor & Todd, 1995). Among these, Davis's technology acceptance model (TAM) is considered to be the most vigorous model explaining adoption behaviour of IT/IS (Davis, 1989; Davis et al., 1989; Igbaria et al., 1995; Mathieson, 1991). TAM is specifically focused on explaining computer usage behaviour and uses. TRA, as a theoretical basis for specifying the causal linkages between *Perceived usefulness* and *Perceived ease of use*, produced determinants of user attitude, intention and actual adoption of technology. TAM's approach to identify behaviour is less general than TRA's.

The combined field of wireless and healthcare is relatively new and has largely been left unexplored with respect to adoption determinants. As mentioned previously, in most of the studies, the technology in question is relatively simple and the studies were conducted in desktop computing environments. Therefore, it can be argued that existing theories would not provide answers to the unique issues relating to wireless technology in the healthcare environment.

There is therefore a need for new research in order to gain a better understanding of the healthcare environment and users' characteristics with respect to the adoption of wireless technology. For the research undertaken and reported here, it was realised that it would be highly beneficial to develop a framework for the adoption of wireless technology in the healthcare environment. Such a framework would not only help to identify adoption factors in a sensitive environment but also provide the researcher with a road map for the implementation and use of such technology.

3.5 Synthesis

What can be realized from this review is that the majority of the studies have focused on the hardware or physical component of wireless devices, as this appears to be a focal point of interest to many authors now. Other studies refer to the implementation or management of these wireless technologies in healthcare organizations, as cost appears to be a determining factor in such implementations. Studies reviewed appear to have examined the usage aspects of wireless applications on limited scale. While studies such as Davies et al.'s (1989) examined "technology acceptance" in organizations and derived a model for such acceptance, the outcomes of such studies cannot be generalised for wireless applications as the technology is radically different from traditional desktop technology. With desktop technology, users access data by using wired and fixed devices; on the other hand, in a wireless technology setting, the data come to the users via hand-held devices, and this new paradigm gives users much greater mobility and hence access to data.

Therefore, this study was designed to investigate the factors underlying adoption of wireless applications. By doing so, the study aimed to fill in the gap in the literature and provide insights into those factors that need to be given priority while using wireless applications for data collection purposes. It was also expected that the outcome of the study would enhance the data collection procedures in healthcare by nurses, realising significant cost and time savings. The overreaching aim of the study was to explore and identify the internal and external drivers and inhibitors of adoption of wireless handheld devices in the healthcare industry.

3.6 Conclusion

This chapter provided a review of the existing adoption theories and models in the domain of information systems. Prominent adoption models/theories were indentified and analyzed with a view to utilizing their constructs for the adoption of wireless handheld devices in a healthcare setting. The next chapter will provide further analysis from the published literature in the context of healthcare and wireless technology.

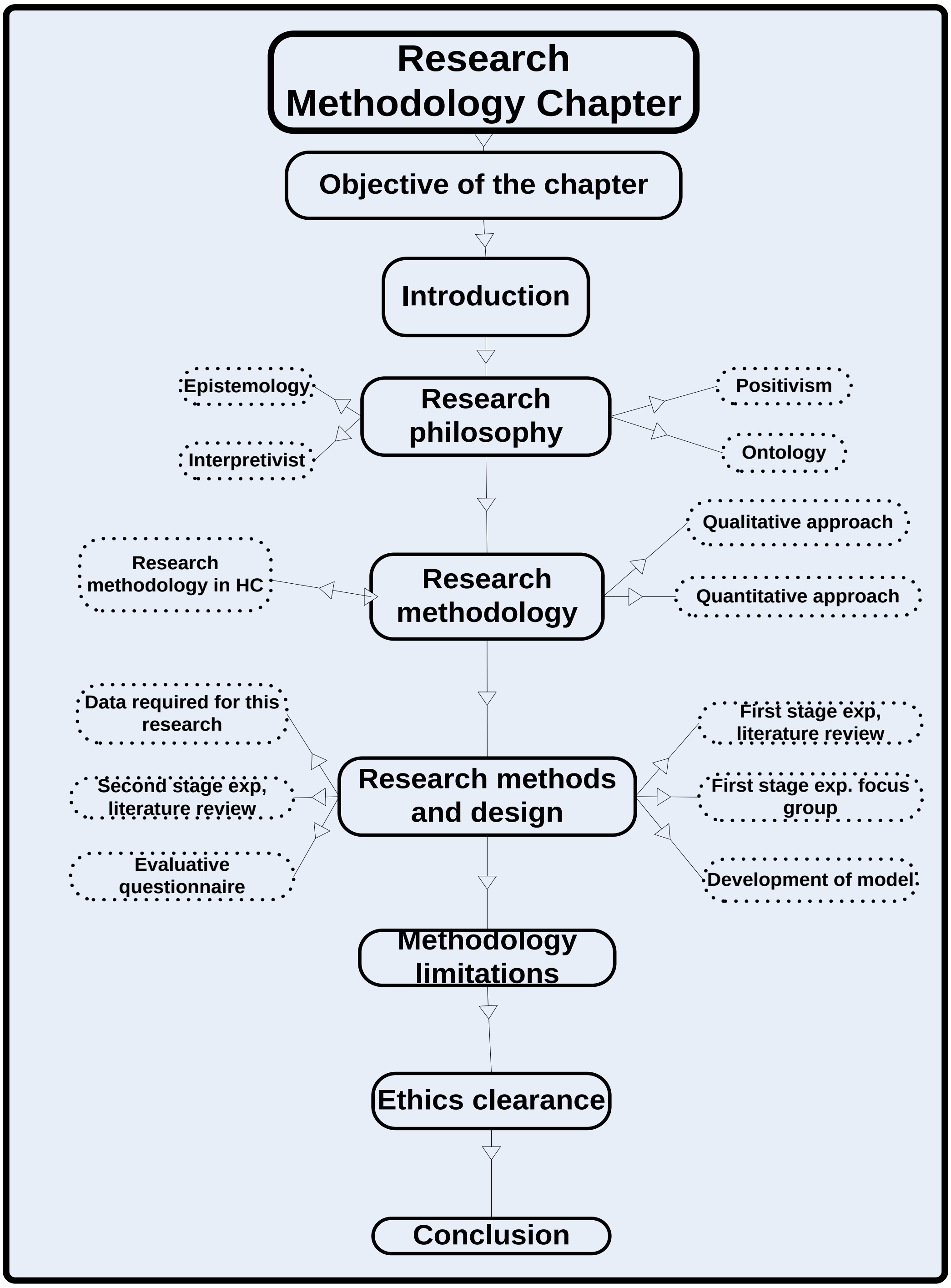
Chapter 4 - Research Methodology

4.1 Chapter overview

The previous chapter provided a comprehensive analysis of major theories and models used in the domain of adoption of technology specific to information systems. This chapter will deal with the theoretical foundation, the research framework, and hypotheses developed for this study. This chapter specifically explores the research methodology with reference to the various adoption theories discussed in the previous chapter in order to justify the appropriateness of the research methodology chosen for this study.

Further, this chapter develops an argument from the literature with a view to providing the justification for arriving at the theoretical background employed. On the bases of the theoretical background, an initial research model was developed for this study. This initial model was used in developing a set of hypotheses. The chapter concludes by describing the development of a set of measurement factors used to test these hypotheses. The research model suggested in this study is an extension of the existing models of adoption of technology with specific applicability to wireless handheld devices in the healthcare domain.

A brief layout of the structure of this chapter is shown below.


Research Methodology Chapter
Objective of the chapter
Introduction
Epistemology
Interpretivist
Research philosophy
Positivism
Ontology
Qualitative approach
Research methodology in HC
Research methodology
Quantitative approach
Data required for this research
Second stage exp, literature review
Evaluative questionnaire
Research methods and design
First stage exp, literature review
First stage exp. focus group
Development of model
Methodology limitations
Ethics clearance
Conclusion

4.2 Introduction

In Chapter 3 it was established that there are many well known adoption theories. The conceptual basis for this study is derived from these adoption theories. In Chapter 2, the Literature review, the major adoption theories and models were discussed; these were Innovation Diffusion Theory (IDT), Technology Acceptance Model 1 (TAM-1), Technology Acceptance Model 2 (TAM-2), Unified Theory of Acceptance and Use of Technology model (UTAUT), Theory of Reasoned Action (TRA), Theory of Planned Behaviour (TPB), the Combined Technology Acceptance Model and Theory of Planned Behaviour (C-TAM-TPB), and social cognitive Theory (SCT). The basic objective of this research study has been to identify the determinants for the adoption of wireless handheld devices for the Australian healthcare environment. While the existing theories are applicable to a 'wired[7]' environment, due to its very nature, the wireless environment is different and hence there is a need to validate the various constructs provided by the theories and models discussed in the previous chapter. This validation, then, will lead to the development of a framework for the adoption of wireless devices in a healthcare environment. Such a framework allows us to explain the acceptance and usage behaviour of the healthcare professionals towards the acceptance of wireless handheld devices. In essence, this chapter provides information on the theoretical bases on which this research is conducted and provides the initial framework for the adoption of wireless handheld devices in the Australian healthcare setting. As stated earlier, due to the relative newness of wireless technology, it is essential to validate the initial model. Such validation has been conducted with appropriate research methods so as to ensure the relevance of the framework to this study. This is explained in the following sections.

7 By "Wired" environment means, ICT technologies are not mobile and connected to hard wires.

4.3 Research philosophy

An appropriate research paradigm is an essential concept for any research study. Therefore, a research paradigm can be viewed as a world-view for understanding the complexities of the real world (Patton, 1990b), or assumptions relating to a world which is shared by a society of researchers exploring that world (Deshpande, 1983). A paradigm consists of both theories and methods (Cresswell, 1994). A basic concept of research provides the underlying view or process that would guide researchers in the choice of methodology, including ontology, epistemology, and positivism, which underline the research approach in this study (Cornford & Smithson, 1996; Falconer & Mackay, 1999; Guba & Lincoln, 1994). These three approaches, and a fourth, interpretivism, are explained below.

4.3.1 Ontology

Ontology is borrowed from the domain of philosophy and refers to realities of the real world, which make sense and can be verified. It can be representational, conceptualizing the domain of knowledge in the field of computer and information science (Poli, 2002). Here, a researcher tries to understand the research phenomena by removing the interpretive aspects of the research (Walsham, 1993). In the context of scientific theory it can be viewed as irreducible conceptual phenomena and the existence of reality in the area of research (Cao, 2003). Poli however, defines descriptive ontology as concerning "the collection of information about the many items making up the whole world or the specific domain under analysis" (Poli, 2002, p. 642).

4.3.2 Epistemology

Epistemology refers to the information or knowledge gained from the phenomena under research (Maykut & Morehouse, 1994). A positivist epistemology researcher at the first stage of an investigation tries to explore causal relationship through research questions and hypotheses, and then tries to formulate research and analysis strategies (Falconer & Mackay, 1999). On the other hand, non-positivists have a personal attitude towards research by actively getting involved in activities, and would rather gather information before committing to theoretical research strategies (Falconer & Mackay, 1999).

4.3.3 Positivism

This approach is modelled around the concept of natural sciences (Roth & Mehta, 2002). The positivist approach explores knowledge based on a systematic approach with the objective of exploring social laws (Angus, 1986; Marshall, 1994; Roth & Mehta, 2002). The paradigm of positivism can be defined as an external reality and requires theoretical propositions to be empirically tested to find out if such proposals are true (Chia, 1997; Manning, 1997). The first view from this approach demonstrates that reality is objective; the second view gained from this concept is that derived knowledge is valuable only if it depends on the external reality under consideration (Easterby-Smith, Thorpe & Lowe, 1991). In this particular paradigm, the researcher remains neutral and explores the cause–effect relationship and logically evolved from a possible causal law (Neuman, 1997) and tries to evaluate the causal inferences of social phenomena (Lin, 1998; Shankman, 1984).

4.3.4 Interpretivist

This approach makes no attempt to uncover objective truth; rather, it seeks to unravel patterns of subjective understanding. The interpretivist approach tries to explore the patterns of subjective understanding with the assumption that various levels of phenomena are due to the understanding and perceptions of the world. According to Roth and Meta (2002), an interpretivist view of phenomena helps in the understanding of social structures of communities, and the cultural understanding of people involved in the phenomena. Table 4.1 provides a comparison of positivist and interpretivist approaches.

Table 4.1: Comparison of positivist and interpretivist approaches

Positivism	**Interpretivism**
Causation—Seeks to understand the causal explanation for a phenomenon or event	Interpretation—Seeks to understand how people interpret a phenomenon or event
Objective reality—Presumes the "existence of facts"	Subjective reality—Recognizes the "construction of facts"; facts are seen as interpreted and subjective
Generality—Analysis seeks a "law" that extends beyond specific instances studied	Specificity—Analysis is context-specific and based only on the subjective understanding of individuals within a specific context.
Replicability—Analyses can be tested and verified empirically against other cases	Self-validation—Analyses can only be self-validating, through the consistency and coherence of "thick description"

Source: adopted from (Roth & Mehta, 2002)

To address the research question posed in the previous chapter, a choice needed to be made between the positivist and interpretivist paradigms (Crotty, 1998) to address the research questions posited in this study. The positivist paradigm relates to reductionism and determinism, and demonstrates that no scientific object is so abstract that it cannot be measured (Hesse, 1980). On the other hand, the interpretivist approach looks into the personal nature of social constructs which are identified and refined through the interactions of the researcher and the research topic; the objective is to explore personal and individual meaning of phenomena (Lincoln & Guba, 1985). The concept of the positivist paradigm guides the researcher into the use of precise definitions and research methods which are relevant to data collection and analysis (Gage, 1994). This approach was deemed to be appropriate for the research problem in this study, the purpose of which is to find the determinants for the adoption of wireless handheld devices in a healthcare environment. In other words, this research also sought to establish a causal relationship of determinants of adoption, to develop a framework for the adoption of wireless handheld devices in a healthcare environment. Consequently, the positivist paradigm was accepted as being suitable for this study.

Researchers in the field of social science — and specifically in the field of information systems — employ case studies, field studies, or field/laboratory studies. Case studies involve gathering information or data either from a single source or from a variety of sources; field studies help researchers to study cause-and-effect phenomena; and field/laboratory studies are extension field studies (Sekaran, 1992, 2000). This research found the field study approach to be suitable to explore the determinants for the adoption of wireless handheld technology in a healthcare setting. This approach was selected due to its ability to gather data/information from various uncontrolled environments (Sekaran, 1992, 2000). Field studies also help in the analysis of the relationships and effects between the dependent and independent variables (Ditsa, 2004). This approach also appears to be relevant to answer the research questions in this study.

The purpose of this research has been to identify the determinants for the adoption of wireless handheld technology in a healthcare setting. The research is exploratory in nature. The suitability of mixed methods for this study can be justified from two aspects. The first aspect is in understanding user preferences; the second in providing suitable statistical evidence. The mixed-method approach has the ability to provide richness and high validity to the outcomes. Mingers (2001) observed that the mixed-method approach provides increased richness, validity, and ability to extract information from complex situations (Mingers, 2001a). Therefore, the mixed-method approach not only extracts the benefits of qualitative and quantitative research methodologies, it also guides and improves the information gathered from the wider healthcare community.

In an environment where investigation is carried out on the use of technology in a human context, prior studies have recommended a mixed-method methodology, as this will provide a stronger basis for the validity of the outcome of the study. Prior research also indicates that human social and psychological factors should be studied through qualitative methods (Remenyi, Williams, Money & Swartz, 1998a). For example, Morgan, (1997) mentions that the use of focus groups in social science research can be a self-contained method, used as a supplementary source of data, or used in multi-method studies (Morgan, 1997a). While many techniques are available to capture perceptions and attitudes of usage of wireless applications, this study found it suitable to employ a focus group and a survey technique (Zikmund, 1994) as previous studies have used this approach for similar exercises (Morgan, 1997a). In this study it was decided to employ a focus group approach, as this would elicit open-ended responses to obtain factors that are not constrained by a pre-determined identification of constructs found in traditional surveys, as well as to determine the importance of the pre-determined factors.

4.4 Research methodology

For wireless technology, the healthcare environment is relatively new, and very different in nature compared with the commercial environment. Therefore, in order to understand the true adoption factors — both drivers and inhibitors — of wireless technology, it is imperative to study the social and cultural contexts of the healthcare environment. Thus it was felt that a combination of qualitative and quantitative techniques would be essential to identify the determinants of adoption. It should be noted that, in this study, qualitative and quantitative research techniques were not competing with each other; rather, they complemented each other. Cooper and Schindler (1998) mention that mixed-method methodology helps to identify the high quality of research findings; it could also provide an opportunity to identify variables accurately and through a variety of analyses as well (Cooper & Schindler, 1998). This advice has been followed in this study to:

- Gain insight into the healthcare environment and research question;
- Understand the role and specific characteristics of the healthcare environment; and
- Identify and enhanced the adoption framework.

Due to the exploratory nature of this study, an appropriate research methodology has been critical to understanding the determinants for the adoption of wireless handheld devices in the given healthcare environment. Factors and variables included in the theoretical framework developed in this study were drawn from the widely accepted theories of DOI (Rogers, 1995), the TRA (Ajzen & Fishbein, 1975), the TPB (Ajzen, 1991), the TAM (Davis et al., 1989; Davis, 1989) and other factors associated with the healthcare domain mentioned in the previous studies (De Groote & Doranski, 2004; Gururajan & Vuori, 2003; Lee, 2004; Lu, Kyung Lee, Xiao, Sears, Jacko & Charters, 2003; Lu, Xiao, Sears & Jacko, 2005; McAlearney, Schweikhart & Medow, 2004). A detailed discussion on these theories and models was provided in Chapter 3: *Review of adoption theories*.

Even though adoption of technology has been well researched, adoption of wireless handheld devices in a healthcare environment is poorly represented in the literature. In particular, there is limited knowledge available on the adoption theories specific to wireless handheld devices in healthcare environments. There are some studies (Chismar & Wiley-Patton, 2006; Lapointe, Lamothe & Fortin, 2006; Spil, 2006) which highlight the shortcomings or inabilities of these adoption models and theories, and their applicability in healthcare environments for introducing wireless handheld devices. However, studies in the domain of information systems can be extended to explain the adoption of wireless handheld devices in the healthcare context (Horan, Tulu & Hilton, 2006; Jayasuriya, 1998; Gururajan, Hafeez-Baig & Kerr, 2007).

According to Kerlinger, (1986), research design can be explained as a means of defining a plan and structure for answering a research question. Patton (1990a) sees the research framework as a way of dealing with the complexities of the real world. Strategies related to research methodologies are adopted to find answers to a specific research question accurately, reliably, and economically to identify the empirical evidence on the research question (Kerlinger, 1986). This research area is relatively new, and an appropriate research methodology is critical to address the research question. Therefore, it is important to understand the process that is needed to extract information about perception, beliefs and views about the adoption of wireless handheld devices in a healthcare setting. One of the ways to get this information is directly, from the users of wireless handheld devices in a healthcare environment, to ensure the depth and richness of information. The mixed-method approach was considered appropriate for this study to help identify the themes, beliefs, perceptions, opinions, and views about using wireless handheld devices in the healthcare setting. For example, the focus group technique can identify and explore the preliminary themes and initial list of drivers and inhibitors that influence the adoption of such technologies. Through this technique, identified themes have helped to develop a survey instrument and so address the research question formulated for this study.

Research methods in any study can be subdivided into various components. For simplicity, the research methodology in this study has been divided into two main streams: qualitative and quantitative. Both will be explored below. The first stream, qualitative research, emphasizes process and meaning, and involves non-numerical interpretation of data and observations, with the objective of identifying themes, patterns and relationships. Qualitative methods have been developed in the IS domain to study social and cultural aspects of research. Some of the well established techniques in this domain are focus groups, personal interviews, case studies, ethnography, and observations. The second stream, quantitative research, deals with the manipulation of the numerical data gathered with the objective to explore or explain the phenomena reflected in the numerical observations. Quantitative research methods include survey methods, and mathematical modelling. Quantitative research techniques help to describe and explain the phenomena under research through the analysis of variables, relationships and correlations (Bryman, 2004; Neuman, 2003).

4.4.1 Qualitative approach

Qualitative research provides insights and understanding of the population. It involves the use of qualitative data gathering approaches such as interviews, observations, focus groups and documentations. It also concentrates on the process of analysing phenomena which are hard to measure rigorously from quantitative data collection approaches (Casebeer & Verhoef, 1997). According to Malhotra et al. (1996) qualitative research can be exploratory in nature and has the ability to provide insights and understanding of the research issues (Malhotra, Hall, Shaw & Crisp, 1996). A basic objective of the qualitative approach is to explain the social phenomena, and the approach has been used across various disciplines to explore technological, management and organizational issues (Zikmund, 1997). As mentioned earlier, adoption of wireless handheld devices in a healthcare environment is a relatively new research area. Therefore, it is important to understand the behaviour of users and the characteristics of the environment prior to developing a quantitative instrument to collect the views and opinions of the wider community. Such understanding is critical for the result to be useful and valid.

4.4.2 Quantitative approach

Quantitative research is viewed as being objective (McMurray, Pace & Scott, 2004). Variables and relationships among the variables are central to quantitative data analysis and to provide evidence for accepting or rejecting hypotheses (Neuman, 2003). Quantitative research aims to generalize the characteristics of the population. Quantitative techniques concentrate on the measurement and the analysis of relationships between the variables, instead of concentrating on the process itself (Casebeer & Verhoef, 1997). The quantitative approach provides bases for empirical testing for validating or rejecting hypotheses (Anderson, 1983).

4.4.3 Research methodology and health domain

The literature provides only limited information about IS aspects relating to healthcare, especially wireless technology and its adoption. Even more scant are references to methodological issues associated with adoption aspects of wireless technology in this context, due to the relative newness of the field. Mingers, (2000), observed that in traditional IS studies, quantitative methodology is prominent (Mingers, 2001b). Mingers also criticized this bias and suggested that a mixed-method approach would be better than quantitative-only methods at yielding insights that helped answer research questions. Thus, it can be inferred that the ability to select appropriate methodology is critical in answering a research question. Further, it is equally critical for the selection of the right tools within these methods, as these tools help to implement the methodology.

Acceptance of technology is not a simple phenomenon, and studying the technology alone would not provide the required answers. It is important to understand the context in which the technology is being used, as well as user behaviours. The healthcare environment is unique, in that various processes associated with information flow are still evolving. In many instances these are not well documented. Thus, in order to understand IS aspects, first-hand experience is essential, and this can be achieved by talking to the individuals directly involved in the process. Therefore, to determine user behaviour and to identify the barriers and inhibitors for the adoption of wireless technology in a healthcare setting, it is important to ask questions about people's beliefs, perceptions, experiences, and anticipated benefits. This information is initially very important in this study, to build on and to answer the research questions. Thus, selection of a qualitative approach at this stage was seen as desirable to provide answers to the initial research questions posited (Howard et al., 2006).

In order to understand the views of the wider population, a survey technique can be adopted from the quantitative approach. This enables the researcher to validate the behavioural aspects of the study. Further, the quantitative stage can be derived from the qualitative approach. This will thus lead to the development of quantitative instruments that can be tested statistically. Therefore, the rationale behind the use of the mixed-method approach in this research study was that the determinants of the wireless technology in healthcare could best be identified after the exploration of the views and opinions of the healthcare professionals; only then would the survey instrument for the wider population be developed. The literature also provided evidence for such a research process (Cresswell, 2003; Morse, 2003; Patton, 2002). For instance, Morse (2003) mentioned that the mixed-method approach allows the research process to progress comprehensively and completely.

A number of researchers have used both qualitative and quantitative techniques for data collection as a combination in their research and evaluation studies (Patton, 2002). The use of a qualitative instrument as an exploratory approach and a quantitative instrument as a confirmatory approach has been found in several studies (Creswell, 2003a, Tashakkori & Teddlie, 1998b). Newman and Benz (1998) argue strongly that the two approaches can be mutually exclusive, and the use of both qualitative and quantitative approaches can be beneficial as the process is interactive and provides the opportunity to capture various points of view. Other studies in the information domain have used the mixed-method approach (Busch & Richards, 2002, Cohen & Levinthal, 1990, Cresswell, 2003b, 2004; Dias, 1998, Gupta & Govindarajan, 2000, Massey et al., 2002, McDermott & O'Dell, 2001, O'Dell & Grason, 1998, Richards, 2002, Russell et al., 2003, Simonin, 1999, Standing & Benson, 2000, Szulanski, 2003; Tashakkori & Teddlie, 1998a). For example, Roeswell & Tashakkore (1998) suggested that mixed-method methodology can be very beneficial for the investigation of complex research phenomena. Tashakkori and Teddlie (1998a) view the mixed-method methodology as having the strength of incorporating diversity of divergent point of views. The characteristics and the quality of qualitative and quantitative research methodology are summarized in Table 4.2.

Table 4.2: Characteristics of qualitative and quantitative research methodology (adapted from Bauer & Caskell, 2006)

Characteristics	**Qualitative approach**	**Quantitative approach**
Data	Texts	Numbers
Analysis	Interpretation	Statistics
Prototype	Depth interviewing	Opinion polling
Quality	Soft	Hard

In this research study, the two distinctive approaches of focus groups (qualitative technique) and survey approach (quantitative technique) were used. Each provided a particular focus that helped reveal the determinants of wireless devices in the healthcare domain. Focus group discussion sessions were chosen to provide rich data that would help identify the issues and determinants to be included in the survey instrument. In addition, this research philosophy has the ability to extract the benefits of both qualitative and quantitative approaches, as focus group findings complement the survey stage used for the wider community. For example, the focus group approach can be considered as a small-scale pilot study – an exploratory research technique designed to enhance the larger study: the quantitative survey that measured the views and opinions and of the wider professional healthcare community about the adoption of wireless handheld technology in healthcare environment.

4.5 Research method and design of this study

Research theory explains phenomena in the real world by putting the pieces together to explain the complex concepts of the real world; for example, explaining to the social science researcher what is appropriate, reasonable or legitimate. It can also be defined as explaining the roadmap to exploring the relationships among variables, and the methodology for conducting particular types of research (Guba & Lincoln, 1994; Patton, 1990a; Sarantakos, 2002). Sekaran (2002) and Babbie (2004) identified most of the research in the domain of social science as being exploratory, explanatory or descriptive. Exploratory research seeks to help the researcher understand the preliminary nature of phenomena, explanatory research identifies and studies the relationships among various aspects of phenomena, and descriptive research attempts to describe phenomena (Babbie, 2004; Sekarn, 2000).

Stewart and Shamdasani (1998) suggested the appropriateness of the focus group technique for qualitative data collection, especially when no, or minimal, prior knowledge is available on the topic. Krueger (1994), Morgan (1997b) and Stewart and Shamdasani (1990) have reported that focus group methodology has provided insights into attitudes, perceptions and opinions about a particular domain or the interests of the participants. To conduct investigations in this relatively new area of research, qualitative methodology is needed to develop an initial list of possible determinants, as perceived by healthcare professionals, for the use of wireless handheld technology in a healthcare setting. Byers and Wilcox (1991) discovered that focus groups were valuable tools in exploring existing but unknown beliefs, attitudes and views. According to Stewart, focus group techniques have the ability to extract very rich information from the participants' first-hand knowledge (Stewart & Shamdasani, 1990).

The quantitative phase of this research consisted of a questionnaire survey. According to Bagozzi (1996a), using questionnaires is, to some degree, more an art than a science. Seaman (1987) highlighted the importance of the survey approach. Because data can be gathered from a relatively natural setting, it provides an opportunity (a) to analyze the variables in the existing social milieu, (b) to gather views of a large population at reasonable cost, (c) to keep the anonymity of the respondents and (d) to administer the instrument at a reasonable level of effort (Seaman, 1987). Questionnaires are also used widely in research to make generalizations about public opinion (Cresswell, 1994, Remenyi et al., 1998b). Cavana, Delahaye and Sekaran (2001) believe that the survey approach through questionnaires is one of the most appropriate techniques to capture opinions on new services and to analyze relationships among various research variables. The questionnaire approach is also used effectively where the researcher is certain about the questions involved in the survey, and how to measure them (Sekaran, 2002; Zikmund, 1997).

The research reported here qualified, through these criteria, to be undertaken through the focus group discussions. The questionnaire itself was eventually developed from the published literature and from the findings of the focus groups that were employed.

4.5.1 Data required for this research

Due to the exploratory nature of this study, the primary data that were collected were qualitative in nature. These data were collected in five stages: Stage 1 was an exploratory literature review, Stage 2 involved exploratory focus group discussion sessions, Stage 3 was a second literature review, Stage 4 was an evaluative questionnaire and Stage 5 included the development and testing of the PDA adoption model. The analysis of this set of qualitative data then helped to identify determinants and other issues to be included in the survey instrument for the quantitative data gathering approach. Before finalizing the framework for the determinants for the adoption of wireless handheld technology, a confirmatory focus group was also conducted to capture the views of the healthcare professionals and to confirm the findings of the survey (Details about the focus groups can be found in the next chapter). The five stages are described below.

Stage.1, the exploratory literature review, involved a thorough review of peer-reviewed and scholarly publicly published reports and articles. This review identified the initial list of determinants for the adoption of wireless handheld devices in the healthcare domain. The findings of this stage of the study were used to help draft the initial list of questions for the focus group sessions. (See Chapter 2, the literature review chapter, for a detailed description of this stage.)

In Stage 2, a series of focus groups was conducted with healthcare professionals, healthcare academic researchers, and technical and administrative staff involved in a healthcare setting. One of the basic reasons for this stage was to obtain first-hand information about the views and opinions of these groups on the uses of wireless technology in a healthcare setting. The findings of this stage were incorporated in the development of an instrument to collect the views and opinions of the wider healthcare community. (See Chapter 5 *Qualitative data collection* for a detailed description of this stage.)

Stage 3 was a second exploratory literature review. This was required, as the healthcare and wireless combination is a relatively new area, and allowed the incorporation of new material. This particular phase of the study was combined with the findings of the focus groups to develop the survey instrument for the next stage of the research. (See Chapter 2 *Literature review* for a detailed description of this stage.)

Stage 4 was the use of an evaluative questionnaire. Analysis of the literature review and the findings of the focus groups had helped to refine the research question and research model, which were further investigated at this stage of data collection. Through the findings of the previous three stages, a survey questionnaire was developed, and healthcare professionals were approached to generalize the views and opinions of the wider community for the use of wireless handheld technology in a healthcare setting. (See Chapter 5 *Qualitative data collection*, for a detailed description of this stage.)

Stage 5 dealt with the development of a preliminary adoption model of PDA based on the literature review and the findings of the focus group discussions. A variation of Roger's (1995) theory of innovation and diffusion was used as the basis for developing the adoption model for the wireless handheld devices in the Australian healthcare setting.

Due to the limited empirical research and varied views of researchers, a positivist approach was undertaken to develop the research model, rather than merely employing an existing model. The research model is operationalized, based on correlational hypothesis (List of hypothesis is available on page 139) testing, as well as the use of determination of definitive cause and effects through higher level statistical analysis.

4.6 Methodology limitations

Most of the data collected from the focus groups and the survey questionnaire were from the state of Queensland, and most of the participants came from the public hospitals. Information received from the focus group discussions and the survey questionnaire were not validated against any criteria, except that the findings and data analysis were compared with the findings of the previously published material. While all the public and private healthcare facilities had the opportunity to participate in the research, many were unable to do so due to lack of time and resources available in the Australian healthcare environment.

Another limitation was that the questionnaire was self-administered, and the researcher had no control over which individuals were to take part, or to select those who might have had experience and exposure to wireless handheld technology. However, the managers and administrators of the healthcare facilities were consulted before approaching the respondents for the focus groups and the survey questionnaire, and it is anticipated that these managers and administrators ensured that appropriate respondents were involved in the study. In addition to this, the preliminary information provided before the focus group and survey participants clearly outlined the types of respondent eligible to participate in the study.

4.7 Ethics clearance

In any research study, ethical clearance is important, and is mandatory if the research involves humans. This study directly involved people through the process of focus group discussions and the survey instrument. Therefore, procedures were followed to gain ethical clearance from the USQ ethical committee and the Toowoomba district health services. At the same time, participants in the focus groups and respondents to the survey were clearly notified about their voluntary participation, the confidentiality of the data and the participants' identities. Furthermore, participants in this research were informed about their right to privacy and their option of discontinuing their participation in the study at any time. In this research an informed consent was implied by the participants' completing and returning their questionnaires. Anonymity of the respondents was guaranteed: there was no entry in the questionnaire to identify a specific respondent, so it is impossible for the researcher to identify any individual response. Furthermore, all the data gathered in this study were kept secure and confidential, according to USQ regulations.

Data and information gathered in this study were stored in digital format at the secure USQ server. It was also made clear to the participants that under no circumstances would the identity of any individual or group of individuals be released in any publications that may eventuate from this study.

4.8 Conclusion

This chapter has provided details about the research methodology adopted and the research design to address the research question in this study. The research process is divided into three phases: initial literature review, preliminary focus group and survey technique. However, the overall process can be viewed as four stages: preparation, exploration, conceptual development and confirmation. The preparation stage helps to identify the gaps in the literature; the exploration stage identifies the actual issues associated with the adoption of wireless handheld technology in a healthcare environment through preliminary focus group discussions; the conceptual framework is developed through the literature and focus group data analysis; the confirmation process is involved in confirming the framework through survey and confirmatory focus group sessions.

The next chapter will provide details about the strategies used for data collection.

Chapter 5 – Qualitative Data Collection

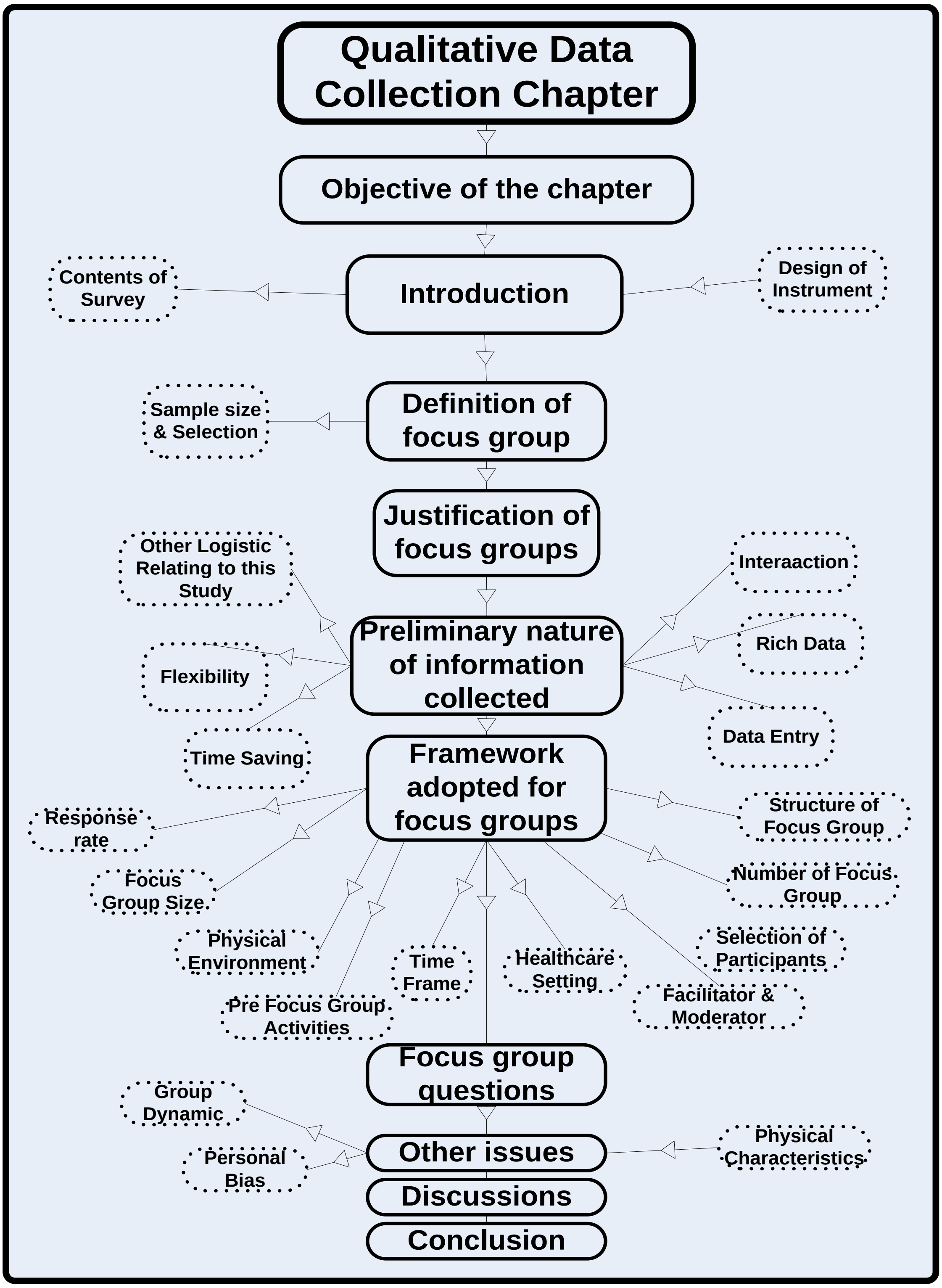
5.1 Chapter overview

The Methodology chapter (Chapter 4) provided information on the research methodology that was adopted to answer the research question(s) in this study. Furthermore, the chapter also provided analysis and justifications for choosing the techniques and methodology adopted to address the research questions identified earlier.

This chapter deals with qualitative data collection, and provides an overview of the focus group methodology adopted to understand the views and opinions of healthcare professionals[8] about the uses of wireless handheld devices in a healthcare setting. Furthermore, this chapter provides information about various strategies adopted for conducting focus group discussion sessions.

A brief layout of the structure of this chapter is shown below.

8 Most of the data collected in this research study was in Queensland, Australia, whereas the two conferences attracted participants from other states and territories of Australia. Therefore, the findings of this study may have some implications on the other states and territories of Australia.



Qualitative Data Collection Chapter
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Contents of Survey
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Flexibility
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Facilitator & Moderator
Selection of Participants
Number of Focus Group
Structure of Focus Group
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Group Dynamic
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5.2 Introduction

Due to the relative newness and exploratory nature of this research, there was a need to directly approach healthcare professionals to gain their opinions and understand their views about the adoption of wireless devices in their setting. The employment of focus groups is one of the techniques extensively used for collecting qualitative data, and is a widely respected tool in the domain of social science research (Morgan, 1986, 1997a; Malhotra, Agarwal & Peterson, 1996a; Stewart & Shamdasani, 1990). Focus groups, according to Vaughn et al. (1996), contain the following two core elements:

1. A trained moderator who sets the stage with prepared questions or an interview guide;
2. The goal of eliciting participants' feelings, attitudes and perceptions about a selected topic.

Historically, focus group discussions for collecting qualitative data have been an extension of traditional individual interview techniques, where predetermined series of questions with close-ended responses were used to gather views of individuals in a controlled environment (Krueger, 1988). During the 1930s and 1940s, the use of non-directive interview techniques was increasing, and researchers in the domain of social sciences used such techniques to study the motivational attributes of individuals (Roethlisberger & Dickson, 1938; Rogers, 1942). Originally, focus group techniques were introduced at Columbia University to study the response of audiences to radio programs around 1941 (Stewart & Shamdasani, 1990). Since then, focus group discussions have been used widely in a variety of domains, including World War II analysis of propaganda (Swenson & Griswols, 1992), modern marketing studies into the response of consumers (Carson, Gilmore, Perry & Gronhaug, 2001), film industry evaluations of the success of new releases (Vichas, 1983), and in communication studies (Flores & Alonso, 1995; Brotherson & Goldstein, 1992). Focus group discussions have become so popular that they are sometimes considered as synonymous with qualitative research methodology, although this view has been criticised (Gordon & Langmaid, 1988; Morgan, 1988). One of the strengths of focus groups is that they encourage participants to interact with each other, thus enabling simultaneous interactive involvement of the participants in the research process (Greenbaum, 1988).

5.3 Definition of Focus Group

Krueger (1988) defines the focus group as a carefully planned group discussion to collect information on a topic in a permissive and non-threatening environment. The number of participants is normally restricted to from seven to ten. Focus groups are normally facilitated by a moderator and are conducted with a control group of respondents (Malhotra et al., 1996b). Overall, the environment of the focus group is relaxed, comfortable, and enjoyable as participants share their views about the selected topic. It is anticipated that participants influence each other by responding to others' comments and ideas (Krueger, 1998). According to Kitzinger (1994), focus group sessions are designed to explore participants' views and opinions on a specific issue to gain insight through group interaction. Morgan (1988) suggested that a unique feature of group interaction in a focus group is that is can provide valuable insights. Consequently, it is a useful tool for investigating participants' thoughts. This is achieved as participants provide their views and opinions on a particular topic, and provide justification of their views to other participants. This enables participants to interact and share each other's views. Such an environment provides the researcher an opportunity to explore the issues further (Morgan, 1988).

A focus group is a technique to collect qualitative data in an area where the topic is determined by the researcher (Morgan, 1996). In simple terms, a focus group can generate a positive conversation on a selected topic, and the format of the group can provide an opportunity for the members to exchange information related to the topic for which data are being collected. Kitzinger (1994) defined the focus group technique as group discussions organized to explore people's views and experiences on a specific set of issues. Focus group methodology is unique when compared to other group interview techniques due to its distinguishing feature of group interactions to produce data and information (Morgan, 1988). According to Morgan:

> As a form of qualitative research, focus groups are basically group interviews, although not in the sense of an alternation between a researcher's questions and the research

> participants' responses. Instead, the reliance is on the interaction within the group, based on topics that are supplied by the researcher who typically takes the role of a moderator. The hallmark of focus group is their explicit use of group interaction to produce data and insight that would be less accessible without the interaction found in a group (Morgan 1997b, p. 2).

The main objective for using focus group discussion session in this research study is derived from Morgan's views.

Morgan identifies three uses of focus groups: (1) as a self-contained principal source of information gathering, (2) as a supplementary source where the primary source is survey methodology and (3) in studies that combine two or three modes of data gathering (Morgan, 1997a, c). Based on this analysis, the research reported in this thesis used focus group techniques to collect initial views of healthcare professionals about wireless handheld devices. The findings of a focus group were then used to develop a survey instrument to collect data from the wider community.

The focus group methodology has been employed in this study for the following reasons:

- As the field of study chosen is relatively new and limited, focus groups provide valuable information through interaction – information that is not likely to come from a personal interviews.
- A focus group helps to draw together users of wireless handheld devices, thus helping the researcher to understand the drivers and inhibitors of wireless handheld devices in healthcare, and consequently to prepare a wider, more relevant range of questions for the large-scale survey instrument.
- Focus groups in this research provide an opportunity not only to clarify and expand on the core questions, but also to provide an opportunity for participants to openly express their views.
- Focus group techniques in this study provide an opportunity to interrelate and record non-verbal responses and interpretations (such as body language) of other group members. In such an environment, members can react to and build upon each other's responses, and so produce ideas and information that are not possible in a personal interview environment.

- Focus group sessions are a powerful tool for generating ideas, and for gaining feedback about views and opinions expressed by participants.

5.4 Justification for Focus Group

One of the strengths of the focus group technique is that it allows both the researcher and the participants to listen to all participants' views and opinions, and to learn from them; in this way such groups provide excellent opportunities to further explore the topic under discussion. Focus group sessions are not passive; the moderator needs to be a good listener, and motivated to learn from the discussion. The moderator needs to be careful in that the discussion should not be dominated by an individual in the group; all participants must have an equal opportunity to express their views. Morgan (1998) states that the moderator needs to be careful, should not control the conversation too much, and needs to understand the group dynamics and the group's priorities. The nature of the focus group is such that the moderator will have limited scope to follow the exact sequence of questions as prepared, because of the free-flowing style of conversation. However, because the type of discussion in focus groups is self-evolving, the moderator may have to intervene to ensure that all areas of the chosen topic are covered appropriately.

Byers and Wilcox (1991), Krueger (1988), Morgan (1997c) and Stewart and Shamdasani (1998) state that the use of the focus group technique is appropriate in a field where limited amounts of information are available. It has already been stated that, due to the relative newness of this research domain, the literature has revealed only limited pertinent information in terms of factors that influence technology adoption. Therefore, the following reasons are provided to justify the suitability of focus groups for this study:

1. Focus groups have the ability to encourage participants to generate new ideas and opportunities to provide underlying reasoning for these new ideas.
2. Focus groups have the ability to seek answers to open-ended questions that may not be possible in a survey.
3. Focus groups have the ability to explore healthcare professionals' perceptions and motivations.

4. Focus groups have the ability to explore initial views and opinions of healthcare professionals regarding the determinants for the adoption of wireless handheld technology in a given healthcare environment.
5. Focus groups have the potential to extract valuable information from the healthcare professionals in a limited time span (Krueger, 1988).
6. Focus groups have the ability to explore in depth the adoptability of wireless handheld technology in a healthcare setting.
7. Focus group discussions provide a variety of options and flexibility to examine a wide range of topics with a mix of participants.
8. Focus group data can be used to develop a meaningful survey instrument. Therefore, focus group techniques will be complementary to the quantitative methodology that is used in this research.

Historically, focus group techniques have been used as a stand-alone methodology (Morgan, 1996) or used as a mixed mode strategy for a research study (Byers & Wilcox, 1991). For example, focus group techniques have been used in combination with survey instruments, individual interviews or experiments (Krueger, 1988; Stewart & Shamdasani, 1990). In the research undertaken for this thesis, focus groups have been used as a complement to the survey technique.

Focus group discussion sessions are an excellent way to explore new ideas. A well executed focus group can explore real feelings and issues, and provide a richer source of information than personal interviews. Information gathered through a focus group provides excellent help in designing a survey to validate the views of the wider community, and focus groups have the ability to identify issues that can be further explored through larger samples of the population (Krueger, 1988; Patton, 2002). The following table provides a summary of advantages of using the focus group technique for this study.

Table 5.1: Summary of advantages of using focus group discussions for this research study.

No.	Advantages of Focus Group	Applicability to this Research
1	Provides quick and cost effective way of gathering first-hand information	Healthcare professionals are very busy and very difficult to engage.
2	Opportunity for researcher to interact directly with the participants	Researcher is able to clarify and provide opportunity to follow up.
3	Ability to observe non-verbal views and opinions of the participants	Gestures, smiles, frowns, provide additional added value to verbally expressed opinions and views.
4	Unstructured and unformatted style of focus group sessions has the potential to provide rich data	Healthcare professionals are busy, and lack of substantial research in the domain provides valuable insight to identify determinants.
5	Focus group provides ability to react and build upon the views of other focus group members	Such an environment provides opportunity to produce ideas and data that might not be captured otherwise from healthcare professionals
6	Focus group discussion provides flexibility with variability among the participants and topic under discussion during the focus group sessions.	The focus group research methodology technique can be adopted to investigate and explore the participants' views and opinions.
7	Focus group provides opportunity to gather first hand information in a relatively new domain	Adoption of wireless in healthcare is a relatively new domain, and focus groups provide an excellent opportunity for first-hand information about their views and opinions.
8	Focus group produces rich and easy-to-interpret information	In this research study, it is easy to understand opinions and views of participants, in spite of healthcare being quite technical and using specific terminologies and abbreviations.

Even though focus group methodology is a valuable research technique and provides valuable initial data, in this research, focus group techniques have some limitations and challenges. It is important to minimize these challenges in order to extract high quality of data and information for further analysis. Table 5.2 outlines major challenges and limitations, along with strategies that can be adopted to minimize their adverse effects.

Table 5.2: Summary of limitations associated with the focus group technique, and strategies adopted to minimize their effects in this research.

No.	Limitations of Focus Group	Strategy to reduce the effect of these limitations
1	Focus groups do not allow statistically significant generalization of responses for the wider community.	Focus groups have been used in this research only to explore the domain; generalizations were made through the survey questionnaire.
2	Focus group participants are difficult to engage in conversation.	Selection of the participants through their manger or supervisor with previous interest or use in wireless handheld devices. People were kept informed along each stage of the focus group activity. During the focus group discussions, participants were addressed by name, and invited to express their views and opinions.
3	Small number of respondents limits significantly generalizations that apply to the larger population.	In this study it was not intended to use the focus group research technique alone. The focus group technique was used to explore the views and opinions of the respondents. Generalization were made on the findings of the survey (Survey was developed from the findings of the focus group) of the wider community.
4	Responses from focus group members are not independent, and one dominant member may bias the findings of the focus group.	An expert facilitator was used to run the focus groups, and participants were encouraged to provide their views
5	Open-ended responses are difficult to summarize, and are open to various interpretations.	In this study, data were collected from healthcare professionals at three different stages, and more than one method of collection was employed.
6	The moderator may bias the results of the focus group findings.	All focus group sessions used the same set of questions, and the same moderator and facilitator ran all the focus group sessions. Furthermore, health supervisors were also invited to the focus groups for feedback and quality control.

From Tables 5.1 and 5.2, it can be summarized that focus group methodology was suitable in this research for maximizing the advantages while minimizing the effects of challenges and limitations of this technique. In addition to this, focus groups were used only at preliminary stages to collect initial views and opinions of healthcare professionals. The survey questionnaire was developed from the findings of the focus group sessions, and was used to generalize the views of the wider community. Walter (1985) identified that focus groups are a means for adding insight to the results achieved through the survey technique. The focus group technique is widely used in the information systems domain, and in this research has acted as a powerful tool in exploring the initial views and opinions of healthcare professional about adoption of wireless handheld technology in a given healthcare setting. The focus group technique has also been used as complementary to survey technique used in this research.

The objectives of focus group discussion sessions for initial data gathering, which were adopted in this study, can be summarized as follows:

- To understand the current views and opinions of healthcare professionals towards advantages and disadvantages of wireless handheld technology in a healthcare setting
- To compare the available literature findings and healthcare professionals' views and opinions
- To understand the constraints of policies and procedures, implications of the legal framework, public and private sector expectations, implications for data and information infrastructure, and effects on the level of service provided
- Ability of the focus group discussions to generate new information, which may not be captured yet in the literature
- To provide an opportunity to extract information about behaviour and demographic factors, as healthcare professionals are engaged in unique activities compared to activities associated with the commercial business environment
- To explore information that is specific to the healthcare environment; for example, the types of technology features, the types of information appropriate for the handheld devices, the types of knowledge and information required, the perceptions of individuals in the context of the working environment, the communication needs, and the information associated with specific clinical process or activities in the context of PDAs.

5.5 Preliminary Nature of Information Collected

In the domain of IS research, focus group techniques are very useful and appropriate when they produce new results which are hard to obtain through other mode of data collection (Morgan, 1996). One of the reasons focus group techniques is so successful is due to their ability to interact and provide insight into the complex behaviour and motivation, instead of just listening and gathering information with other standard data collection approaches. Focus group research methodology is appropriate when the research is exploratory in nature and little is known about the research area, as this is true in this research study (Cox et al., 1976; Morgan, 1988, 1996; Morgan & Krueger, 1993, Stewart & Shamdasani, 1990). Common uses of focus group research methodology can be summarized in the following table:

Table 5.3: Summary of common uses of focus group techniques

No.	Descriptions	Relationship to this study
1	Collection of general information about the research area	Close correlation
2	Ability to refine the research hypothesis for further research and testing	Close correlation
3	Ability to generate new ideas	Close correlation
4	Ability to generate some interest in the area of study	Close correlation
5	Ability to learn from the participants' responses and interests	Close correlation
6	Ability to understand the potential issues associated with the research area	Close correlation
7	Ability to interpret the findings of earlier research	Close correlation

Adopted from Hisrich and Peters (1982) and Stewart and Shamdasani (1990) with modification.

As can be seen from Table 5.3, all the features have a close correlation to this study, as this study is exploratory in nature and has sought to develop a framework through a list of final hypotheses, and survey instruments from the findings of the focus groups.

5.5.1 Other Advantages of focus groups for this study

In addition to the above justification for employing the focus group technique in this research study, there are four other important advantages: flexibility, time saving, participant interaction, and rich data. All are relevant because their characteristics are associated with a healthcare environment.

Flexibility: The focus group technique provides the opportunity to extract real information in an environment where different stakeholders may have competing views, and where they have the opportunity to explore these through their interactions. For example, with individual interviews, the researcher may be left guessing about a stakeholder's particular views or behaviours (Moore & Benbasat, 1996). This aspect of the focus group is relevant to this study, as individuals in the healthcare industry work in different environments, each with unique demographics and characteristics.

Time Saving: Compared with individual interviews, focus group discussions provide some savings of time and other logistical overheads, as a group of individuals can be interviewed in a group setting. Focus groups provide an opportunity to observe and hear opinions when there are time constraints, or when it is difficult to get people to participate in the research. Furthermore, data can be analysed collectively instead of individually. This aspect was relevant to this study as the healthcare industry is currently experiencing shortage of staff.

Participant interaction: In a focus group session, the ability of participants to interact helps them, and the researcher, to understand their complex behaviours and motivations (Morgan & Krueger, 1993). Fern (1982) studied the research methodology of collecting data from focus groups and individual interviews (two focus groups of eight participants in each, compared to 10 individual interviews) and concluded that participants in a focus group environment produced 60 to 70% as many additional ideas as they would have produced in an individual interview environment. One of the reasons for this extra information is that focus groups provide an opportunity to query others and provide explanation for their views (Morgan, 1996).

Rich Data: Focus group discussion sessions have the ability to capture very concentrated data, and to further drill down to collect information about a particular domain. Due to the exploratory nature of this research, it has been critical to explore as many as possible of the drivers and inhibitors that influence the adoption of wireless handheld devices in the healthcare setting. Analysis of this data has been used to develop the survey instrument. The rich quality of data in this domain can be critical for the success of the quantitative approach.

5.6 Framework Adopted for Focus Groups in this Study

Research methodologies are very vulnerable to risk, and the control and quality of research can easily be affected; focus groups are no exception to this (Krueger, 1988). To minimize such a risk, it is important for focus group discussion sessions to be thoroughly planned within a control framework (Krueger, 1993). For example, it is most important to understand and define the problem, or the quality of the focus group can easily be diminished (Krueger, 1988; Payne, 1976). Seven important aspects of this framework will be discussed in the sub-sections below. These are (1) the selection of participants, (2) the structure of the focus groups, (3) the healthcare setting and selection process, (4) the facilitator and moderator, (5) preparatory steps before running the focus group, (6) activities undertaken during the focus group session and (7) activities undertaken after the session.

5.6.1 Selection of participants

Selecting the sample of participants for a focus group can be critical. There are many methods and techniques available for sample selection including, for example, random sampling, purposive sampling and convenience sampling. In determining the approach for this study, it was decided that this phase of the research should be concerned purely with gaining insight and gathering initial views of the healthcare professionals about the uses of wireless handheld devices in healthcare setting; the subsequent generalization phase was to be achieved through the survey of the wider community. Random sampling is usually best for avoiding bias. Convenience sampling is sometimes acceptable, but is exposed to hidden bias; it did not provide the proper strategy for this phase of the research, and what it was intended to achieve (Krueger, 1988; Patton, 1990; Stewart & Shamdasani, 1990). For this research study, therefore, purposive sampling was selected. Such a sampling technique was best suited for the collection of information about critical issues related to the adoption of wireless handheld technology in a healthcare environment. Thus, participants were selected from the most representative groups of the population that could provide meaningful information about the determinants for the adoption of healthcare devices in healthcare environment. It was also important to keep the group as homogeneous as possible in order to minimize the negative effects of group dynamics on the group itself, as well as its effects on quality of information sought from the group (Greenbaum, 1993). Participants for the focus groups were selected with the help of managers and supervisors from the local health district of Queensland Health. Initially, ward managers or supervisors were contacted, objectives were stated, and descriptions of the most desirable participants were made clear to them. Subsequently, supervisors were requested to contact the appropriate individual healthcare professional for participation in the focus group sessions. With the help of the managers and supervisors, a convenient time and place were identified and staff were invited to participate in the focus groups.

5.6.2 Structure of focus groups

The second important aspect of the framework is the structure of the focus groups. In this section Researcher shall address several factors that are important in relation to focus group structure. These are (1) the typical focus group and the importance of focus group structure, (2) the number of focus groups, and focus group sessions needed, (3) the size of the groups – that is, the appropriate number of participants, (4) the time frame and time limitations and (5) the importance of the physical environment.

The typical focus group session can be either highly structured or semi-structured. For example, a highly structured group can force participants to answer closed-ended questions with short, simple and straightforward answers, or ask them open-ended questions relating to specific topics. In a semi-structured group, participants have the ability to explore a topic while remaining focused on it. In this research researcher adopted a semi-structured approach; this encouraged the participants to contribute as much as possible, while allowing me to maintain control, and to keep the discussion on track.

The structure of a focus group can have a direct effect on the validity of the information received. For example, too much control and structure may lead to an environment that provides moderators with what they want to hear. On the other hand, if there is too little control and structure, the session can become a mere brainstorming exercise. This research study required specific information, so that certain questions were required to be covered. To keep the focus of the participants, all the focus group sessions were run with the same set of questions. Such a structure provided an opportunity to evaluate and analyse the data, and to identify themes. As this research study has been exploratory, the overall approach has been semi-structured. The reasons for this are:

1. Participants were given the opportunity to expand on the questions (and other's answers), and to provide explanations, which could be most useful in the design of the survey instrument to be used subsequently to acquire the views and opinions of the wider community.
2. It would be easy to explore the interpretation and applicability of wireless handheld devices for unique healthcare activities and processes, or specific needs of healthcare professionals.
3. Focus group sessions provide the opportunity to explore the role of ICT, and perception towards ICT, in a healthcare setting.
4. Participants are able to learn from others' views and be able to provide feedback about their own unique working environment.
5. The semi-structured approach provides an opportunity for the researcher to influence the direction of the discussion in the context of the information provided by the participants. This aspect can be very helpful given the exploratory nature of this topic (Krueger, 1994; Morgan, 1997c).

The second factor that is related to structure is the number of focus groups required. Time and cost, issues raised, the research question, characteristics of the population sample, and the number of ideas generated in each successive focus group can be directly related to the number of focus groups that are needed in any research (Malhotra et al., 1996a). Even though there are no hard and fast rules regarding the number of focus groups required, there is a relationship between this number and the homogeneity of the group with respect to the members' backgrounds. As a rule of thumb, the higher the homogeneity of the background, the fewer the number of focus group discussion sessions will be required (Morgan, 1988). On the other hand, in

Morgan's opinion, three to five focus group sessions should provide significant insights into most topics (Morgan, 1997c).

One of the strategies employed to understand the number of focus group sessions that are needed is to conduct the post-focus-group analysis after each session. This analysis should be conducted to evaluate the replication of information gained from the previous focus group and analysis of the number of new ideas generated. Another measure to determine the number of focus group discussions needed is that of the moderator's ability to predict what information would be captured from the next focus group session (Zeller, 1993). Krueger (1988) and Morgan (1988) suggested that such situations could occur after three to four focus group discussion sessions. When the research is of an exploratory nature, and the research is aimed at collecting views and perceptions on the research topic, only a few focus groups are normally needed (Stewart & Shamdasani, 1990).

As mentioned in Chapter 4 *Research methodology*, for this research it was anticipated that a sufficient understanding of the topics, and the perceptions and views of the participants, could be obtained from five focus groups in total: two from nurses and one each from physicians, academics, and technical staff involved in the area of wireless in healthcare domain. In practice, by the end of the fifth focus group, the information gathered started to become saturated. A sixth focus group was held, but it was clear that there would be no new information. According to Lipstein (1975), increasing the number of focus groups does not improve the accuracy of the information gathered.

The third factor related to structure is the focus group size; that is, the number of participants. It is critical to have an adequate number of participants in each focus group to ensure the creation of ideas and healthy discussions; at the same time too many can increase complexity and become difficult to manage. Researchers are still debating the ideal number of participants in each focus group. Some researchers support a number ranging from 6 to 12; others recommend from 8 to 12 participants in each focus group session (McDaniel & Gates, 1993; Stewart & Shamdasani, 1990). Others argue that the number lying within the range of 6 to 8 (Daume Jr, 1988) can also be very effective (Calder, 1977; Zikmund, 1984). Normally it is anticipated that the larger the group, the more difficult it is to manage, and the more restraints there are on the participants. The current trend is towards the lower end of the scale. Traditionally in Canada, focus groups of 8 to 10 are considered appropriate, but a focus group size of 5 to 6 is also considered as quite reasonable and appropriate. On the other hand in the United States, researchers prefer focus groups to contain from 6 to 8 participants (Harris, 1995). Some researchers believe that focus group size can lie between 5 to 10 participants (Krueger, 1994; Morgan, 1997c; Patton, 1990; Stewart & Shamdasani, 1990). Therefore as a general rule, a spread of 5 to 8 participants is an acceptable range. In spite of these figures, the number of participants in a focus group is an individual decision for the researcher; for example, it will cost less to have more people in a focus group. On the other hand, by having a larger group, it is difficult to manage the group and difficult to capture each participant's views, perceptions and reactions (Morgan, 1988). The literature also identifies the importance of understanding the amount of information individuals are able to share. For example, a small group would be appropriate if the topic is general and is of interest to the participants (Krueger, 1994; Morgan, 1997c; Patton, 1990; Stewart & Shamdasani, 1990).

With larger focus groups there are also more difficulties. Their management becomes more complex, there are more people to accommodate when there are problems with the availability of time for each participant, participants tend to form natural or political sub-groups, and logistical problems increase with larger groups. However, whatever the final size of the focus group is, it is important to invite more participants than necessary, so as to fill gaps left by those who fail to turn up. Morgan has suggested a guideline of 20% above the level of participants required (Morgan & Krueger, 1993).

Therefore, in this study it was decided to adopt the general strategy for group size mentioned above: a group of 5 to 9 healthcare professionals was seen as appropriate to discuss their views and opinions about the uses and adoption of wireless handheld devices in the Australian healthcare environment. The strategy of 5 to 9 participants was selected on the basis that if two of the participants did not show up (in healthcare there is a high incidence of emergencies), then there would still be sufficient members in the group to contribute to the discussion.

The fourth factor related to focus group structure is the time frame. It is important that each session should be long enough so that focus group participants can feel at ease and enough time is available to fully explore the research topic. Typical length of focus group time recommended is from 1.5 to 2 hours (Malhotra et al., 1996b). Others believe that focus group sessions should not exceed 2 hours (Morgan, 1988; Payne, 1976). An important aspect to remember while deciding the length of focus group is to cover the whole spectrum of issues and topic. For this research study each of the focus group secession was around 1.5 to 2 hours as suggested by prior studies. Participants were allowed to leave early or join late, due to the nature of their work, but they were encouraged to attend the complete session if possible.

The fifth factor related to focus group structure is the physical environment. For example, it is critical to provide a comfortable and relaxed atmosphere if healthy discussions are to take place. Stewart and Shamdasani (1990) suggested comfortable seating arrangements so the participants are facing each other, good ventilation and lighting, and overall comfort of the participants. All of the focus group environments for this study were selected in consultation with the managers or supervisors, and local healthcare meeting rooms or board rooms were utilized for the purpose of the focus groups. The sessions were organized around lunch times, and some light refreshments were also provided. One focus group was conducted outside the healthcare facility to accommodate participants from different healthcare organizations and allow them to convene in a common physical location.

5.6.3 Healthcare setting and selection process

The third important aspect of the framework is the setting. Focus group discussion sessions were conducted with participants of public and private hospitals to collect the preliminary views and opinions of healthcare professionals regarding the use of wireless handheld technology in healthcare environment. The healthcare facilities were selected on the bases of their size and convenience of access, as the healthcare professionals were busy, and their jobs are time-sensitive. Due to considerations of convenience and location, only healthcare facilities in the state of Queensland were contacted. Initial contact was made with authorities from the Queensland health district for their approval and for the identification of suitable healthcare facilities. These individual healthcare facilities were then contacted for the possible identification of participants for the various focus group sessions. Individual healthcare facilities that showed interest in participating in this study were also included for data collection. The distribution of hospitals contacted for the focus group sessions is shown in Table 5.4.

Table 5.4: Summary of healthcare facilities that participated in this study

No.	Regions	No. contacted	No. accepted
1	Toowoomba district healthcare facilities	8	4
2	Brisbane district healthcare facilities	3	1

The focus group sessions were conducted at the participants' premises, except for two that were conducted outside the working environment. The criteria used to identify the healthcare facilities included their exposure to wireless handheld devices and the number of beds at the facility. These data were acquired from Queensland Health.

As mentioned earlier, to ensure quality of information, to generate good ideas and to develop healthy discussion it is important to have sufficient number of participants in each focus group. The quality and richness of information depends on the mix of participants for the focus groups. Participants were selected and grouped according to their area of functional activities. Morgan warned that if a group is sampled randomly, it is likely to comprise members who see the research topic in different ways; in fact, the outcomes of their session may not even be meaningful (Morgan, 1997c). Stewart and Shamdasani (1990) also mentioned that normally, focus group methodology is adopted to acquire specific information from a specific group of people with the intention to share that information. Such a strategy requires appropriate planning to involve participants with specific characteristics. Therefore, Participants for each focus group session were selected either by snowball sampling or through professional gatherings. An initial personal contact was made to the prospective supervisor or manager of the healthcare facility or unit to explain the research and to explore their willingness to participate in the research. After the initial contact a detailed e-mail was sent with information under the following headings:

- Brief research description and objectives

- Research contribution and benefits
- Characteristics of the participants
- Explaining privacy and confidentiality
- Explaining voluntary involvement and opportunity to withdraw any time
- Time frame

The criteria used to select participants for the focus groups from the public and private healthcare facility included the following:

- Participants were either existing or potential users of wireless handheld technology.
- Homogeneity was achieved on the basis of their exposure to wireless handheld devices and their involvement with patient care.
- Age, gender and work status were ignored as they do not play a major role.

Most of the participants were either nurses or nurse administrators. Some participants had an IT focus while others had a management or strategic focus. Most of the participants had exposure and experience with wireless technology and were familiar with PDAs and handheld PCs. It was noticed that almost 50% of the participants had worked in other domains within the healthcare environment; this wider experience contributed to their providing richer information on a wider range of issues about the uses of wireless handheld technology in the healthcare setting. All the focus groups were organized with the participants' convenience and availability in mind, and were held at either the local facility or at an easily accessible common venue.

5.6.4 Facilitator and moderator

The fourth important aspect of the framework relates to the operations of the facilitator and moderator. As mentioned earlier, the quality of the information gathered through a focus group is directly related to its planning and actual conduct. The roles of facilitator and moderator are critical, and the quality of the focus groups heavily depends on their skills and abilities (Greenbaum, 1993; Rigler, 1987). The role of moderator is critically important – a fact that has been stressed by many researchers – and an unprepared moderator can have a seriously negative effect on the group (Krueger, 1988; Morgan & Krueger, 1993; Stewart & Shamdasani, 1990;

Zikmund, 1984). It is important that the preplanning phase for each focus group clearly identifies the purpose and objectives with the help of an experienced facilitator. For instance, the homogeny of the participants, the size of the group and the representation of the population would be addressed carefully in consultation between the supervisor and an experienced focus group researcher.

Facilitators are expected to have special skills with all data gathering techniques, and focus group environments are no exception to this. For example, some of the qualities a facilitator is expect to posses include the ability to communicate, to listen to others, to respect other people's thoughts and feelings, to use a sense of humour at the right time, to understand bias (and identify their own biases), to summarize thoughts, to show empathy and to be flexible (Krueger, 1994). The facilitator in this study was an experienced healthcare researcher and was aware of the protocols of this study. The facilitator was able to guide the discussion to ensure that both richness and quality of information were captured. For example, if few ideas were being generated and discussed, and the moderator failed to pick them up for further exploration, the facilitator was able to intervene and steer the discussions into more productive directions. The facilitator was also helpful in pointing out inactive participants and involving them in the discussions.

The role of the moderator is also critical, and an experienced moderator is needed to extract information from the focus group sessions. For example, the moderator is expected to have knowledge of the research topic; to understand the focus group research technique; to be able to control and steer the discussion so that it remains focused on the topic; to understand the specific cultural and social values of the domain; and to be able to employ the terminologies of the profession and the research domain. To minimize barriers, it is common for the principal researcher to play the role of moderator as well. This was the case in this study, and I took the role of moderator in all focus groups.

5.6.5 Pre-focus-group steps involved

The fifth important issue in providing an effective framework is the pre-focus-group session planning. In this research, the framework was derived from the experiences of the supervisor, the facilitator and the synthesized research literature in the domain of focus group methodology (Krueger, 1994, 1998; Krueger & Casey, 2000; Morgan, 1988, 1997c, 1998; Morgan & Krueger, 1993; Stewart & Shamdasani, 1990; Swenson & Griswols, 1992). During the pre-focus-group planning, the following steps were employed.

Step 1: Acquiring necessary approvals (including ethical approval)

Step 2: Identifying objectives and goals of the focus group

Step 3: Identifying the population and the representative sample

Step 4: Drawing up a list of participants that would represent a sample from the identified population for participation in the focus groups

Step 5: Communicating appropriate information

Step 6: Preparing a list of questions

Step 7: Identifying a facilitator and discussing the agenda

Step 8: Drafting possible follow-up questions to the probable answers

Step 9: Validating and pre-testing questions

Step 10: Selecting appropriate venues, and ensuring an environment in which participants feel comfortable

Step 11: Contacting possible participants through a personal letter with an outline about the objectives and goals of the project. At this stage it was anticipated that 8 to 10 participants would be chosen for each focus group.

5.6.6 Activities during the focus group

The sixth important aspect of the framework is the activities that occur during the focus group sessions. To encourage effective participation, participants' trust and confidence were assured. For this purpose the following strategies were adopted:

1. No one except the researcher and the supervisor had access to the data gathered through the focus group sessions.
2. Data were stored on the university's secured network drive
3. No names or identities were revealed in any publication or report developed from the data gathered.

The major activities conducted during the focus group sessions were as follows.

1. The moderator welcomed the participants of each session and provided a brief outline of the research project.

At the beginning of each session of the focus group, the moderator formally introduced himself and the facilitator, and clarified the facilitator's role. The moderator also formally welcomed the participants, and thanked them for accepting the invitation and making an effort to participate in the focus group session. The moderator clarified that their participation was purely voluntary and that they could withdraw from the focus group at any time. In addition to this, all participants were asked to sign a written consent form. Time was given for the participants to read and clarify any question or any concern they might have had. Participants were also given a brief about the security of the data and how the data would be used in this research.

2. The aim and objectives of the focus group were conveyed to the participants.

Once the formal welcome and other procedural steps had been completed, the facilitator highlighted the aims and objectives of the session, and introduced the procedural script for the session. The facilitator provided an overview of the technological aspects of the session with some examples of uses of wireless technology in the healthcare environment. The research topic was described briefly in simple language, and the session was opened for discussion with a simple question, such as one relating to information about their existing uses of wireless handheld devices.

The facilitator also discussed the overarching question of the group session: "What do you perceive to be the drivers and inhibitors of the adoption of wireless hand held application in the healthcare industry for data management?"

3. Participants were invited to take part in the discussion, irrespective of their views being positive or negative.

The facilitator encouraged participants to give their views, irrespective of their positive or negative nature. In the beginning, each participant was requested to wear a name tag so as to identify individuals during the session. This strategy worked well, and helped to reduce the probability of dominant participants high jacking the discussion. Participants were encouraged to share their views and experiences by assuring them that there was no right or wrong answer. Participants were requested to respect each other's views.

4. Each session started with a brainstorming exercise.

Each focus group session started with a brainstorming exercise – a standard technique used to gain opinions and themes. Such an exercise provided some opinions and themes. From time to time ideas were summarized for everybody in order to generate new ideas or to rectify any communication gaps.

5. The moderator ensured that participants were given every opportunity to expresses their views openly.

After the brainstorming exercise had been completed, the discuss/organize component of the session was invoked. This module facilitated an open discussion on the brainstormed items developed in Step 4. In this step, the participants discussed all items raised earlier. Participants were encouraged to cover negative as well as positive aspects of wireless technology in a healthcare environment. One of the primary objectives of this exercise was to identify the list of drivers and inhibitors in a group environment for the use of wireless technology in healthcare environment.

Participants were requested to listen to each other and speak one after another. The moderator made sure that dominant people did not take over the discussion and invited shy or passive participants to participate.

6. The facilitator listened intently and intervened at appropriate intervals.

It was critical for the moderator to make the distinction between when people were answering a question or just talking. At appropriate times the moderator closed any off-topic discussion and moved on to the next topic. For example, the moderator made sure that all participants had an opportunity to express their views and opinions. In addition to this, the moderator used specific phrases to encourage or invite others to participate; for example, asking 'Can you provide some examples?' or 'What are other's views?', or inviting specific participants by name so that clarifications could be sought on their opinion by asking, 'How do you perform these activities in your unit/department?', 'Is it normal practice' and 'Can you elaborate on your point?'.

7. The moderator closed the focus group session.

The moderator began closing the session by briefly summarizing its highlights. Before finally closing the session, however, the moderator also invited participants to add to an existing discussion or to raise any new issue not covered during the session.

5.6.7 Activities after the focus group discussions

The seventh, and final, aspect of the framework to be discussed is the activities that take place following the focus group discussions. It is important to debrief focus group participants soon after the close of sessions. All focus groups were debriefed within 24 hours, an activity that took only 15 to 30 minutes, depending on the complexity of the subject or the interest of the participants. The following strategies were employed in debriefing the participants.

- Most important themes and ideas were recorded
- Additional information, or anything new, was highlighted in the respective focus group as compared to other groups
- Analysis of the expectations of the moderator was compared with the actual activities and information gathered
- How this particular focus group session was different from the previous sessions was recorded
- Highlights or important points were added in the report while discussing and analyzing the focus group data.
- Any issues or unexpected events were raised
- E-mails were sent to thank the participants for their valuable time, and for sharing information.

5.7 Focus Group Questions

The quality of information gathered at any focus group session directly relates to the moderator’s skills, the mix of participants and the questions asked during the discussions. To get the most out of focus group sessions, it is important that they are well planned and that the questions are developed carefully, with strategic objectives in mind. For example, some of the questions were intentionally framed as open-ended, to elicit a variety of views and rich information on the topic. While drafting the questions, the researcher avoided complex language and technical jargon so as to minimise confusion. At the same time, initially simple and easy questions were developed, followed by more-complex and difficult questions to help the participants settle and relax. The following strategies were adopted in the framing of the focus group session questions:

- Use of open-ended questions to gain a better understanding of the determinants and issues relating to the adoption of wireless handheld technology in a healthcare setting.
- Questions were avoided that would yield a simple answer of "Yes" or "No".
- Participants were encouraged to think back and relate the questions to their experiences.
- The types of question were considered, so that individuals felt motivated and involved in the discussions
- Carefully thought out sequences of questions, ranging from easy to general and then to specific questions.

A copy of the focus group questions has been reproduced in Appendix 4.

5.8 Other Issues Associated with Focus Group Strategy

There are three other observations to be made on issues associated with focus group strategy. These are the influence of group dynamics, the effects of personal bias in the facilitator and moderator, and some additional comments on the physical characteristics of the venues that were used.

5.8.1 Group Dynamics

Group dynamics refers to the interactions between the members of a group. The nature of these interactions is influenced by the composition of the participants, and this was important for the focus group discussion sessions in this research (Morgan, 2007). The effect of group dynamics is critical for the quality of data extracted from participants, and is influenced by factors such as demographics, physical appearance, personality, gender, age, social and cultural values, and behaviour. While selecting participants for each focus group session, group dynamic characteristics were taken into account. However, characteristics such as religion, age and gender, which had no relevance to the intended outcomes, were ignored.

5.8.2 Personal Bias:

Facilitators and moderators who are conducting group activities may introduce personal bias. For example, personal bias can be introduced by preconceived ideas and views. Myers (1999) observed that these preconceptions can be challenged during work 'in the field' thus having a positive effect on the researcher; that is, in focus groups, a facilitator or moderator can be positively influenced by having participants question the researcher's preconceived ideas or bias during the process of extracting information from the focus group participants. In the research reported here, the moderator was aware of this effect, and provided opportunities for open and healthy discussions with the participants.

5.8.3 Physical characteristics of the venue

As discussed above (in Section 5.6.2 *Structure of focus groups*) the physical environment is an important aspect of focus group sessions. While Section 5.6.2 dealt with the selection of the venue, this section notes the importance of the internal features of the focus group room; that is, attention was also paid to room size, lighting, seating arrangements, recording mechanisms and noise levels, all of which can have a bearing on the quality of information gathered.

As mentioned earlier, due to logistic issues, all focus groups were conducted either in the meeting room or the boardroom of the healthcare facility. These included two digital voice-recording devices, one on each end of the table. Such an environment not only provided sufficient support for an informal atmosphere, but also provided participants with an opportunity to withdraw from the discussion any time they wished to do so. Most of the issues mentioned above were adequacy addressed in these meeting room and boardroom facilities. Such an arrangement provided the opportunity for 60 to 90 minutes of quality information gathering.

5.9 Discussions

The focus group strategy adopted in this research was designed to be exploratory in nature. At this stage participants' perceived views on the topic of discussion was explored. This included factors such as drivers for and inhibitors of the use of wireless applications in healthcare. As discussed earlier, the findings of the focus groups were used to help develop the survey instrument for the quantitative stage of this study. The main roles of the focus groups were to support and complement the findings of the quantitative approach.

Furthermore, focus group sessions also helped to extract positive as well as negative comments, all of which were gathered and recorded. It was intended that both negative and positive discussions would be translated into the questionnaire for the purpose of the large scale survey. This process was critical so that the points of view elicited in the focus groups could be validated with the larger part of the population through a survey. At this stage of the study, the researcher was able to identify further areas of investigation so as to design a meaningful survey.

5.10 Conclusion

This chapter has provided an overview of the qualitative methodology, in particular focus group techniques adopted in this study to capture the views and opinions of the healthcare professionals. In total, five focus group sessions were conducted. Detailed discussions were provided regarding the logistics associated with conducting the focus group secessions. This chapter also provided detailed information on strategies about how to take advantage of the focus group techniques for this study. Furthermore, the chapter also provided strategies adopted to minimize the effects of limitations of the focus group technique. Finally, a comprehensive plan has been provided on how to cover the activities involved before, during and after the focus group sessions.

The next chapter will provide an analysis of the data gathered through the focus group sessions conducted with the healthcare professionals. From the qualitative data analysis, the preliminary framework for the adoption of wireless handheld devices in the healthcare setting will further be refined.

Chapter 6 – Qualitative Data Analysis

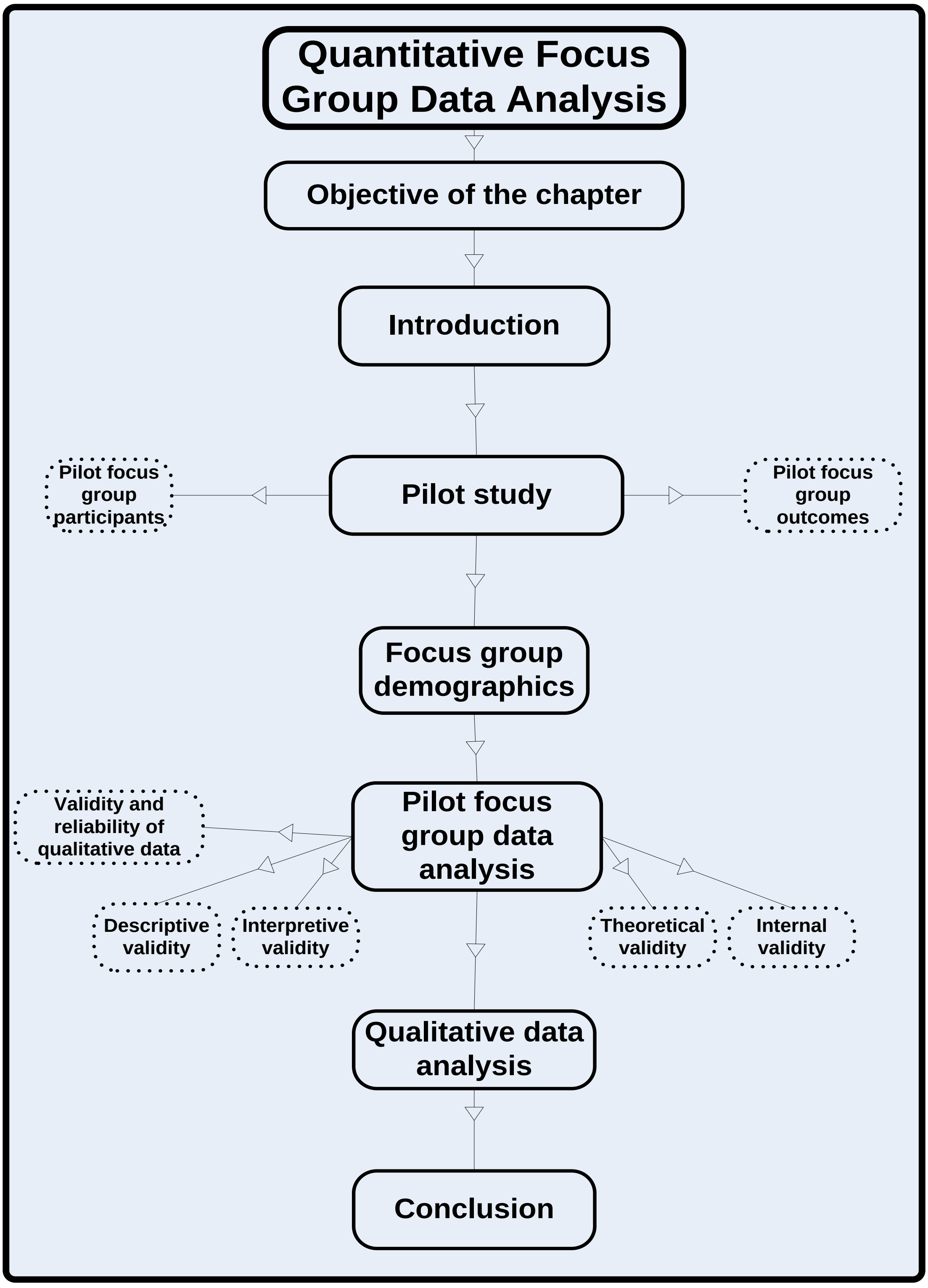
6.1 Chapter overview

The previous chapter (Chapter 5) provided information about the qualitative (focus group) technique used in this research. Chapter 5 also provided a comprehensive analysis of the focus group technique that was used to collect the preliminary views and opinions of healthcare professionals about wireless technology; for example, how the focus group sessions were run, the types of questions asked, and what strategies were used to minimize the limitations and take advantage of the focus group techniques for this study.

This chapter provides the analysis of the focus group data collected from the healthcare professionals. Leximancer software was used to analyze this qualitative data. Open coding and selective coding techniques were employed to the data gathered from the focus groups, as this technique helps to organize the large amount of data into smaller themes, and to identify any patterns or interrelationships that may exist (Dick, 1990; Dick and Carey, 1990; Leedy & Ormrod, 2005).

One of the main objectives of this chapter is to identify the themes that are derived from the healthcare professionals. It examines, for example, the process adopted for the data analysis and how various themes emerged. The themes that were identified from the focus group data analysis were used in the development of the survey instrument for the quantitative methodology subsequently adopted. This chapter also provides information on the pilot focus group conducted in this research.

The brief layout of the structure of this chapter is shown below.



Quantitative Focus Group Data Analysis
Objective of the chapter
Introduction
Pilot focus group participants
Pilot study
Pilot focus group outcomes
Focus group demographics
Validity and reliability of qualitative data
Pilot focus group data analysis
Descriptive validity
Interpretive validity
Theoretical validity
Internal validity
Qualitative data analysis
Conclusion

6.2 Introduction

As this study is exploring the opinions, views and perception of users towards the use of wireless handheld technology in a healthcare environment, qualitative methods such as focus group techniques were employed to understand and explore determinants of wireless handheld technology adoption in a healthcare setting.

To further refine the research framework, five focus group sessions were conducted in order to explore the views and opinions of the healthcare professionals with respect to the adoption of wireless handheld devices. In this study four focus groups were conducted by involving nursing staff in the region, and a fifth by involving physicians and academics. For each focus group session, six to eight healthcare professionals participated. All were selected randomly with the help of a nurse manager or supervisor at the healthcare facility.

The focus group sessions were conducted at a convenient venue suitable to the healthcare professionals. Focus group sessions were facilitated by a team of two persons: a facilitator and a note taker. This technique provided an opportunity to explore various aspects of the research, especially by the facilitator, without the need to be concerned about taking notes. An initial list of topics, or determinants, were generated, discussed, and evaluated in a group environment. These determinants were then merged with determinants found in the literature, and were grouped under major headings (to be discussed in the next section) using qualitative data analysis procedure (Miles & Huberman, 1994).

6.3 Pilot Study

Some of the problems highlighted in the previous chapter associated with the focus groups can be eliminated or minimized by conducting a pilot focus group. The researcher had an opportunity to attend and observe other focus group sessions before conducting a pilot focus group for this study. (The researcher has also attained formal training from ACSPRI training on focus group technique.) This exercise provided valuable first-hand knowledge for facilitating a successful focus group. In addition to this, the pilot focus group in this study was observed by an expert focus group researcher, who provided constructive feedback. Krueger (1994) explained that the purpose of conducting focus groups is to clarify some of the critical aspects of research, such as (a) whether such a study should be conducted, (b) the types and value of data and information that will be captured, (c) potential users and (d) the way in which information can be analyzed. As mentioned in the literature review chapter, research in the domain of healthcare with respect to adoption of wireless handheld technology is unique and under-researched. For example, many researchers in the domain of information systems have raised awareness about, and demonstrated the potential of, wireless handheld technology in a healthcare environment (Gururajan, 2004; Gururajan et al., 2005; Kasper, 1996; Lee, 2004; Lu et al., 2003a, Lu et al., 2003b,). These researchers have also identified that there is a need to gather first hand information from healthcare professionals to understand further research for the use of ICT in a healthcare domain. The pilot study (exploratory in nature) conducted in this research study comprised two stages. Stage one was a review of the published scholarly literature in the domain of healthcare and wireless handheld technology. In the second stage, a focus group discussion session was undertaken as a pilot study. Both stages helped to synthesize the literature with the views of the healthcare professionals about using wireless technology in healthcare settings. Such a strategy provided an opportunity for pre-testing the process, topics, and rigour of the research process.

6.3.1 Pilot focus group participants

After acquiring an ethical clearance from the University ethical committee, supervisors and managers from the local hospital and health department were contacted. Six participants for the pilot group were from the one medical unit, and all had some knowledge of wireless handheld devices. Morgan (1997) believes that approximately four to six members are appropriate for a pilot focus group. The pilot focus group was also moderated by an experienced researcher.

6.3.2 Pilot focus group outcomes

Prior to conducting the pilot focus group, a set of questions was developed from the literature, and reviewed by healthcare professionals and academics. This pre-test process went though several revisions; in their final versions, the questions were used in the pilot focus group session. Subsequently, these questions were used in all the remaining focus groups with minor modifications to accommodate the specific group of individuals. These focus group questions were used to guide the process, but the investigator allowed participants to open new themes. A copy of the guiding questions used for focus group sessions is provided in Appendix 4.

In brief, the pilot focus group provided valuable training and insight for conducting further focus groups effectively. Furthermore, the facilitator provided valuable feedback as well; for example how to handle dominant members and passive or shy members of focus groups. The pilot focus group also provided information on avoiding bias in the discussion (for example by the researcher accidentally agreeing or nodding his head during the discussions).

6.4 Focus group demographics

This research study conducted five focus group sessions to explore the views and opinion of the healthcare professionals. These focus groups were held at five different locations, and a total of 43 participants took part in these focus group sessions. Three focus groups were conducted in the participants' work environment; the other two were conducted outside their work environment. For these two groups, a private location was chosen for convenience, to accommodate participants from different healthcare facilities. Table 6.1 summarizes the participant categories in these focus groups.

The focus group participants comprised a representative sample of healthcare professionals involved with the decision-making process, and the practical use of wireless handheld technology in the Australian healthcare setting. All the participants in the focus group were requested to complete a profile sheet (an example of the profile sheet is reproduced in Appendix 3). The same profile sheet was used for all the focus group sessions. Questions included type of organization, gender, profession, years of experience, age group, qualification, and primary area of clinical focus. Table 6.1 briefly summarizes the demographic information.

Table 6.1: Summary of demographic information of focus group participants

Type of focus group	Number of participants	Average age of participants
Physicians	5	45
Nurses	25	30
Nurses' manager	5	40
Administrative staff	4	32
Academic and Technical staff	4	42

These focus group sessions brought together individuals who are potential users of the technology. The organizations of various groups provided an opportunity to explore shared opinions, views, and beliefs with respect to uses of wireless handheld technology in a healthcare setting. The moderator and the facilitator selected participants for each focus group to ensure that the qualitative data was rich in content from each focus group session. For example, in the 5^{th} focus group, participants were all physicians. Nine physicians were invited and seven confirmed their wiliness to participate. Out of the seven physicians, only five were able to join. There was one female and four males. Two physicians were middle-aged to more mature, and had limited exposure to using wireless handheld technology. The other two were relatively young and had used wireless handheld technology. The female participants had no real exposure to wireless handheld technology, but had used mobile phones, pagers and other wireless devices in their healthcare facility. Table 6.2 provides a brief summary of demographic information about the participants.

Table 6.2: Summary of focus group participants by job title

Type of work (job title)	Number of participants	Average years of experience
Physicians	5	15
Nurses	30	12
Other	8	10

The demographic information was very useful during the analysis of the transcripts. For example, information about the participants' working environment, their expectations about how the technology might be used, their age group and job title was used to formulate demographic questions in the survey instrument. There was another question on the profile sheet asking about their understanding of wireless technology and their opinion about possible uses of wireless handheld technology in a healthcare setting. These questions enabled the researcher to analyze the transcripts and their views relative to demographic information. For example, if a particular member of the group saw no benefits in using the wireless handheld technology in their working environment, this could relate back to their existing job.

6.5 Pilot focus group data analysis

The pilot focus group was conducted in October 2006 and the first regular focus group was conducted in January 2007. There was a minimum of five and maximum of nine participants in any focus group session. In total, there were 43 participants for all the focus group sessions; 30% were males and 70% were females. All the participants had an exposure to wireless handheld devices and some of them had used them in their healthcare environment.

The focus groups were started with a brief introduction that outlined the research and purpose of the data collected, and logistic matters such as voluntary involvement, the recording of proceedings, signing of consent forms and the participants' permission to withdraw at any time. The focus group discussion sessions adopted a strategy of open-ended and unstructured questions. The moderator made sure that all participants were encouraged to participate, and given an opportunity to do so in the discussions. Such a strategy provided not only the opportunity for participants to express their views, and also the opportunity for the researcher to facilitate the environment to explore a range of issues associated with the research topic. To clarify and reinforce ideas generated, participants were encouraged to elaborate on the topic or to provide examples. After each focus group session, the moderator and facilitator held a detailed discussion, and prepared a summary of events to complement the audio recording of the proceedings of the focus group discussions.

As mentioned earlier, the focus group sessions were organized either at the local facility or at a convenient location; further, light refreshments were also provided in appreciation of their time. A brief synopsis of various activities undertaken during the focus group session is summarized below:

- Participants were provided with the consent form.
- For most of the time, participants were happy to talk, even after the official closure of the focus group session.
- The average duration of a focus group session was 90 minutes.
- Immediately after each focus group session, recollections of the notes were written up.
- Within 24 hours of conducting each focus group session, the researcher summarized the main points and other non-verbal gestures.
- A professional transcriber transcribed all the digital recordings, and special care was taken to ensure the content of the Word file was as accurate as possible. On an average, 10 to 15 hours were spent transcribing each focus group file into a Word file.
- During the focus group sessions, exploratory and descriptive information was explored on the adoption and uses of wireless handheld technology in the participants' own healthcare facility.
- Individual's perceptions about issues, benefits and factors relating to drivers and barriers were explored.
- Focus group sessions were conducted in a semi-structured format to optimize the probability of extracting information, opinions and views of the participants, and to identify the drivers and inhibitors. The semi-structured approach has been used in previous research that has been exploratory (Sekaran, 2003). Simple questions were followed by open-ended questions, and open-ended questions were followed by specific questions to investigate specific aspects of wireless in the healthcare setting, and to ensure the validity and depth of information received. Respondents were encouraged to use examples to illustrate their opinions and views.

Focus group proceedings were recorded on a digital voice recorder and transcribed by a professional transcriber. The transcribed data files were converted in to Microsoft Word version 7 format. The researcher manually reviewed all the transcribed files and eliminated any information identifying the participants. Once all the information identifying the participants had been removed, the transcribed text files were uploaded into the Leximancer application to analyze the qualitative data further. The reliability and validity of the qualitative data are addressed in the following section.

6.5.1 Validity and reliability of qualitative data

Johnson and Onwuegbuzie (2004) identified four types of validity that would establish the creditability of qualitative data: descriptive validity, interpretive validity, internal validity and external validity.

Descriptive validity relates to the factual accuracy of the data collected through a qualitative approach, and involves confirming the data by presenting it accurately and avoiding its distortion. In this study, descriptive validity was achieved by providing actual parts of the transcribed data. This process of achieving descriptive validity is widely supported in the literature (Morgan, 1997; Myers, 1999; Trauth, 1997).

Interpretive validity has been defined by Chioncel (2003) as functions of accounts and inferences from the data. Interpretive validity relates to reporting that relies on a respondent's own words and concepts. In this research, the interpretation is derived from the researcher's interpretation of the actual text data provided by the focus group participants. By providing direct quotes, along with the researcher's analysis, interpretive validity has been achieved in this research study.

Once the data is interpreted and analyzed to identify themes and constructs as extracted from the qualitative data, theoretical validity can be achieved by identifying the themes, and the relationship between the themes, through a manual process and by utilizing facilities such as the Leximancer application. In this research, theoretical validity was achieved by reviewing the items identified in their context during the focus group sessions. This exercise further helped to identify the emerging themes from the qualitative data analysis and to refine the initial model to explain the relationships among the themes.

Internal validity refers to the uniform procedures applied to all the focus group sessions to ensure consistency. Each focus group was conducted by the researcher with the same set of questions, and with a consistent approach and methodology. In all the focus group sessions, the researcher was assisted by a moderator. The researcher did the post-focus-group analysis and summarized the highlights of each session, which cannot be captured through the digital voice recorder. Examples include the motivation of the group, and individuals' physical gestures and body language.

In this research, the focus group sessions helped to uncover themes, provide explanations, and observe participants' reactions which would not have been possible through quantitative techniques alone. Participants provided rich and insightful data and feedback for the development of the framework for the adoption of wireless technology in a healthcare environment and for the preparation of the survey instrument. For example, these sessions highlighted the issues that were directly related to the healthcare environment, and provided greater confidence about how to further develop the research. They also provided the opportunity to examine and explore the determinants in depth before the administration of the survey instrument to test the views and opinions of the wider community.

6.6 Qualitative data analysis

Before analyzing the data by using a specific tool, the researcher manually read all the transcripts and identified the words and phrases that were relevant to the research question and to this study. During this manual analysis, repeated or duplicate themes were identified, then either merged or eliminated. There is always a possibility that repeated words in a transcript may not belong to a particular theme. This strategy also provided the researcher an opportunity to understand the context of the discussion and improve the researcher's intuition and knowledge of the domain, and so help in the interpretation of the contents.

During the interpretation process, the researcher was careful to maintain the actual statements from the focus group participants. For example, phrases that were used in building the themes included the following: time saving, quality of care, error reduction, cost saving, training, privacy, security, mobility, communication, real time data, data on the move, patient care, added value, time limitation, device features, integration, productivity, flexibility, efficiency, evidence base diagnoses, improve clinical practices, impact on healthcare, support, local champion, suitable for specific environment, lack of integration, existing rigidity of healthcare environment, user friendliness, usefulness of the device, record management, better administration, ease of use, and quick access to information.

A four-stage approach was used for analyzing the qualitative data, and a brief summary of each stage is provided in Table 6.3.

Table 6.3: Summary of four stage qualitative data analysis

Stages	**Approach**	**Outcomes**
Stage 1	Identification of concepts or areas discussed repeatedly	Initial list of repeated items
Stage 2	Categorization of information by reviewing items in the context in which they appear	List of categories
Stage 3	Identification of categories to evaluate their effect on identifying drivers and inhibitors	List of drivers and Inhibitors
Stage 4	Regrouping of drivers and inhibitors to identify themes	List of themes

During the first stage, data from all focus groups were analyzed by manually reviewing the text transcriptions and by using the text analysis application "Leximancer". Initially, data were analyzed by using the default options available in the application. Such analysis provided a list of items used repeatedly in the transcription with the frequency of occurrence. This approach to identifying themes on word count has been used in marketing research (Karueger, 1993; Patton, 1990).

Even though there were some guiding questions for the focus group sessions, participants were given opportunities to identify and discuss topics freely. The focus group discussion sessions were semi-structured, with the philosophy that the session would be valuable as long as the discussion was in the chosen topic area and the researcher did not lose control of the session. This initial process identified a list of items from the transcribed text related to this research study. A summary of these items is listed in Table 6.4.

During the second stage, the list of items produced in the table above was further analyzed manually to identify the grouping and their validity and relevance to the study. This was accomplished through grouping related items and aggregating similar terms by reading and rereading the paragraphs or the statement to understand the context. This process was quite time and labour intensive, as the process involved reading and rereading and classifying terms. Such a process helped to categorize the items belonging to the same category. These items were regrouped into categories to simplify the process. This was achieved through indentifying areas in the context people were discussing during the focus group sessions, a list of these categories is provided in Table 6.5.

From this data analysis and identification of categories, it was noticed that items identified in the transcription had positive or negative influences. For example, lack of training was mentioned as a barrier and adequate training before the actual adoption was mentioned as a driver. Similarly, the word *culture* was mentioned sometimes in the context of a negative influence and at other times in the context of a positive influence.

Table 6.4: First stage output – summary of items contributing to the healthcare professionals' intention to use the wireless technology in a healthcare environment.

List of Contributing Items		
Added value Attitude towards technology Awareness Business competition Clinical data Clinical impact Clinical technology Comfort with device Communications Compatibility Competing technologies Competitors influence Connectivity Cost saving Customizations Data entry features Delivery of information Demographic characteristics Design features Device characteristics Device Quality/usefulness Device standard Device usage Easier to do day to day tasks/Quality of services Easy access to information Efficiency Electronic medical records Electronic records Error reduction Evidence base practice Existing data Bases Existing format rigidity Existing process/ clinical flow Existing processes/ systems Existing technology Existing workflows	External stakeholders Financial resources Flexibility Friendly environment Healthcare environment Improve job performance Improve patient care Individual behaviour Infrastructure Instant communication Integrations of existing processes Inter-compatibility Interface usability IT infrastructure Job satisfaction Leadership Learning Local champion Local politics Local values Making job easy Management commitment Methods/relevant solutions for PDAs Mobility Non financial resources Organizational culture Organizational politics Patient expectation Peer group pressure Perceptual constraints Performance Physical features Planning Portability Productivity Public image Quality of care	Quality of care/clinical performances Quality of information Quality of information/ error reduction Real time access Real time access for information Real time connectivity Reduce inaccuracies Reduction in transcription error/inaccuracies Reliability Reliability and security Report management Save effort Security Social values Speed of transmission Standard and procedures Standards Strategic direction Structure Support Technical knowledge/expertise Technical support Time management Time saving Training Unique activity Unique clinical process. Usability features Wireless applications Work load issues Work load reduction Work practices Work style Workflow Working environment Workload

Table 6.5: Second stage output – summary of list of categories identified through the first stage

Summary of Categories	
1. Job Satisfaction 2. Productivity 3. Outcome expectations 4. Technical know-how 5. Device characteristics 6. Technical issues 7. Support 8. Environment 9. Integration 10. Resources 11. Non IT Infrastructure 12. Organizational/management issues 13. Complexity 14. Features on device 15. Ease of use 16. Beliefs 17. Perception	18. Motivation 19. Workflow 20. Clinical performance 21. Communications 22. Suitability 23. Cultural values 24. Social influences 25. Job fit 26. Benefits 27. Extrinsic motivation 28. Technological characteristics 29. Clinical processes 30. Training 31. Security 32. Privacy 33. Fear of liability 34. Standards

At the third stage of the qualitative data analysis, all the themes identified in Table 6.5 were analyzed again with the help of transcribed data to identify drivers and inhibitors for the adoption of wireless handheld devices in a healthcare setting on the basis of positive or negative tone and influences as describe by the participants. A list of these drivers and inhibitors is summarized in Table 6.6.

The outcome of this analysis, as shown in Table 6.6, has no direct influence on the actual framework tested in this study. However, by identifying the drivers and inhibitors, the researcher was assisted in developing the survey instrument by involving both positive and negative aspects of the technology.

Table 6.6: Third stage output – summary of drivers and Inhibitors

Drivers	**Inhibitors**
1. Job satisfaction 2. Outcome expectations 3. Device characteristics 4. Support 5. Environment 6. Resources 7. Complexity 8. Ease of use 9. Integration 10. Training 11. Beliefs 12. Perception 13. Motivation 14. Workflow 15. Clinical performance 16. Communications 17. Cultural values 18. Social influences 19. Job fit 20. Benefits 21. Extrinsic motivation 22. Clinical processes 23. Standards	1. Technical issues 2. Productivity 3. Non-IT infrastructure 4. Organizational/management issues 5. Cultural values 6. Features on device 7. Suitability 8. Integration 9. Technical know-how 10. Technological characteristics 11. Training 12. Security 13. Privacy 14. Fear of liability

At the fourth stage, as the ultimate objective is to extract “themes” from the data in terms of drivers and inhibitors, the categories identified in Table 6.5 were grouped under specific theme areas. Table 6.7 provides a summary of each theme identified, and the corresponding categories they contain.

Table 6.7: Fourth stage output – summary of themes and category items contributing to each theme

Themes	**Categories included in each theme**
Technical readiness	• Technical know-how • Device characteristics • Technical issues • Security and privacy
Organizational readiness	• Resources • Non-IT infrastructure • Organizational/management issues • Training • Standards
Perceived readiness	• Support • Environment • Integration
Perceived ease of use	• Complexity • Features on device • Ease of use
Perceived usefulness	• Job satisfaction • Productivity • Outcome expectations
Attitude	• Beliefs • Perception • Motivation • Fear of liability
Clinical practices	• Workflow • Clinical performance • Communications
Social context	• Suitability • Cultural values • Social Influences
Compatibility	• Technological characteristics • Clinical processes • Integration
Intention to use	• Job Fit • Benefits • Extrinsic motivation

6.7 Conclusion

This chapter has provided findings of the focus group data analysis. These findings were then used to develop the survey questionnaire to analyze the views and opinions of the wider healthcare community about the adoption of wireless technology in healthcare. The next chapter provides the information about the quantitative data collection adopted in this research study.

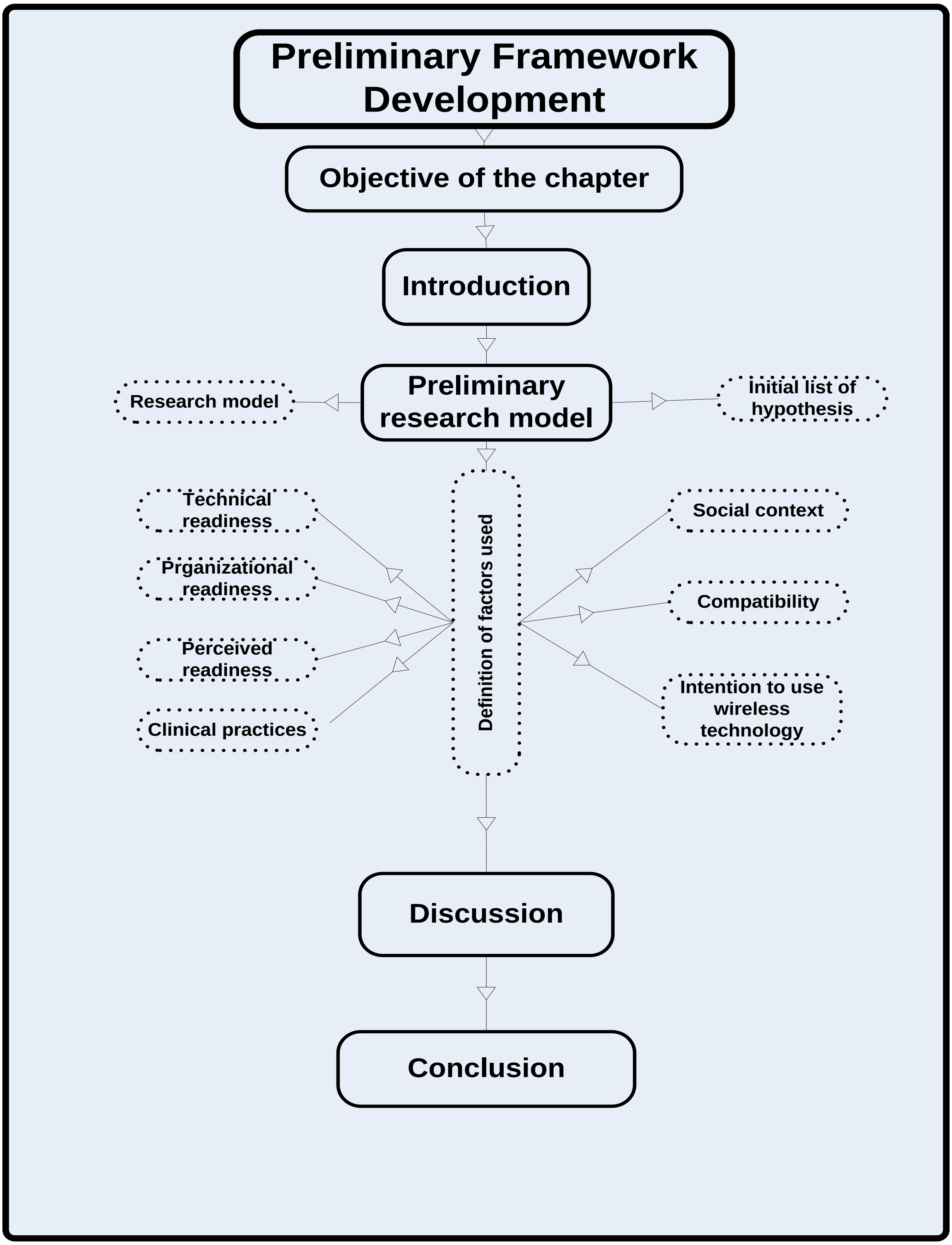
Chapter 7 – Preliminary Framework Development

7.1 Chapter overview

The previous chapter provided a comprehensive analysis of qualitative data collected for this research study. Furthermore, the chapter also provided analysis and justification for the use of the focus group technique and the methodology adopted to acquire first hand information from the healthcare professionals about their views and opinions on the adoption of wireless technology.

This chapter will further refine the research questions to formulate the initial framework for the adoption of wireless technology in the Australian healthcare setting. In brief, this chapter will discuss the theoretical foundation for this study, the research framework and the hypotheses developed for this study. The research model suggested for this purpose is an extension of existing models of adoption of technology, but including health-specific variables and their applicability to wireless technology in the healthcare domain, including their adoption to accommodate the unique characteristics of the wireless technology.

The brief layout of the structure of this chapter is shown below.


Preliminary Framework Development
Objective of the chapter
Introduction
Research model
Preliminary research model
Initial list of hypothesis
Technical readiness
Prganizational readiness
Perceived readiness
Clinical practices
Definition of factors used
Social context
Compatibility
Intention to use wireless technology
Discussion
Conclusion

7.2 Introduction

The literature review in Chapter 2 provided a discussion on the major adoption theories and models, leading to a framework for the adoption of wireless technology in the Australian healthcare environment. There is no single model that is applicable to the healthcare setting, and previous models appear not to be validated with wireless technology either. While some of the constructs from the existing models are applicable, there is a need to integrate health-specific variables to a health-specific framework.

Further, this chapter develops an argument from the literature and the findings of the focus group data analysis with a view to developing and justifying the theoretical background used for this study. On the basis of the theoretical background provided, an initial research model was developed for this study. This initial model was also used to develop a set of hypotheses that this research then tested.

The next section, the *Preliminary research model*, provides information on the theoretical basis for this research. The remainder of the chapter is devoted to identifying the major constructs from the adoption literature and then developing the initial framework (including hypotheses) for the adoption of wireless technology in the Australian healthcare environment. As stated earlier, due to the relative newness of wireless technology, it is essential to validate the initial model. Such validation is conducted with appropriate research methods so as to ensure the relevance of the framework. This is explained in the following sections.

7.3 Preliminary research model

Research theory seeks to explain phenomena in the real world. It does this by putting together existing knowledge components to explain the complex concepts of the real world; for example, research theory reveals, for the social science researcher, what is appropriate, reasonable, or legitimate. It can also be defined as explaining the roadmap to explore the relationships between and among variables, and the methodology for conducting particular type of research (Guba & Lincoln, 1994; Patton, 1990; Sarantakos, 2002). Sekaran (2000) and Babbie (2004) identified that most of the research in the domain of social science has been exploratory, explanatory or descriptive. Exploratory research is used to seek a preliminary understanding of phenomena, explanatory research is used to identify and study the relationships among various aspects of phenomena, and descriptive research is used to describe the phenomena themselves.

Even though the research reported here is exploratory, Rogers' (1995) innovation diffusion theory (discussed in Chapter 4 *Research methodology*) will be used to structure the determinants. Rogers' work has been used previously to understand the phenomena involved in adopting medical equipment innovations in the healthcare industry (Meyer & Goes, 1988; Scannel, 1971). In his influential work, Rogers (1995) suggests five perceived attributes of an innovation: relative advantage, compatibility, complexity, trialability and observability.

Previous researchers in the domain of adoption and innovation diffusion theories have agreed that the intention to use a new technology is based on an adopter's perceived belief about the innovation itself (Ajzen & Fishbein, 1975; Davis, 1989; Davis et al., 1989; Rogers, 1995). The research reported here focuses on the healthcare professionals' perceptions about the benefits and difficulties of using wireless handheld technology in an Australian healthcare setting. Such perceptions can lead to a better understanding of the relative advantages that adopting the innovation could bring to existing systems (Iacovou et al., 1995). Ajzen argued that the "perception of control" can play a vital role in determining the decision to use an innovation. This perception leads the RTA theory towards the TPB theory (Ajzen, 1991). Therefore, factors such as perceived attributes as identified by Rogers' IDT and perceived usefulness as identified by Davis in TAM can be used interchangeably, as they are in this research framework. TRA also summarized that external factors can affect the beliefs and perceptions. Such factors are considered to have positive effects on the intention to use the innovation. On the other hand, these variables can also have a negative effect on the intention to use, as perceived readiness, including available infrastructure, lack of wireless healthcare applications, and suitability of wireless technology in a healthcare setting may affect the perception of healthcare professionals (Hart and Porter, 2004; Iacovou et al., 1995; Kendall et al., 2001).

As stated earlier, the theoretical lens is drawn from the well established adoption theories in the domain of information systems; that is, the Diffusion of Innovation Theory (Rogers, 1995), the Theory of Reasoned Action (Ajzen & Fishbein, 1975), the Theory Plan Behaviour (Ajzen, 1991), and the Technology Acceptance Model (Davis et al., 1989; Davis, 1989). (See Chapter 3: *Review of adoption theories*, for detailed analysis of these theories and models). For example the focus group data analysis identified factors such as relative advantage, compatibility, complexity, experience and voluntariness, perceived usefulness, perceived ease of use and trialability, in addition to healthcare-specific variables. Therefore, the incorporated theoretical lens which will guide this study is shown in a pictorial format below.

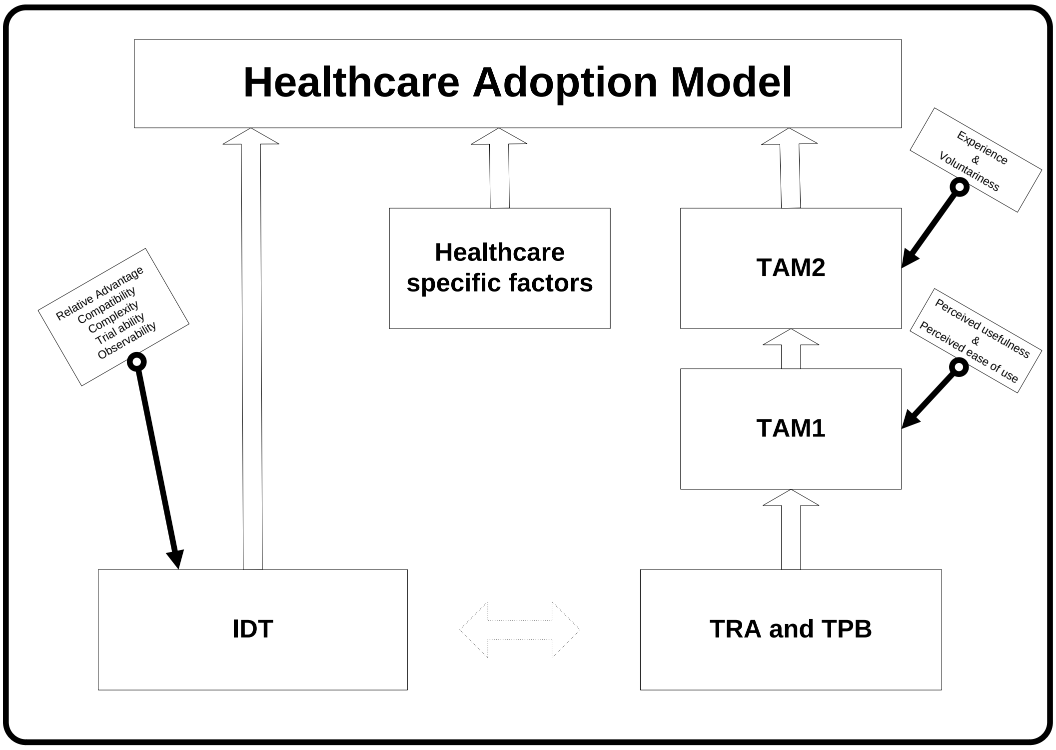


Figure 7.1: Initial theoretical lens of this research study. The healthcare specific factors are expanded below.

Most of the studies reviewed in the literature have been conducted either in a manufacturing environment, in the context of desktop computers or among the students using a particular software application (Grist et al., 2007; Gururajan et al., 2008; Spil, 2006). No comprehensive study has been found which explores the adoption of wireless technology in a healthcare environment. However, some of the published literature in the domain of information systems has been related to factors and variables specific to a healthcare setting. The combination of healthcare and wireless is unique. Therefore, investigating the determinants of the adoption of wireless technology in healthcare will provide new knowledge leading to the successful adoption of this technology in healthcare settings. In addition to the factors identified by the prominent adoption theories in the domain of information systems, this study has been able to explore additional factors through the literature review and focus group discussions with healthcare professionals. (See Chapter 6: *Qualitative data analysis* for a detailed analysis of focus group discussions.)

To synthesize these, the research model chosen for this research incorporated some health-specific variables, in addition to factors from the various adoption theories. Hence, variables from the literature and the first-hand data collected from the healthcare professionals were incorporated to develop the intention-to-adopt[9] model for the wireless technology in the healthcare setting (see Figure 7.2). Consequently, the snapshot of the intention to adopt model for the wireless technology in healthcare setting which helps to explain factors that influence the intention of healthcare professionals to use wireless technology in a healthcare environment can be represented graphically, as shown in Figure 7.2.

9 The terminology “Intention to adopt” or “intention use” has been used interchangeably in this research

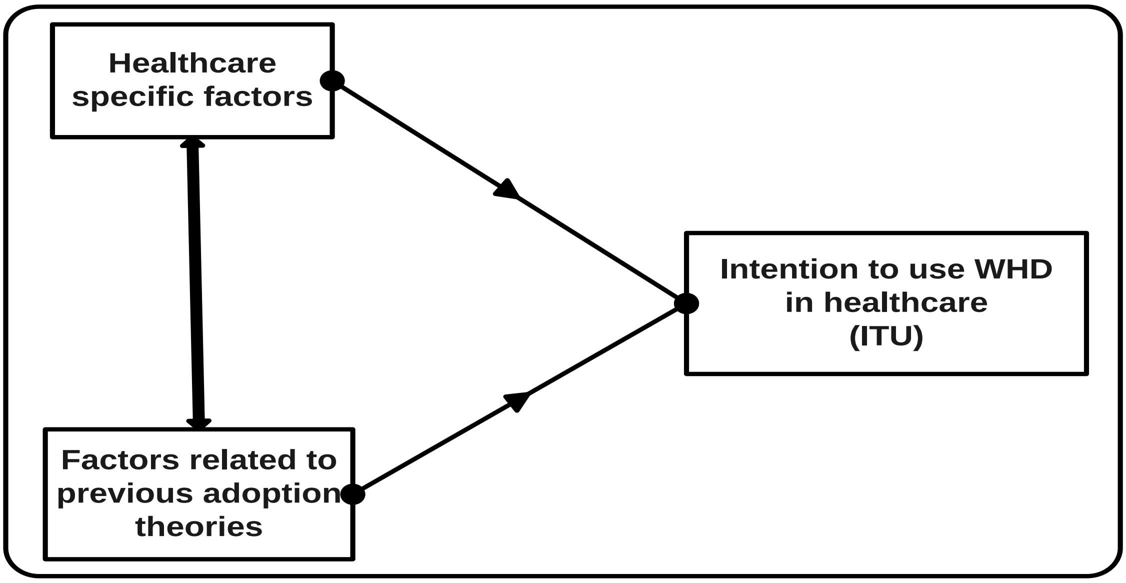


Figure 7.2: Snapshot of adoption model for WHD in healthcare environment

Therefore, as mentioned in the previous chapter, qualitative data analysis provided valuable insights about professionals' views and opinions about adoption of wireless technology in a healthcare setting.

7.3.1 Research model

The usefulness of the findings of any research depends on the quality of the data collected and the quality of the data analysis, and both heavily rely on the research design. Any flaws and errors in the research design can influence the research process. In this study, it was anticipated that several factors would influence different levels of adoption of wireless technology and its application in the healthcare environment. Due to the limited empirical studies available to assist in the selection of the most significant variables for wireless technology and application adoption, a number of possible relevant factors have been identified from the literature review. These were grouped into four broad categories: technological factors, organizational factors, end-user factors, and management factors. This grouping was chosen to reflect and distinguish between perspectives that were technology-specific, organization-specific, end-user-specific and management-specific. Therefore, all these determinants were able to be incorporated in the initial adoption framework, as shown below:

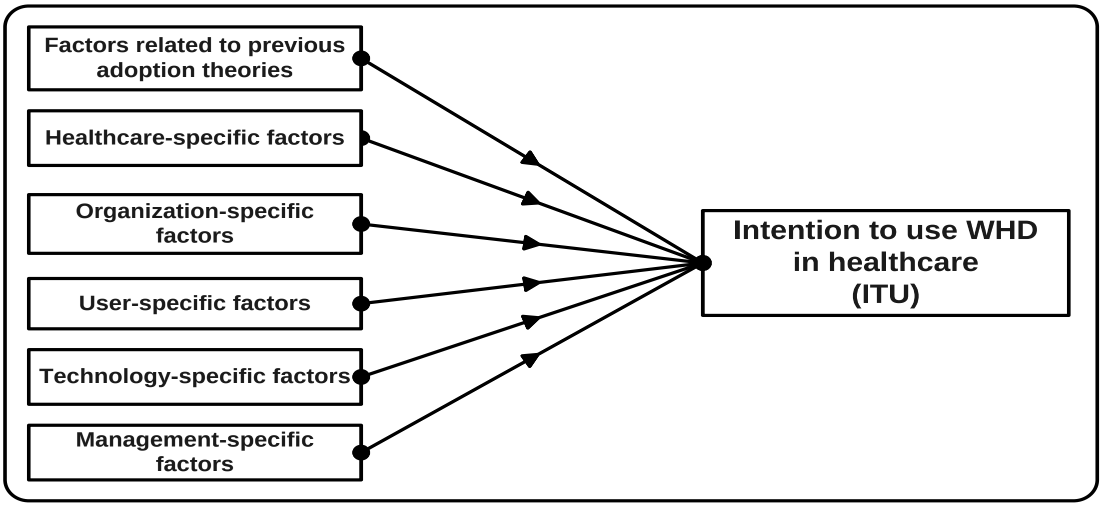


Figure 7.3: Refined initial adoption framework for WHD with additional factors in the healthcare environment

This preliminary research model was needed to incorporate and test the well-established adoption theories and models, and to extend the IOD, TRA, TPB, and TAM theories for wireless technology in the healthcare environment by identifying and incorporating healthcare-specific factors.

The three specific healthcare factors for wireless technology identified through the focus group discussions were Clinical practices (CP), Social context (SC), and Compatibility (C). It is believed that in addition to traditional factors for adoption, these factors influence the intention to adopt wireless technology in an Australian healthcare environment. These factors were tested by collecting views and opinions from the wider community of the Australia healthcare industry, using the survey instrument described earlier.

The conceptual model was further developed by including readiness and healthcare factors to the already-tested factors in the adoption domain. These added factors, which influence the intention to adopt wireless technology in the Australian healthcare environment, were developed from the literature and the initial qualitative data analysis. The initial research model developed for this study was therefore as follows.

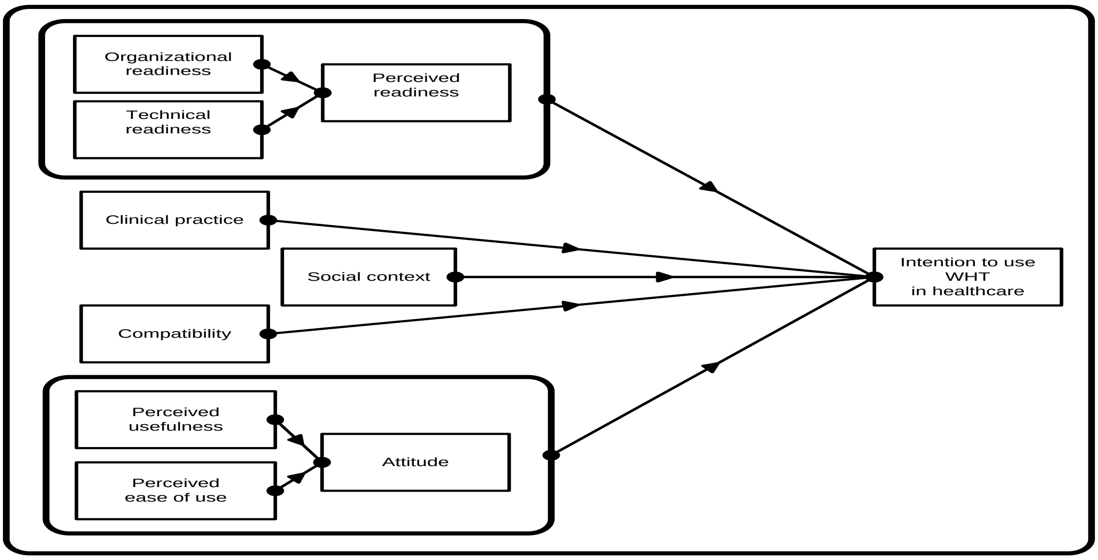


Figure 7.4: Further refinement (after focus group data analysis) initial adoption model for wireless technology in Australian healthcare environment

The following section provides a discussion on the constructs introduced in the initial adoption model for wireless technology in the Australian healthcare setting.

7.3.2 Definition of factors used in the initial framework

There are seven main factors (or constructs) in the research model: Organizational readiness (OR), Technical readiness (TR), Perceived readiness (PR), Clinical practices (CP), Social context (SC), Compatibility (C), Perceived usefulness (PU), Perceived ease of use (PEU), Attitude (A) and Intention to use (ITU). In the model, OR, TR, PR, CP, SC, C, PU, PEU and A are independent variables that help to predict the dependent variable, ITU. These constructs can be defined as follows.

Organizational readiness:

Organizational readiness (OR) in the context of wireless technology is the level of ICT sophistication that exists in the healthcare facility[10], the ability to provide financial and non-financial resources, the availability of knowledge, training, policies and procedures, and the degree of integration of clinical activities. Increased levels of leadership and commitment from management can lead to organizational readiness

10 This definition is developed specifically for this study

toward the adoption of wireless devices in a healthcare setting. Encouragement and level of strategic planning are also part of organizational readiness.

Earlier studies have identified the importance of organizational factors that influence adoption phenomena (Kwon & Zmud, 1987; Tormatzky & Fleischer, 1990). In the healthcare environment, the use of technology is a common feature, as healthcare professionals already use a range of sophisticated medical equipment. Thus, individual perceptions and available infrastructure can influence an intention to use the technology. For example, healthcare professionals are conversant with handling pagers, communication devices, X-ray machines, and desktop computers. In this study, clinical practice, social context, and compatibility of existing technology can play vital roles in the adoption of, or intention to use, the wireless devices in a healthcare setting. Therefore, this research will study the impact of these variables on adoption or intention-to-use in the context of a healthcare setting.

One other variable, observability, was included. Observability is “the degree to which the results of an innovation are visible to others” (Rogers 1995, p. 16) and reflects how explicit the results and outcomes of an innovation are. This variable, from Rogers’ IDT, was therefore tested in the healthcare environment as a construct under the label of Organizational readiness (OR) (see Figure 7.4).

Technical readiness

Technical readiness (TR) refers to an organization’s technical ability to install and provide the support required for the use of wireless technology. It refers to having adequate technical knowledge, awareness and interconnectivity, and reliability of the infrastructure available with respect to technical issues.

Another variable, trialability, is “the degree to which an innovation may be experimented with on a limited basis” (Rogers 1995; p. 16). It describes how easy an innovation is to try out or test. This variable will also be tested in the healthcare environment and this construct is included under the label of Technical readiness (TR).

Perceived readiness

Perceived readiness (PR) can encapsulate the perceptions of users about wireless technology. It also contains perceptions about usability, and the readiness of their organization to adopt the use of wireless technology. Examples include perceptions about the availability of electronic records, the ability to retrieve and store information electronically, available knowledge, and existing work practices.

Earlier researchers in the domain of adoption and innovation diffusion theories provided a solid background of evidence that adopter decisions and intentions to use new technology depend on their perceived belief about the innovation itself (Ajzen & Fishbein, 1975; Davis, 1989; Davis et al., 1989; Rogers, 1995). Such beliefs are influenced by the idea of *complexity*, which is defined as "the degree to which an innovation is perceived as difficult" (Rogers 1995, p. 16). Thus complexity measures how difficult an innovation is to understand, learn, and use. This research will test this construct for wireless technology in the healthcare environment. Consequently, this construct is included under the label of Perceived readiness (PR).

Perceived usefulness

Perceived usefulness has been defined as the degree to which an individual believes that by using a particular technology, his or her performance will be enhanced (Davis, 1989; Venkatesh et al., 2003; Wu et al., 2008). Perceived usefulness (PU) relates to an innovation's relative advantage; it is "the degree to which an innovation is perceived as better" (Rogers, 1995, p. 15) and measures both explicit and implicit advantages. In this research, the construct *relative advantage* is used to access the usefulness of wireless technology in the healthcare industry. Consequently, this construct is included under the label of Perceived usefulness (PU).

Perceived ease of use

Perceived ease of use (PEU), is directly borrowed from the original study of TAM, where perceived ease of use was defined as the degree to which an individual believes that using a particular technology would be free of effort. Perceived ease of use is expected to have a direct effect on the perceived usefulness and intention to use (Davis, 1989; Venkatesh et al., 2003; Wu et al., 2008).

Attitude

Attitude (A) is also directly borrowed from the original TAM. Attitude can be defined as an individual's behaviour towards using the technology. An individual's attitude can be either positive or negative towards a particular technology. Attitude can also be aligned with the previous adoption models such as TRA and TPA in the context of intrinsic motivation (Davis et al., 1992) and affect towards use (Thompson et al., 1991, Venkatesh et al., 2003).

Clinical practices

Clinical practices (CP) refer to the clinical procedures that can be accessed by wireless technology. For example, it can include factors related to quality of care, the opportunity to save time, increased concerns of healthcare professionals about communication channels, the management reporting process and the superior quality of information.

Social context

The Social context (SC) of the healthcare environment can affect the use of wireless technology. For example, the extent to which wireless technology in a particular healthcare setting is perceived to be socially acceptable would influence its adoption. How patients and healthcare professionals perceive this technology depend on factors such as their particular organizational culture or political environment, and this can have an effect on the potential use of wireless technology in any healthcare setting.

Compatibility

Compatibility (C) refers to the ability of wireless technology to integrate with existing procedures and technology. It can be measured as the degree to which the innovation is consistent with the existing practices in the healthcare environment; that is, the healthcare facility's ability to integrate the existing procedures, work practices and infrastructure with the wireless technology (Chau & Hu, 2002; Moore & Benbasat, 1991; Schaper & Pervan, 2007; Taylor & Todd, 1995). Innovation which is perceived as being incompatible with the clinical process, or incompatible with the objective of improving patient care or services, will eventually lead to the potential rejection of the innovation (May et al., 2001).

According to Rogers, compatibility is "the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of potential adopters" (Rogers 1995, p. 15) and measures how compatible an innovation is with the existing culture, structure, infrastructure, and previously adopted ideas. This construct was also tested for wireless technology in the healthcare environment. It is labelled as Compatibility (C).

Intention to use

In this research study the phrase *intention to use*[11] wireless technology is related to the level of the user's purposefulness or determination to use the wireless handheld technology in a given healthcare setting.

7.3.3 Synthesis of factors

In synthesising the factors described above, it is possible to divide them into two broad categories: healthcare factors and organizational factors. The simplest graphical representations of the determinants for the adoption of wireless technology in healthcare setting can now be drawn as shown in Figure 7.5.

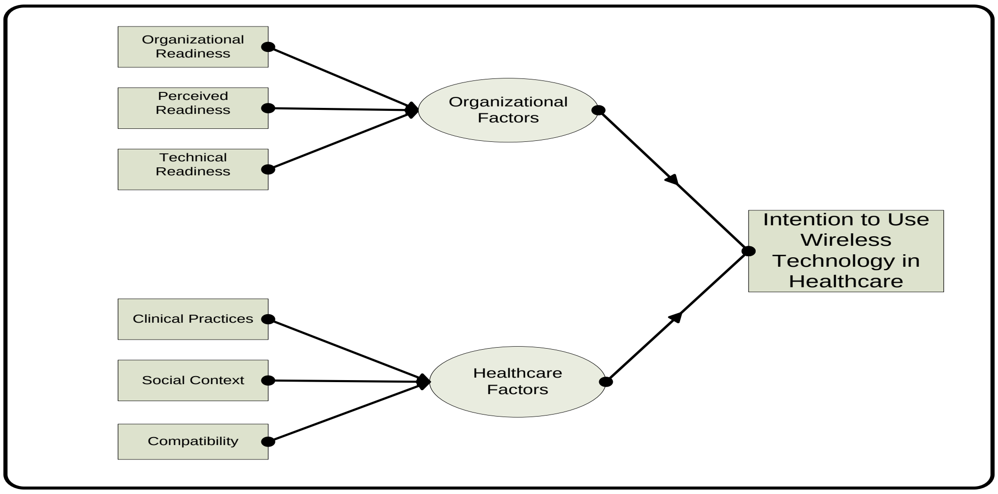


Figure 7.5: Simplified initial adoption model [12]for wireless technology in the Australian healthcare environment

11 In this research study only intention to use the wireless handheld devices, such as PDA's, were tested. There was no attempt to measure the "actual use of wireless handheld devices".

12 Variables, "perceived ease of use", perceived usefulness", and "attitude" were drop for further analysis and it is explained in chapter 8, section 8.3.8.

This model provided the basis for an exploration of possible hypotheses.

7.3.4 Initial list of hypotheses

From the initial model for the adoption of wireless technology in the Australian healthcare setting, the following provisional list of hypotheses was tested.

Hypothesis 1: *Perceived technical readiness of the healthcare facility will not indirectly facilitate the adoption of wireless technology in the Australian healthcare systems.*

Hypothesis 2: *Perceived organizational readiness of the healthcare facility will not indirectly facilitate the adoption of wireless technology in the Australian healthcare systems.*

Hypothesis 3: *Perceived readiness of the healthcare facility will not facilitate the adoption of wireless technology in the Australian Healthcare systems.*

Hypothesis 4: *Clinical practices will not affect the adoption of wireless technology in the Australian healthcare systems.*

Hypothesis 5: *Social context will not facilitate the adoption of wireless technology in the Australian Healthcare systems.*

Hypothesis 6: *Compatibility issues will not affect the adoption of wireless technology in the Australian Healthcare systems.*

Hypothesis 7: *Perceived usefulness of the wireless technology to the workforce will not indirectly affect the adoption of wireless technology in the Australian healthcare systems.*

Hypothesis 8: *Perceived ease of use of the wireless technology to the workforce will not indirectly affect the adoption of wireless technology in the Australian healthcare systems.*

Hypothesis 9: *Attitude of the workforce towards the wireless technology will not affect the adoption of wireless technology in the Australian healthcare systems.*

The above-mentioned research hypotheses can be incorporated into the initial research framework as follows:

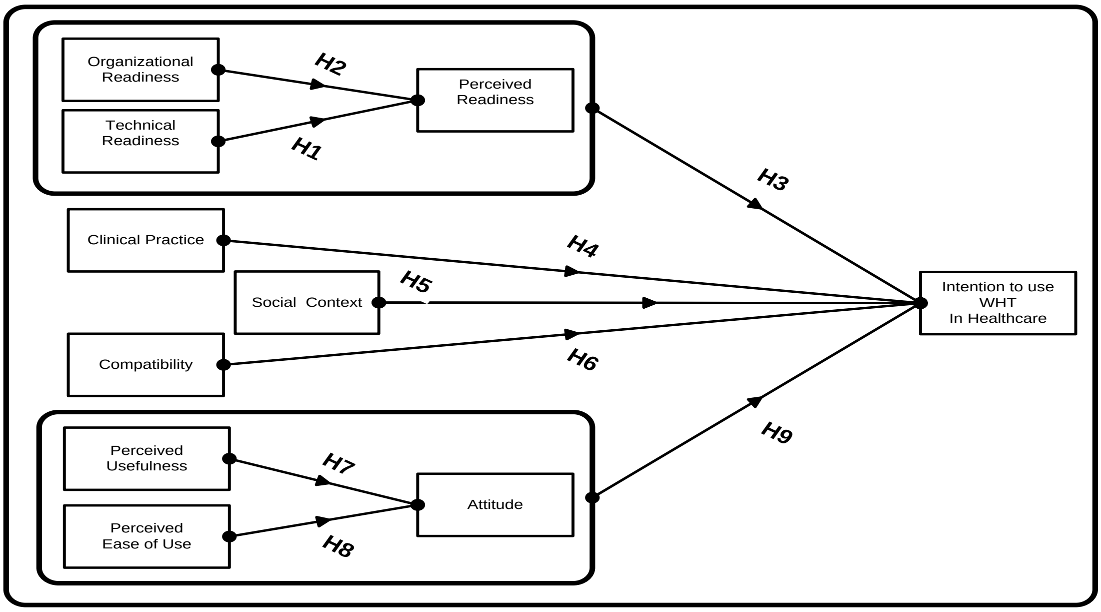


Figure 7.6: Nine hypotheses collectively resulted in the provisional theoretical model

7.4 Discussion

In order to test the adoptability of wireless technology in the healthcare environment, this study has incorporated two additional variables specifically related to the healthcare environment; namely Clinical processes (CP) and Social context (SC). These additional variables were identified through the qualitative data analysis presented in the previous chapter. However, the specific focus of this study has been to identify the internal and external determinants as perceived by a selected group of stakeholders from the healthcare industry. The possible hypothesized determinants impact on other mediating variables, and these have been derived from an extensive literature review, from group interviews and from discussions.

In this study the concept of readiness, in the context of organization and technology, represents healthcare professionals' beliefs and perceptions about the availability of resources and their ability to use wireless technology in the existing environment. Readiness may therefore influence their intention to adopt the innovation. Therefore, availability of infrastructure, financial and non-financial resources, availability of appropriate wireless healthcare applications, and suitability of wireless technology were considered critical to understanding the adoption of, or intention to use, wireless technology in the Australian healthcare environment.

In this research framework, Intention to use (ITU) has been treated as the dependent variable (DV). The independent variables (IDV) were Organizational readiness (OR), Technical readiness (TR), Perceived readiness (PR), Perceived usefulness (PU), Perceived ease of use (PEU), Attitude (A), Clinical practice (CP), Social context (SC) and Compatibility (C). (See Figure 7.6.) Further, Perceived readiness was modelled as the dependent variable for Organisational readiness and Technical readiness, and Attitude was modelled as the dependent variables for Perceived usefulness and Perceived ease of use. In the initial research framework, Intention to use is concerned with the prospective adopter's positive and negative views and their opinions about wireless technology in the Australian healthcare setting. These are referred to as drivers and inhibitors of adoption of wireless technology.

The framework suggested in this research has similar bases to the classical innovation diffusion models for adoption. For example, the concept of awareness is incorporated through internal and external sources through the Perceived readiness item in the research model. Individual views and opinions about Technical readiness and Organizational readiness of a healthcare faculty may lead to an adopter forming an opinion that could lead to his or her intention to use the wireless technology in a healthcare setting. As a result, a positive perception can lead to drivers, and a negative perception can lead to inhibitors for the adoption of wireless technology in a healthcare setting. It can be argued that this study has built upon the existing adoption theories by adding Perceived readiness by the user and by incorporating healthcare-specific variables such as Clinical practice, Social context and Compatibility.

7.5 Conclusion

This chapter has provided initial discussions about the theoretical lens and the determinants used to develop the initial framework for the adoption of wireless technology in the healthcare environment. These constructs are Intention to use (ITU) as the dependent variable (DV), and Organizational readiness (OR), Technical readiness (TR), Perceived readiness (PR), Perceived usefulness (PU), Perceived ease of use (PEU), Attitude (A), Clinical practice (CP), Social context (SC) and Compatibility (C). On the basis of these determinants, an initial set of nine hypothesizes was developed.

The next chapter will provide information about the quantitative data collection methodology adopted in the study.

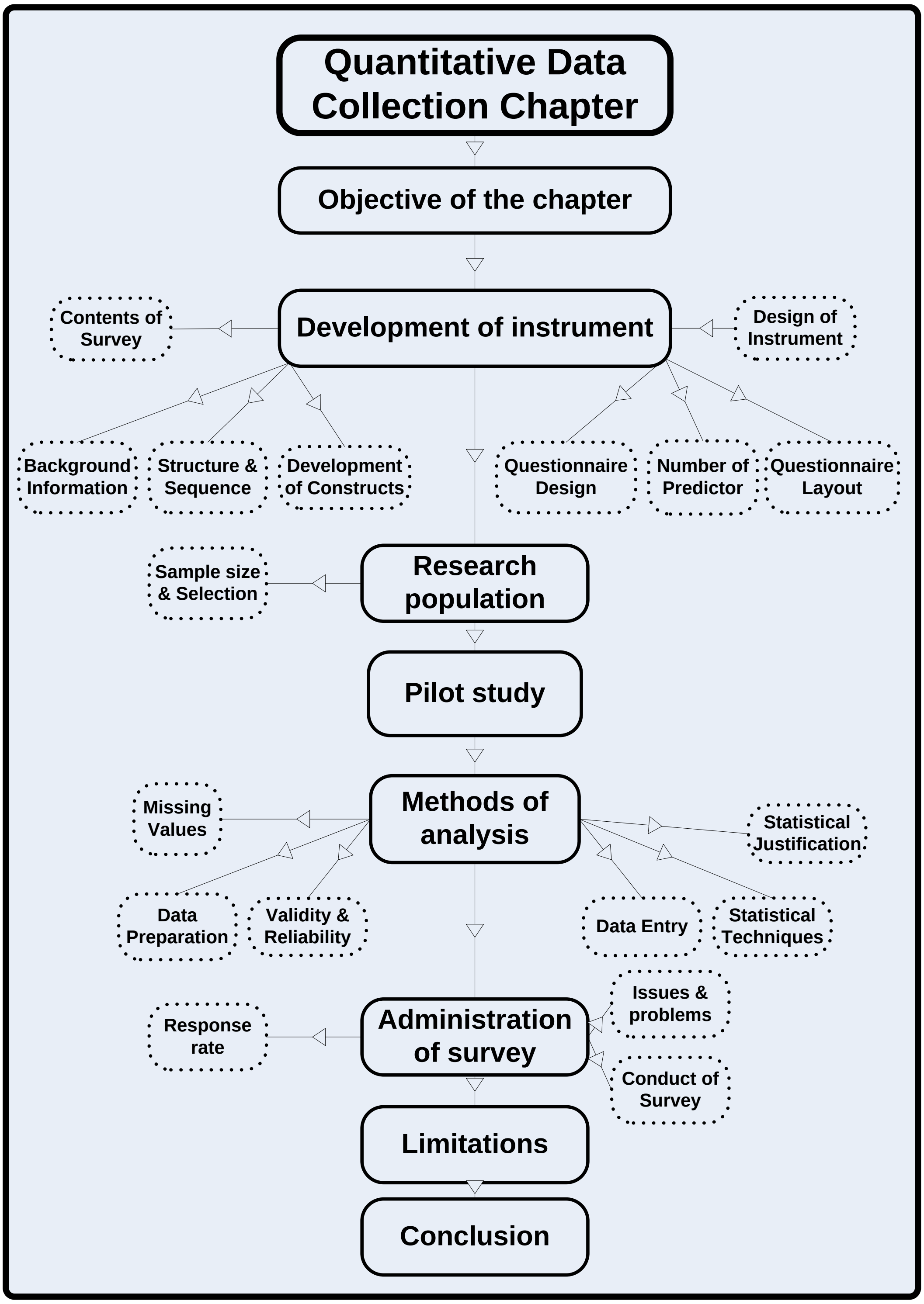
Chapter 8 – Quantitative Data Collection

8.1 Chapter Overview

The previous chapter provided information about the qualitative approach adopted in this research study. This chapter concentrates on the analysis of qualitative data and further refinement of the framework for the adoption of wireless technology in a healthcare setting. It is important to note that qualitative and quantitative approaches are complementary, so using both minimizes the effects of the limitations encapsulated in each if used alone. The findings from the qualitative approach played two critical roles: first, it helped in refining the framework developed for the adoption of wireless technology in the healthcare environment of this research; second, it helped to develop the survey questionnaire that gathered views and opinions from the wider community.

This chapter provides justifications and the process for the broader investigation of the framework through the survey technique. The chapter also provides information about the processes involved in developing, validating, pilot testing, and administering the questionnaire. In the context of research methodology, this is the third stage of the process. One of the main objectives of the survey technique is to acquire the views and opinions of the wider community about the determinants of adoption of wireless technology in a healthcare environment. The procedures and work reported in this chapter were used to strengthen and improve the generalization of the framework for the adoption of wireless technology in healthcare environment.

The brief layout of the structure of this chapter is shown below.


Quantitative Data Collection Chapter
Objective of the chapter
Development of instrument
Contents of Survey
Design of Instrument
Background Information
Structure & Sequence
Development of Constructs
Questionnaire Design
Number of Predictor
Questionnaire Layout
Research population
Sample size & Selection
Pilot study
Methods of analysis
Missing Values
Statistical Justification
Data Preparation
Validity & Reliability
Data Entry
Statistical Techniques
Administration of survey
Response rate
Issues & problems
Conduct of Survey
Limitations
Conclusion

8.2 Justifications of the quantitative approach

As mentioned in Chapter 4: *Research methodology*, this study has adopted a combination of qualitative and quantitative research approaches, and data is collected at three different stages. The first stage, exploratory focus group discussions, was aimed at capturing healthcare professionals' opinions and views about the use of wireless handheld technology in a healthcare environment. In the second stage, a questionnaire was developed from the findings of the first stage data analysis and the literature review. This stage aimed to capture the views of the wider community in the healthcare domain for the adoption of wireless handheld technology.

As justified in the methodology chapter, a mixed-mode methodology (qualitative and quantitative) was considered appropriate for this study. This section provides detailed descriptions and justifications of the quantitative approach adopted in the research methodology. The advantages of the questionnaire approach are its low cost, its convenience for participants, and the fact that it can be self-administered. Disadvantages of the approach are its low response rate and the inability of the researcher to control the conditions under which the respondents complete it. In such an environment, precise questionnaire items are very important and play a critical role in the process. Instructions and information provided to the participants not only improve the response rate, but also secure consistency in the way that the survey questionnaire is completed. For example, written information was provided to participants to ensure their anonymity, the security of information, confidentiality, expected outcomes, contribution of the research, and benefits to the wider community. Furthermore, it was clearly stated that their participation was voluntary and, preferably, that the survey should be filled in at one sitting. The following sections provide details about the development of this survey instrument.

8.3 Development of instrument

This section will describe the steps taken to develop the instrument for the quantitative part of the research.

8.3.1 Background information

In the first stage, the literature review identified drivers and inhibitors for the adoption of wireless technology in a healthcare environment. From this review, questions for the focus group sessions were developed. This list of questions went through a rigorous process of review. A list of these questions is provided in Appendix 9. These questions were designed to acquire first-hand knowledge about the views and opinions of healthcare professionals, which related to the use of wireless technology in a healthcare environment. Detailed information about the focus group discussions has been provided in Chapter 6.

Qualitative data from the focus group discussion sessions were analyzed through the Leximancer software, and detailed discussions on how these themes were developed have been provided in Chapter 7. Before developing the questionnaire from the focus group data analysis, the literature was once again reviewed to maintain currency in this domain. Clearly identified themes from the analysis of the focus group data helped to develop the survey instrument and refine the framework for the adoption of wireless technology in a healthcare environment.

8.3.2 Questionnaire layout

In the development of the questionnaire, a funnel approach was adopted, where the questionnaire started with general and easy questions and progressively moved to specific and more difficult ones. To keep the participants motivated, and to elicit the most accurate replies from them, demographic questions were placed at the end of the questionnaire, as respondents need to think harder when answering these questions. Because of this, as the respondents progressed towards the end of the questionnaire, the demographic questions needed little or no effort at all. The technique of starting with easy questions and gradually improving the complexity not only made for easier progression, but also reduced the likelihood of participants withdrawing. This idea has been supported by other researchers (Burns, 1997; Cavana et al., 2001; Remenyi et al., 1998).

In addition to this, the development process of the instrument also followed the guidelines provided by prior studies in the information systems domain (Bourque and Fielder, 1995; Vaus, 2002). Some of the guidelines adopted while developing the instrument were as follows:

- A covering letter was attached with the instrument to clarify the objective, aim, outcome and contributions of the study.
- The instrument was reviewed by experts, peers, academics, and healthcare professionals.
- Questions and scales were constructed to reflect neutrality.
- Instructions about the filling in the survey were written clearly.
- Response categories were designed to reduce possible biases.
- To measure a particular construct a multi layer approach was adopted.
- A thorough pilot test of the instrument was conducted to ensure readability, understanding, and a stress-less experience while filling out the form.

8.3.3 Number of predictors

The number of predictors used in any research study can vary. Stevens suggested that the number of predictor items required per construct can be 15 for reliable results (Stevens, 1986). For this study, there were seven constructs (one dependent variable, *Intention to use*, and six independent variables: *Organizational readiness*, *Technical readiness*, *Perceived readiness*, *Clinical practices*, *Social context* and *Compatibility*). Initially, the instrument contained 10 constructs and 120 questions; i.e. 12 items measuring a single construct; however, the pilot study revealed that the overall length of the questionnaire needed to be reduced due to the nature of the healthcare industry and the participants in the study (as explained below).

In the final instrument, there were 40 questions for the six predictors (independent variables) and six questions for the seventh (dependent) variable. In addition, there were seven questions related to the demographics of the participants. Therefore, on average there were eight questions per construct in the final instrument. Several researchers in information systems have supported the use of shorter survey instruments (Nelson et al., 2004; Zikmund, 1994; Zikmund, 2002). A detailed description and justification of the process adopted to reduce the overall length of the instrument used in this research are provided below.

8.3.4 Style of questions

Zikmund (1997) suggested that in order to gather accurate data with minimum respondent fatigue, it is important that a questionnaire needs to be brief, neat, attractive and easy to follow. Zikmund also suggested that a questionnaire return rate can be improved by keeping participants interested and motivated throughout the completion process. Consequently, while developing and designing the questionnaire in this study, to keep the motivation high for the participants, the layout was carefully designed. For example, the length of the survey was restricted to a single sheet of paper. One side of the sheet provided information about the importance of the research, and the potential benefits for the participants were explained clearly. The research objectives, aims, and the contribution of the research to the general community were also explained. To assist understanding, the introduction included a visual component — a few pictures related to the uses of wireless handheld technology in healthcare. The other side of the sheet comprised the questions. The layout of this side started with an appropriate heading, followed by the questions, which were divided into eight sections to improve readability. All questions were grouped by topic in a logical sequence. The questionnaire started with simple questions; as indicated earlier, the demographic information was located at the end of the questionnaire to retain the participants' interest Frazer and Lawley (2000).

To provide an attractive visual appearance, and to help with ease of reading, alternate questions were shaded gray (with a white row in between; see Appendix 9). To ensure readability and clarity, a simple font and point size (12 Times New Roman) were chosen.

To minimize any ethical concerns respondents might have, it was clearly mentioned in the introductory section of the study that ethical approval had been obtained from the Toowoomba district health services and the USQ ethics committee. For those who needed further information on the study, contact information about the principal supervisor and the researcher was also provided. Furthermore, there was no personal information gathered through this survey instrument, making it impossible to identify any individual participant in the study.

8.3.5 Nature and design of questions

The structure of the questionnaire included dichotomous questions, multiple-choice questions and scale questions. For example "Yes or "No" options were employed for questions like gender status, and five stages of the Likert scale were used to measure the responses for the constructs (ranging from "Strongly agree" to "Strongly disagree" based on the reliability and appropriateness of this study. For example, in the questionnaire, a five-point Likert-type scale was used to measure the response of the participants to how strongly each item was perceived by them in adopting wireless technology in a healthcare setting. A five-point Likert scale has been one of the poplar techniques use by researchers (Zikmund, 1997; Adams et al., 1992; Nelson et al., 2004; Wynekoop et al., 1992). The multiple-choice options were appropriate for questions relating to individual profiles, such as profession, experience and qualifications (Foddy, 1993; Czaja & Blair, 2003).

In any quantitative instrument, the scaling of items helps in the analysis of each theoretical construct developed in the framework so that statistical tests can be developed to verify the constructs and their relationships. Zikmund (1988) stated that it is important to consider the sensitivity of the scale when measuring the attitudes of respondents. In this study, a five-point response scale, from *Strongly agree*, *Agree, Neutral*, *Disagree* to *Strongly disagree* was used as this is more sensitive than a three-point response scale. In this context, the term *sensitivity* can be defined as the ability of the questionnaire to accurately measure the views and opinions of the respondents about the variables. Furthermore, special care was employed to ensure that questions were structured, closed-ended, clearly stated, unambiguous and easy to follow.

The conclusion section of the instrument concentrated on the profile of the participants. This section of the instrument was developed very carefully to enable analysis of the following:

- Familiarity about the demographic of the sample
- Analysis in sub-groups by age, gender, qualification, and experience. Such a strategy also provides the opportunity for further comparisons between and among these variables if required.
- Opportunity to compare the profile of the participants to that of the whole population to justify the representativeness of the sample.

During the development stage of the instrument, attention was paid to the sequences and type of questions being asked in the questionnaire. The sequence of questions is critical in keeping the motivation of the participants to complete the questionnaire effectively, and can influence the findings of the study (Malhotra et al., 1996b). Questions were developed from general to specific, in order to ensure the smoothness of the flow without resorting to the use of section headings. Headings were omitted to avoid the possibility that they would influence the respondent while filling in the survey. Questions in each section were organized to minimize the effect of order bias by the participants while filling in the questionnaire.

The items used to measure the specific variables were adopted from previous research reported in the literature, with appropriate modification to make them suitable for this study (Gururajan et al., 2005a, Gururajan et al., 2005b, Lu et al., 2003, Lu et al., 2005). The questionnaire went through several revisions with academics and healthcare practitioners. Specific attention was given to each question to ensure that it was necessary and adequately covered. Each question was also checked to ensure that it provided enough information and was easy to understand (Malhotra et al., 1996b). For example, the questionnaire began with questions like "Do you use wireless handheld devices?" and "Are wireless handheld devices suitable for your job?". Subsequent questions measured respondents' views and opinions about adoption of wireless technology in a healthcare setting. While developing the instrument, technical terms and jargon were avoided, and only brief, legitimate and applicable questions were included (Zikmund, 1997). While designing the instrument and developing the questions, consideration was given to ensuring that the participants required a minimum amount of effort to fill in the instrument (Emory and Cooper, 1991).

In summary then, all possible care was taken in developing the instrument to meet the objectives of the research: words, terminologies and phrasing of sentences were chosen carefully and revised several time by healthcare professionals and the researcher. According to Peterson (2000), there are no specific guidelines or formal, comprehensive rules available to determine how questions should be worded or phrased in a survey instrument (Peterson, 2000). Guidelines provided by Neuman (1997) for framing sound questions and wording were followed to avoid any undesirable wording effects in the instrument.

8.3.6 Structure and sequence

A questionnaire can be subdivided in to three general sections: an introduction, the questions, and a conclusion (Alreck and Settle, 1985; Emory and Cooper, 1991). The basic objective of the introductory section is to inform the potential participants about the research objectives and benefits. In this study the introductory letter explained the aim, a description of potential participants, the time needed to fill in the form, the anticipated outcome, and benefits to the healthcare industry. The introductory letter also clearly stated that participants' involvement was purely voluntary, and provided contact information about the researcher and the supervisor in case participants needed further information.

Alreck and Settle (1995) have argued that the instrument can be made more efficient and effective if related questions are grouped together. In this research, the questionnaire contained items and scales of measurement. This part of the instrument was directly related to the research question, the hypotheses and the criteria the instrument was measuring, and the responses of the participants. To ease the task of filling out the instrument, therefore, related questions were grouped together in various sections.

The survey questionnaire consisted of 11 sections. Ten of these were the constructs identified in the methodology chapter; the 11th section related to demographic information. These sections were titled as *Organizational readiness*, *Technical readiness*, *Perceived readiness*, *Ease of use*, *Perceived usefulness*, *Attitude*, *Clinical process*, *Communications*, *Compatibility*, and *Intention to use*. In addition to this list, the final section of the questionnaire was on *Demographics information*, and included the type of institution, age, gender, qualification, experience, and profession of the participants.

8.3.7 Contents of survey

For the design of a survey questionnaire it is important to consider and understand what questions need to be included, and in which order they should be placed (Emory & Cooper, 1991; Malhotra et al., 1996a; Malhotra et al., 1996b). Aaker (1996) suggested that questions in the survey questionnaire should be guided by the research question in the study. Zikmund (1997) suggested that questions should also be guided by the criteria of relevance and accuracy in addressing the research question. From the analysis of the focus groups transcripts, ten different themes were identified. The questions in the survey instrument were related to these themes as shown in Table 8.1.

Table 8.1: Summary of themes and items associated with each construct

No.	Categories	Variables	Items
1	Perceived usefulness	Job satisfaction	Performance; Efficiency; Productivity; Easier-to-do day-to-day tasks/Quality of services
		Productivity	Cost saving; Time saving; Save effort; Reduce inaccuracies
		Outcome expectations	Improve patient care; Workload reduction; Real time access; Reduction in transcription error/inaccuracies
2	Technical readiness	Technical know-how	Technical knowledge/expertise; Local champion; Attitude towards technology; Interface usability
		Device characteristics	Device quality/usefulness; Usability features; Device standard; Physical features
		Technical issues	Infrastructure; Connectivity; Technical support; Reliability and security
3	Perceived readiness	Support	Training; Electronic records; Local champion; Friendly environment
		Environment	Business competition; External stack holders; Planning; Structure
		Integration	IT infrastructure; Existing data bases; Existing workflows; Existing format rigidity
4	Organizational readiness	Resources	Financial resources; Awareness; Non financial resources; Standard and procedures
		Non-IT infrastructure	Clinical impact; Compatibility; Support; Training
		Organizational/ management issues	Management commitment; Leadership; Organizational culture; Strategic direction
5	Perceived ease of use	Complexity	Integrations of existing processes; Security; Perceptual constraints; Device usage
		Features on device	Flexibility; Customizations; Design features; Device characteristics
		Ease of use	Mobility; Data entry features; Speed of transmission; Comfort with device
6	Attitude	Beliefs	Workload; Time Saving; Productivity; Efficiency
		Perception	Quality of care; Quality of Information; Public image; Job satisfaction
		Motivation	Workflow; Error reduction; Communications; Easy access to information
7	Clinical practices	Workflow	Evidence base practice; Workload issues; Quality of care/clinical performances; Existing process/clinical flow
		Clinical performance	Time management; Quality of information/error reduction; Electronic medical records; Report Management
		Communications	Real time connectivity; Communications; Delivery of information; Learning
8	Social context	Suitability	Unique activity; Demographic characteristics; Working environment; Unique clinical process.
		Cultural values	Local values; Local politics; Organizational culture; Organizational politics
		Social influences	Individual behaviour; Social values; Competitors' influence; Patient expectations
9	Intention to use	Job fit	Improve job performance; Making job easy; Mobility; Flexibility
		Benefits	Time saving; Real time access for information; Portability; Instant communication
		Extrinsic motivation	Patient expectations; Pear group pressure; Added value; Healthcare environment
10	Compatibility	Technological characteristics	Reliability; Standards; Competing technologies; Existing technology
		Clinical processes	Clinical technology; Clinical data; Methods/relevant solutions for PDAs; Wireless applications
		Integration	Work practices; Work style; Inter-compatibility; Existing processes/systems

It was critically important to have the questions relate to all the items mentioned above; further, the wording of each question needed to be simple and straight-forward without the use of technical terms. The peers (academics who do research in the healthcare domain) and healthcare professionals revised the wording of the questions (English is the third language of the researcher). The initial version of the questionnaire produced 142 questions. Given the nature of potential participants (healthcare professionals), such a lengthy questionnaire would be time consuming to fill. The instrument went through several formal and informal reviews. The feedback given through the review process included the following:

- There were too many themes.
- Questions were lengthy and sometimes too technical.
- Too many questions measuring the same item.
- There were some replications among the questions measuring the different item in different themes.
- Some of the questions were ambiguous.
- Questions needed to be simple but meaningful.

After the peer review process, the instrument was revised by reducing the length and number of questions asked in the survey. The techniques adopted in this process included:

- Number of themes measured in the survey was revaluated and themes which were well developed and tested in the previous studies were removed. For example *Ease of use*, *Usefulness*, and *Attitude* have been well researched in the domain of information systems. During a consultation with the supervisor and healthcare professionals, it was decided that questions relating to these themes would be eliminated to reduce the overall length of the survey instrument. Once these themes were identified, numbers of items measuring the remaining themes were reduced.
- Replicated questions were either regrouped or eliminated.
- The number of questions measuring the same constructs was reduced.
- Some of the questions were reworded to keep them brief and simple.

8.3.8 Development of constructs

The questionnaire items were used to measure and validate the constructs adopted from previous studies (Davis, 1986; Gururajan, 2004a, 2004b; Gururajan & Murugesan, 2005; Venkatesh et al., 2003). These items were customized with appropriate modifications to suit the adoption of wireless handheld technology in a healthcare environment. Table 8.2 provides a summary of determinants used in this study and their association with the hypothesis.

Table 8.2: The Constructs, Concepts and Variables associations to relevant hypothesis

No.	**Conceptual definition**	**SPSS variable name**	**Operational definition**	**Scale**	**Relevant hypothesis**
1	Technical readiness	TR	1 = Strongly agree 2 = Agree 3 = Neutral 4 = Disagree 5 = Strongly disagree	Interval	H1
2	Organizational readiness	OR	1 = Strongly agree 2 = Agree 3 = Neutral 4 = Disagree 5 = Strongly disagree	Interval	H2
3	Management readiness	MR	1 = Strongly agree 2 = Agree 3 = Neutral 4 = Disagree 5 = Strongly disagree	Interval	H3
4	Perceived readiness	PR	1 = Strongly agree 2 = Agree 3 = Neutral 4 = Disagree 5 = Strongly disagree	Interval	H4
5	Clinical practices	CP	1 = Strongly agree 2 = Agree 3 = Neutral 4 = Disagree 5 = Strongly disagree	Interval	H5
6	Social context	SC	1 = Strongly agree 2 = Agree 3 = Neutral 4 = Disagree 5 = Strongly disagree	Interval	H6
7	Compatibility	Compatibility	1 = Strongly agree 2 = Agree 3 = Neutral 4 = Disagree 5 = Strongly disagree	Interval	H7
8	Intention to use	Intention	1 = Strongly agree 2 = Agree 3 = Neutral 4 = Disagree 5 = Strongly disagree	Interval	H8

8.4 Research population

Malhotra et al. (1996b) suggested that samples of any population need to be selected carefully, so that valid conclusions can be drawn about the actual population. The population in this study is healthcare professionals, which include physicians, nurses, technicians and administrative staff involved with data management and users with some exposure to wireless handheld technology. Sample size needs to be a true subset of the entire population, as in most of the cases population size can be very large and costs associated with collecting data from the whole population can be enormous. According to Martins et al. (1996), population should be defined in terms of element, sample unit and size. Sudman and Blair (1999) identified some of the critical dimensions associated with sampling strategies, such as recognizing the variability in the size of various units in the population, picking the appropriate unit within the population, and identifying the appropriate respondent for collecting the required information within the selected unit. The strategy adopted in this study to identify the participant sample was to consult directly with the immediate supervisors or managers of the various healthcare units. They were to make their selection of participants on the basis of participants' exposure to wireless handheld technology (Sudman & Blair, 1999).

8.4.1 Sample size and selection

Fowler (1993) identified three features of the size of the sample where a questionnaire is to be distributed. These are *Sampling frame*, *Sample size*, and *Sample selection criteria*; they are closely interrelated. This study concentrated on the healthcare professionals in private and public hospitals with some exposure to wireless handheld technology. It was anticipated that a good majority of the healthcare professionals would have an exposure to pagers, smart phones, wireless internal telephones and PDAs. The decision to confine the distribution of the questionnaire to the Australian state of Queensland was due to the following:

- This state is large enough to provide participants with a wide variety of backgrounds.
- This state has an adequately large number of private and public hospitals.

- The state provided manageable logistic features (for example, distance and access).

The target population for this study was healthcare professionals (physicians, nurses, administrators and technicians) with some exposure to wireless handheld technology, and who were employed in a public or private hospital in the state of Queensland. Deciding on an appropriate sample size with sound theoretical backing from the literature is not an easy task. According to Bartlett et al., (2001) studies in the field of social science use no well-established procedure to define the sample size. Krejicie and Morgan (1970), however, have attempted to simplify the process for establishing a sample size. Roscope (1975) provides a rule of thumb that a sample lying between 30 and 500 should be appropriate for most research; for categorical data where data can be subdivided, a sample of 30 for each sub-division may be appropriate. In multivariate research, the sample size could be 10 times the number of variables; with experimental research a sample size of 10 to 20 could be sufficient (Bartlett et al., 2001; Krejcie & Morgan, 1970).

However according to Alreck and Settle (1985), if the population size is around 10,000 or more, a sample size of between 200 and 1000 respondents is acceptable. Stevens (1986) suggested that on average, 15 cases per predictor variable would be acceptable to yield reliable predictions. Lwanga and Lemeshow (1991) argue that sample size depends on the aim, nature and scope of the study; Lachin (1981) adds the type of analysis being used. As this study was exploratory in nature, and due to the healthcare professionals' workload commitments, it was anticipated that following the above guidelines, an average of 7 to 8 cases for each item would be sufficient for advanced level statistical analysis, such as multiple regression analysis and structural equation modelling. In the final questionnaire there were 46 questions measuring seven constructs.

8.5 Pilot study

Before the distribution of the questionnaire to the wider community, a pilot study was conducted with academics and healthcare professionals. This exercise was undertaken to assess the reliability and validity of the instrument. Sekaran (2002) argued that a pilot study is helpful to eliminate ambiguity and bias, to improve the questionnaire in terms of ease of understanding and to facilitate analysis. Prescott and Soeken (1989) also stressed that a pilot study can guide the methodological development plans for research, can help assess the clarity of the questionnaire's items, and can improve its completion time and reliability. Consequently, for this research, after the questionnaire had been refined through peer review, a pilot study was conducted to test the instrument using a group of 35 healthcare professionals, including academics, nurses, healthcare researchers and administrative and supervisory staff from Toowoomba Base Hospital, Mater Hospital, Prince Charles Hospital and Bailey Henderson Hospital (all in Queensland). The pilot study was conducted to further fine tune the questionnaire, to improve the scales, to identify problems with the process of completing the questionnaire, and to calculate the average time to fill it out. This brief sample is similar to the target population selected for this research. This pilot testing of the instrument before the distribution of the questionnaire to the wider community provided an opportunity to assess the construct validity and the reliability of measures (Straub, 1989).

In addition to the pilot testing of the actual questionnaire, a one-page additional feedback sheet, containing only eleven questions, was also developed to obtain feedback about the experiences of the participants on the pilot study. The following areas were included in this questionnaire:

- Time required by the participant to complete the questionnaire
- Readability of the questionnaire
- Flow and sequences of questions
- Difficulty in completing the document, and any stress level
- Ambiguity, clarity, and effectiveness of the questions.

The feedback from this one-page addition helped in measuring the experiences of the participants during the actual process of filling in the questionnaire. This additional feedback provided information about participants' stress levels, the time taken to complete the task, the document's readability, the clarity of the terminology used, the ease of filling in the questionnaire, the ease with which the questions flowed, any ambiguity in questions, and the questions' ability in effectively measuring the participants' responses. The feedback from the pilot study recommended the following changes to the main instrument:

- The questionnaire was too long
- Some formatting changes were needed to improve readability
- There was some replication
- It took too long to complete the questionnaire
- Some questions needed to be reworded
- Some sequences had to be rearranged
- To keep the questions short and precise, the acronym WHT was used instead of "wireless handheld technology"
- The length of the questionnaire was reduced to a single page
- To provide a more representative response, healthcare facilities were included, even without actual experience of wireless handheld devices, as long as they had some exposure to wireless technology.

Feedback from the pilot study was further reviewed with the supervisor and the other academics and practitioners in the domain of healthcare and technology adoption. A decision was made, with the help of the supervisor, to review the instrument thoroughly so as to address the issues highlighted in the pilot study. The changes were made prior to the primary study. During the process of reviewing and refining the instrument, the following strategies were adopted.

- As there were too many themes, the literature in the information domain was revisited to identify the themes that had already been tested and well established in the context of adoption. For example, constructs such as *Perceived ease of use* and *Perceived usefulness* were two of the main factors in the TAM1 and TAM2 of Davis's technology adoption model. These constructs had already been tested repeatedly in various domains and in the context of the field of information systems. Therefore, a decision was taken to drop these constructs from the questionnaire as there was adequate research information available on these aspects. Therefore, contribution by other studies with respect to these constructs for the adoption of new technology was considered well matured.

- Each theme and its corresponding items were reviewed to reduce the overall questions in the instrument. For example, the theme *Attitude* was considered to be outside the scope of this study as the study was not measuring the attitude of the wireless handheld technology adoption in the healthcare environment. Consequently, attitude and questions relating to attitude were also dropped. It was decided that the *Attitude* construct should now be mentioned under the section on limitations of the study.
- Another strategy used in the process of reducing the questions was to revisit the data analysis of the qualitative approach to identify items which were not discussed extensively during the focus group discussion sessions. Therefore, with the consultation of the supervisor, it was decided to drop the questions relating to these items, as they were considered as less significant by the focus group participants.
- In order to keep the questions clear and simple, help was sought from the non-information-systems academic and a healthcare professional to review the construct and number of words used in each question.
- Questions relating to items that appeared in more than one construct were reviewed and removed.
- Special care was given to avoid double entries, loaded questions, leading questions, questions with multiple meanings, ambiguous terminologies and technical jargon.

After this, the questionnaire was subjected to another round of peer review by academics and healthcare professionals. Almost all reviewers agreed that the new instrument was now suitable for data collection. According to Zikmund (2003) such a process provides face validity and initial content validity of the instrument. The final version of the instrument has been included in Appendix 9.

8.6 Methods of analysis

As mentioned earlier, the above process of analyzing data was descriptive, statistical and inferential. Descriptive analysis helps to summarize and simplify the data, so that large amounts of data can be described in a meaningful manner, such as being able to see how the data are dispersed (Fink, 1995b; Graziano & Raulin, 2000). For example, to understand the characteristics of the data collected, frequency analysis can help the researcher to explore the data for demographics information.

Through inferential analysis, a researcher tries to interpolate the findings of the descriptive and other statistical techniques to analyze the data and comprehend its meanings and implications. Examples include tests of statistical significance such as the *t*-test, the chi-squared test, and regression analysis (Fink, 1995b; Graziano & Raulin, 2000; Zikmund, 1994; Vaus, 2002).

8.6.1 Data preparation

The main source of data in this research was the survey questionnaire, as mentioned in the previous chapter; the questionnaire development process was well planned and went through various reviews and a pilot testing. All the questions were simple, brief and closed-ended. Each question in the questionnaire was associated with an item intended to measure the participants' response to that particular item.

In order to have reliable and valid outcomes from any data analysis, it is critical that data are carefully selected, prepared, entered, and analyzed. At the same time it is also important to understand how the data will be analyzed before it is actually collected. Such a strategy avoids having data in the wrong format and, consequently, the possibility of having misleading results. The analysis of data in this study will be through descriptive and inferential processes.

8.6.2 Data entry

The association of each item in the questionnaire is shown in Table 8.2 above. The data collected from the survey were only those that were required. These data were carefully entered into a Microsoft Excel spreadsheet for analysis using the SPSS application. After sorting out the missing values and incomplete elements from the survey questionnaires, a coding scheme was developed to transfer the data from the Excel spreadsheet to the SPSS format.

Before analyzing the data it is essential to screen it for accuracy. Outliers need to be identified as they can skew the results. Outliers are defined as those observations in the data which are inconsistent with the other values (Fink, 1995a). Almost all of the questions used in this study were assessed on a 5-point Likert scale and were closed-ended questions. The accuracy of the data was also checked through descriptive statistics for all the variables in the questionnaire (Tabachnick & Fidell, 1996).

SPSS requires the variable names, as each question was measuring a particular item; consequently, the item name was used as the variable name in the SPSS. After the data entry operation was complete, the researcher visually inspected the data for any abnormalities or data entry errors. After a preliminary inspection of the data, formal descriptive analysis techniques were used to identify any error and become more familiar with the features of the data.

8.6.3 Missing values

It is nearly always the case that some respondents will fail to completely fill in the survey or leave a few missing entries. There are several possible reasons for this. One is that the respondent did not want to continue to participate in the study. Where there are a number of entries missing, it is possible that the respondent did not know the answer, or simply did not wish to provide answers to those questions. Whatever the reason, these questionnaires need to be sorted out carefully before the data can be coded and analysed. Descriptive analysis through SPSS also provided an excellent opportunity to analyse the data for possible errors and missing values. Tabachnick and Fidell (1996) concluded that among the different ways of dealing with missing values, the two appropriate methods are either to delete the instances, or to use the mean value for the variable using the available scores. There were 10 instances where missing values were found, and all were excluded from further data analysis. There were five case were only few demographic values were missing; it was decided not to exclude these cases as there were no missing values found for questions 1 to 46, where all the determinants were measured.

8.6.4 Validity and reliability

Zikmund (2003) defines reliability as the degree to which a measure is free of error and provides consistent results, and validity as the ability of the scale to measure what is intended to be measured. Peterson (1994) warns that reliability and validity of measure and scale can only be guaranteed by making certain that the scale follows all the test assumptions. For instance in the case of multiple regression analysis, the data need to be normally distributed, and there need to be 20 observations for each independent variable (Hair et al., 1998).

The term *validity* in this study means that what is measured is what is supposed to be measured, rather than being merely similar, but conceptually different (Kitchenham & Pfleeger, 2002). On the other hand, *reliability* means that a measure's outcomes are the same, irrespective of how many times the measurement is repeated under the same circumstances (Neuman, 2003). According to Sekarn (2000), the reliability of an instrument indicates that the measure is error free, without bias, and provides a consistent result irrespective of the time and place. Therefore, reliability provides consistency and a measure of accuracy. One way to validate the instrument is to conduct a peer review. This approach can strengthen the validity of the instrument. Cavana et al. (2001) maintains that peer review helps to minimize confusion and ambiguity in the questionnaire.

Consequently in this research, peer review exercises were used extensively to eliminate inappropriate questions; to improve readability, layout and clarity of instruction; and to reduce ambiguity. Furthermore, to test the internal consistency of the instrument, reliability analysis was also conducted on the instrument itself, and the factors extracted by factor analysis through Cronbach's Alpha. Cronbach's Alpha provides information about the reliability of the scale for the constructs (Tabachnick & Fidell, 1996). According to Nunnaly (1978) and Paterson (1994), an acceptable value of Cronbach's Alpha is one that is greater than 0.60; any value less than 0.60 is not good; a value around 0.70 is low; one above 0.8 is moderate to high; and a value above 0.90 is very high (Neuman, 2003; Nunnaly, 1978; Paterson, 1994).

The validity of the constructs used in this research was achieved through convergent and discriminant validity. Convergent validity helps to ensure that items are measuring the same factor with a high degree of correlation between each of them. The correlation coefficient helps to measure convergent validity. Discriminant validity is achieved if an item correlates highly with the factor it is intended to measure; otherwise, its correlation is low (Chau, 1996). To achieve construct validity, the convergent validity needs to be higher than the discriminant validity correlation values. Data analysis associated with establishing reliability is provided in the next chapter.

8.6.5 Statistical techniques

For the purpose of testing the pilot study and the data from the survey questionnaire, SPSS (version 16) software was used. Some of the objectives achieved through this exercise are as follows:

- To identify the constructs
- To generate an initial list of drivers and inhibitors
- To conduct the descriptive analysis to describe and analyse the characteristics of participants
- Descriptive statistics
- Correlation analysis
- To check the validity of data
- To check the reliability of data
- Test of differences
- Conduct a *t*-test, to determine the statistical significance between the sample distribution
- Chi test
- Test of differences
- Multiple regression analysis
- Stepwise regression analysis, to select the independent variables which significantly explain the variance in usage and adoption

- Structural Equation Modelling, to further test the research framework.

According to Lucey (1996), statistical analysis is the process of analysis for a large amount of data to identify similarities, patterns, relationships, and to summarize the data. Such an analysis of the data can help to predict particular patterns, behaviours, outcomes and future implications. Researchers in the field of social science generally use the SPSS application to produce reports of descriptive analyses and inferential statistics.

8.6.6 Statistical justification

To develop and verify the adoption model for wireless handheld technology in a healthcare environment, various statistical tools are available. These include NOVA, MANOVA, correlation analysis, factor analysis, regression equation modelling and structural equation modelling. Factor analysis, for example, can help to group related variables. The availability of these tools as appropriate analytical approaches to quantitative research provides further justification for the employment of the questionnaire in this research.

8.7 Administration of survey

According to Malhotra et al. (1996), in the administration of a survey the issue of using the appropriate instrument and motivation of the participants are critical for the response rate and to minimize bias. The justification for and description of the questionnaire provided in Section 8.3 *Development of instrument* provide reasons for the appropriateness of the instrument; the motivation of the participants can depend on the methods adopted to collect the data.

The questionnaire was distributed through a variety of networks. First, formal approaches were made through the Queensland State health department, Toowoomba health district services, and the directors and managers of nursing at various public hospitals. Second, the researcher and supervisor worked through personal networks, GP connections, and Quality in Practice/Australian General Practice Accreditation Limited (QIP/AGPAL) for the distribution of the survey. The basic strategy adopted was to make contact through a personal telephone call to introduce the researcher, the research project, and the type of help sought. After one week, individuals were contacted again to enquire about the receipt of the information and to seek their support for the data collection exercise. Once agreement to support the survey was reached in principle, survey questionnaires with self-addressed envelopes were posted. Two weeks after the survey forms had been posted, individuals were contacted again through a personal call or e-mail to prompt them to fill in the survey.

In addition to this, the researcher contacted the conference organizer of MidInfo congress 2007 (1500 healthcare professionals were expected to attend) and the Association of Queensland Nursing Leaders (AQNL; 300 healthcare professionals were expected to attend) for their annual conference. These conferences provided an excellent opportunity to collect data.

8.7.1 Response rate

A low response rate is a common problem with most studies that use a questionnaire approach. In particular, healthcare professionals are often short of time and are stressed to their capacity. Participants' motivation makes a big difference to the response rate of any survey methodology. Response rate is calculated as number of surveys returned, divided by the total number of survey forms distributed (Fink & Kosecoff, 1998). Chiu and Brennan (1990) identified that response rates to surveys can be improved by using pre-paid return-addressed envelops, by using follow-up personalized letters to request the participant to complete the survey (Chiu and Brennan, 1990). For these reasons this study used self-addressed reply-paid envelopes with the initial distribution of the questionnaire in the healthcare domain.

The basic strategy adopted to maximize the response rate was to contact the supervisor or the manager of the facility through a personal telephone call. The personal telephone call was followed by a personal e-mail, providing the brief summary of the project and objectives of the research. Once an agreement was reached that the facility was happy to participate in the study, survey forms were posted or delivered to the manger of the facility to be distributed among their staff. Three weeks after the initial distribution of the survey, the individuals were contacted again regarding the progress of the survey. It was emphasized that the value of their contribution and their participation in the study was very valuable. After another two weeks, a follow-up letter was sent to remind the participants about the importance of their input in the study. This letter also emphasized the value of their participation in the study. In the final letter, a few additional survey forms were also included, just in case the original forms may have been misplaced.

8.7.2 Conduct of survey

In this study, a largely paper-based distribution technique was adopted (an online survey was also arranged, but the response rate was very low). Mail surveys are relatively inexpensive and provide an opportunity for the respondents to complete the questionnaire at their leisure. (As already indicated, healthcare professionals are extremely busy members of our society.) The questionnaire was distributed through individuals, and through lower and middle management in the private and public hospitals. Dane (1990) and Cavana et al. (2001) believe that a high response rate can be achieved through these strategies.

Coordinators or facilitators of various Queensland healthcare facilities or units were contacted by the researcher through the researcher's supervisor's network, and through the website of the Queensland health department. Initially, the researcher contacted the individuals through a personal call to introduce himself and the nature of research being carried out by the researcher. After the initial contact, a follow-up personalized e-mail was sent to explain the objective and outcomes, and information about the potential participants. In some cases people were happy to take the role of a facilitator in their environment. In other cases further information was requested, such as a copy of the ethical clearance. If the coordinator or facilitator did not return the survey, the researcher contacted them with a personal telephone call to follow up. In most cases after viewing the ethical clearance they were happy to participate in the study. These discussions also confirmed the number of questionnaires that were to be provided. Once the logistics were worked out, questionnaires with reply-paid envelopes were posted to the person. In some cases the researcher personally visited the facility to talk to the supervisor or manger about the possibility of distributing the questionnaire in their healthcare facility.

The questionnaires were distributed during September 2007 and February 2008 through the coordinators in the selected healthcare facilities. Initially, questionnaires were distributed through a coordinator and left with the respondents for two weeks. This strategy ensured that respondents completed the questionnaire privately and at their own leisure. This strategy was also adopted to minimize the influence of the researcher and ensure the anonymity of the respondents.

In order to motivate and persuade the potential participants to complete the questionnaires and to keep the process simple, the questions were printed on one side of the sheet. The other side of the sheet provided the covering letter, which clearly explained the objective, aim and nature of study, and highlighted the benefits and contributions of the study to the healthcare professional. It was hoped this would motivate the potential respondents to complete the questionnaire. Seaman (1987) highlighted this approach for motivating participants by identifying the benefits that the study would bring for the participants, and the contribution it could provide to the research domain. To motivate the supervisors, coordinators and other interested parties, free copies of the findings of the research were also offered. To preserve the anonymity of the participants, each survey sheet provided the contact information of the researcher and the researcher's supervisor; participants who were interested in receiving a copy of the results were encouraged to make contact separately; that is, there was no provision for making such a request on the questionnaire itself.

8.7.3 Issues and problems

During the quantitative data collection phase of the study a number of minor issues and problems emerged. Some of these were:

- Throughout the process of gathering data and information from the healthcare professionals, it was very difficult to engage them to participate in the study as they were busy with their work.
- It was difficult to find a group of healthcare professionals who were actually using wireless handheld technology in a healthcare setting or environment.

- At some locations, it was difficult for the coordinator or facilitator to identify the characteristics of the target population needed to be selected for this research.

8.8 Limitations associated with data collection

From the beginning of the study, the researcher was concerned about the return rate of the survey. As one would expect, it was always going to be extremely difficult to collect data from healthcare professionals because of the pressure of their work. Therefore, it was expected that the response rate for this study would be low, and that the number of cases used in this study would be a limitation. Another limitation was that small hospitals and general practitioners' surgeries had to be eliminated from the population due to the type of patient they dealt with, and their limited exposure to wireless handheld technology.

8.9 Conclusion

This chapter has provided detail information about the process and strategies adopted to collect quantitative data from the wider healthcare community, in particular how the questionnaire was developed, and steps taken to maximize the return rate. This chapter also provided details on the pilot study that was conducted before distributing the survey instrument. The next chapter will provide the results of the quantitative data.

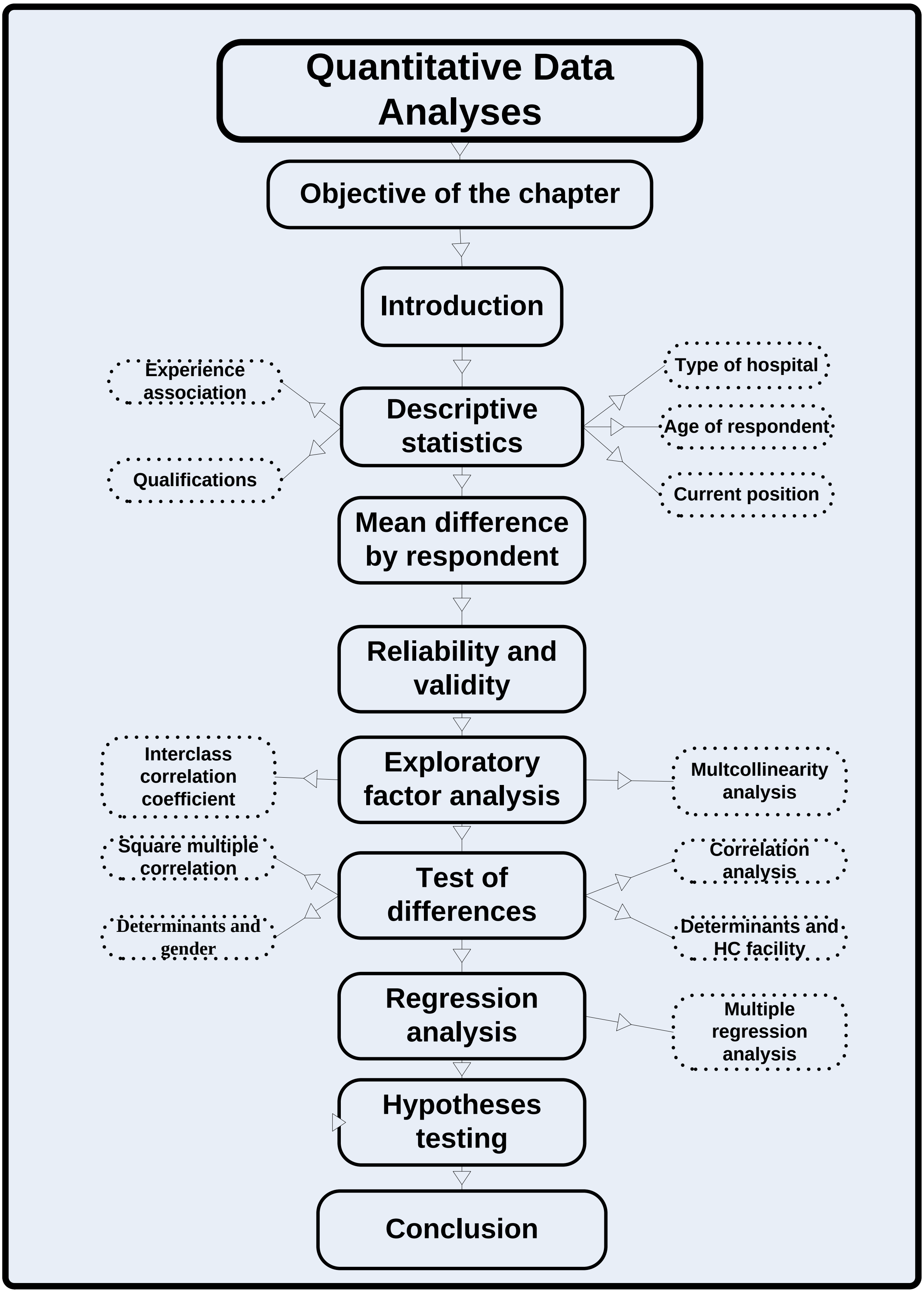
Chapter 9 - Quantitative Data Analysis

9.1 Chapter overview

The previous chapter provided a detailed description and justification for the process and techniques used to develop and refine the survey instrument. Chapter 8 also provided information on the pilot study and how the instrument was refined through the findings of the pilot study.

This chapter provides an analysis of the quantitative data collected through the survey instrument from the healthcare professionals. Regression analysis was used to explore relationships among the dependent and independent variables. This chapter also discusses the testing of the hypotheses identified in Chapter 8.

The brief layout of the structure of this chapter is shown below.



Quantitative Data Analyses
Objective of the chapter
Introduction
Experience association
Qualifications
Descriptive statistics
Type of hospital
Age of respondent
Current position
Mean difference by respondent
Reliability and validity
Interclass correlation coefficient
Exploratory factor analysis
Multcollinearity analysis
Square multiple correlation
Determinants and gender
Test of differences
Correlation analysis
Determinants and HC facility
Regression analysis
Multiple regression analysis
Hypotheses testing
Conclusion

9.2 Introduction

Before being analysed, the quantitative data were coded into a computer file, and a file comparator technique was used to resolve any data entry errors. Data were analysed using statistical software applications SPSS version 17.0 and AMOS version 17. Initially, raw data were manually checked for any abnormal coding errors. Then, using SPSS, descriptive analyses were conducted including a frequency breakdown to identify any errors that might have occurred in the data. Additionally, frequency distributions were employed on the demographic information, and chi-square tests were performed to identify any significant differences between types of demographic information (such as education, age and experience).

Correlation and multiple regression analyses were also conducted to identify relationships among various drivers and barriers[13]. Multiple regression analyses were used to help examine relationships between independent and dependent variables. For example perceived benefits in the context of perceived readiness in the quality of care may have an effect on the adoption of wireless technology in healthcare systems. Further, data were tested for the potential complexities of the wireless technology and compliance regulations, in the context of technical readiness that might impact on the rate of adoption of wireless technology in healthcare settings (Hair et al., 1998; Zikmund, 2003).

Once the multiple regression analysis had been employed to understand the relationships among the drivers and inhibitors, advanced level statistical analysis, such as structural equation modelling, was used to further explore the relationships among the constructs and to validate the framework for the adoption[14] of wireless handheld technology in a healthcare setting.

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13 In this study, *drivers* are defined as factors that motivate; *barriers* are defined as de-motivators for the healthcare professionals to use the wireless handheld technology in a healthcare setting.

14 As mentioned earlier, originally there were nine independent variables (only six of them were tested in this study as the other three are well researched in the domain of information systems, detailed justification for this has been provided previously) and one dependent variable as shown in the framework for the adoption of wireless handheld technology in a healthcare environment.

9.3 Descriptive statistics

Before any serious data analysis is conducted, it is important to check that data are error free. A descriptive analysis through SPSS was conducted to ensure the data are error free. Descriptive statistics analysis may consist of mean, variance, standard deviation, median and missing value analysis. In this research, a cross tabulation procedure was used to summarise the data through mean, mode, median, standard deviation, variance, and frequency count.

9.3.1 Demographic

The survey instrument contained seven questions relating to demographic details of the respondents. This section provides a summary analysis of this demographic information.

Table 9.1: Summary analysis of gender of the respondents

Gender	Frequency	Percentage
Male	132	36
Female	233	64
Total	365[15]	100

Almost two-thirds (64%) of the respondents were female, and 36% were male. This ratio of the population of respondents is aligned with previous studies in healthcare (Bennett, 2009).

9.3.2 Experience association

Australia is a truly multicultural country, and a significant portion of its population has migrated from other parts of the world, especially in the domain healthcare. Due to the shortage of nurses and doctors in the state of Queensland, healthcare-skilled professionals have joined the workforce after completing their professional

15 There were 374 total useable cases in this study. However, in the demographics analysis there was some variation in the total number of cases used, as in some categories there were some missing demographic values. These cases were not rejected from the analysis, as responses for the main survey were still valuable for this research.

educations and initial experience in other countries. The researcher was aware of this fact and wanted to know if the majority of the respondent in the survey fell into this category.

Table 9.2: Summary of country of origin of the respondents

Country (main experience gained)	Frequency	Percentage
Australia	325	87
Other country	49	13
Total	374	100

As the study was specific to healthcare professionals in the Australian healthcare environment, the highest proportion (87%) of the respondents were Australians. The other part of the population was also included in further analyses as these professionals were working in the Australian healthcare environment, even though their experience had been predominately in other countries.

9.3.3 Type of hospital

The type of healthcare facility can play a critical role for the adoption of technology. The table below provides an overall summary of the respondents' association with healthcare facilities.

Table 9.3: Summary analysis for type of healthcare facility

Healthcare facility	Frequency	Percentage
Public hospital	222	61
Private hospital	44	12
Other	97	27
Total	363[16]	100

More than three-fifths (61%) of the respondents were working in public hospitals. Only 12% of the respondents were working in private hospitals and 27% in other places. As the *Private hospital* and *Other* categories represent the non-public sector of

16 As mentioned above, due to some missing demographics information, the total here is 363 instead of 374.

the healthcare industry, for this analysis (see Table 9.4), the *Private* and *Other* categories were merged as the category *Non-public hospitals*.

Table 9.4: Summary of healthcare facilities

Healthcare facility	Frequency	Percentage
Public hospitals	222	61
Non-public hospitals	141	39
Total	363	100

The Australian healthcare environment comprises both public and private healthcare facilities. All the following higher level statistical analyses were conducted on the *Private hospital* and *Public hospital* categories.

9.3.4 Age of respondents

In the original instrument, age was divided into seven categories to capture the views and opinions of various interest groups. The distribution of age of the respondents for all seven categories is shown in Table 9.5.

Table 9.5: Summary of descriptive analysis for the age of the participants

Age	Frequency	Percentage
Under 26 years	39	10.8
26-30	42	11.7
31-35	43	11.9
36-40	60	16.7
41-45	61	16.9
46-50	52	14.4
Over 50	63	17.5
Total	360	100.0

From the descriptive analysis for the *Age* group, it is clear that there has been a good representation of healthcare professionals in this study. The sample representation of age groups was evenly distributed, and almost all the age groups had a good representation in this study.

However, the age distribution was quite dispersed, and all of the seven categories could not be used for further advanced statistical analysis. Consequently, the seven categories were arbitrarily consolidated and re-coded into three categories — *Young*, *Middle age* and *Old age* — to be used for further higher level statistical analysis (see Table 9.6).

Table 9.6: Consolidated range description of age parameters

Category	**Range**
Young	Up to 35 years
Middle-age	35–45 years
Old-age	46 years and above

The distribution of the sample population after re-coding is represented in Table 9.7.

Table 9.7: Distribution of age analysis in the selected population

Category	**Frequency**	**Percentage**
Young	126	35
Middle age	121	34
Old age	115	31
Total	360	100

As can been seen, the distribution appears to be almost even. However, the highest proportion (35%) of respondents were young, compared to 34% for middle-aged and 31% for old-aged respondents.

Respondents who participated in this study represent a wide range of people with a significant level of experience in the healthcare industry. The majority of participants had 11 to 15 years of experience. The total range was from 2 years to more than 25 years. The percentages of participants from different healthcare facilities are evenly distributed as well.

9.3.5 Current position

Table 9.8 shows the frequency distribution of professions in the selected population.

Table 9.8: Summary of descriptive analysis for the professional backgrounds of participants in the study

Profession	Frequency	Percentage
Physician	28	7.6
Doctor	50	13.6
Nurse	150	40.9
Technician	7	1.9
Admin	18	4.9
Other	114	31.1
Total	367	100.0

The professions of the healthcare workers participating in this study were also consolidated into three categories, namely *Doctors/Physicians*, *Nurses*, and *Other*.

Table 9.9: Consolidated frequency analysis for professional background

Profession	Frequency	Percentage
Doctor/ Physician	78	21
Nurse	150	41
Other (e.g. admin, etc.)	139	38
Total	367	100

Most of the participants in this study were in the nursing profession (39.0%). Physicians made up 14.1%, and 32.2% came from other healthcare-related professions such as administration.

9.3.6 Qualifications

The participants were all skilled professionals, and their ability to use the wireless technology could be influenced by their skills and educational background. Table 9.10 provides a frequency analysis for the educational backgrounds of the selected population.

Table 9.10: Summary of educational background of participants in the study

Professions	Frequency	Percentage
PhD or MBBS	99	27.7
Master	60	16.8
Bachelor	109	30.4
Diploma/Certificate	74	20.7
Other qualifications	16	4.5
Total	358	100.0

Most of the participants (30.4%) had an undergraduate degree; physicians made up 27.7% of the sample. These qualification data were then re-grouped into four new categories. The distribution of these is shown in Table 9.11.

Table 9.11: Frequency analysis for the professional skills background of the participants in the study

Education	Frequency	Percentage
MBBS	99	28
Master/PhD	60	17
Bachelor	109	30
Diploma, certificate, other	90	25
Total	358	100

The highest proportion (30%) of the respondents had a general bachelor’s degree, compared to 28% with an MBBS degree, 25% with a diploma or certificate, and 17% with an MS or PhD.

Tabachnick and Fidell (1996) suggested that if a sample size is less than 10% among the dichotomous variables, it is better to remove that from the analysis because this split could produce misleading results. As can be seen from the above table, there were 365 respondents in total, 132 (36.2%) indicated that they were male and 233 (63.8%) identified themselves as female. The majority of the participants were from public hospitals (222, or 61.29%); participations from private hospitals totalled 44 (12.1%); participants from other healthcare facilities totalled 97 (26.7%). Consequently, the data were assumed to be suitable for further analysis.

9.4 Mean differences by respondent characteristics

A *t*-test/ANOVA analysis was used to compare the means to determine if evidence existed to conclude that corresponding populations differed significantly. By conducting the *t*/*F* test, a researcher is able to compare the demographics characteristics of the selected sample, and so gain insight into their intention to use the wireless technology in a healthcare environment. In this analysis, intention to use (ITU) is a dependent variable with a ratio scale; the independent variables are placed on a nominal or ordinal scale. These statistical analyses will help to indicate whether groups within the category do or do not differ significantly. Before conducting the *t*/*F* test, pre-test assumptions were checked. The data were shown to be normally distributed, and the standard deviations of each of the group scores were not significantly different. This was achieved through Levene's test, which tests the assumption of homogeneity of variance (if the *p*-value for $F > 0.05$, one can assume equal variance); this is shown in the sixth and the seventh columns in Table 9.12. In all the cases, Levene's test for homogeneity of the variance is shown to be not significant ($p > 0.05$), indicating that the *t*/*F* test of analysis of variance can be conducted.

One-way analysis of variance was conducted, with the ITU as dependent variable and other demographic characteristics as independent variables; the assumption of homogeneity was judged to have not been violated, and each of the independent variables, means and standard deviations for each of the grouped variables was found to be not significant as $p > 0.05$; that is, there is no difference between any two groups. For example, in the case of gender, Levene's test was not significant, F (1, 362) = 0.038, $p > 0.05$; therefore, the assumption of homogeneity of variance was judged to have not been violated. For the female mean, $M = 2.2$, and the standard deviation SD = 0.73; this was not significantly different from the male mean (M = 2.1, SD = 0.79, $F = 0.993$, $p > 0.05$). The analysis of the independent variable *Country most worked* demonstrated similar results. For *Public hospitals*, $M = 2.1$, SD = 0.76; for *Private hospital*s, $M = 2.4$, SD = 0.75; and for *Other healthcare facilities*, $M = 2.1$, SD = 0.73, $F(1, 359) = 2.53$, $p > 0.05$. This prompted further analysis of the data.

Table 9.12: Descriptive statistic, and Mean Differences by respondent Characteristics

	Variables	**Frequency (%)**	**Means value**	**Std. deviation**	**Levene statistic**	**Sig. value**	***t*/*F*[1] test value**	***p***
Country	Australia	325 (86.9)	2.1	0.72	0.040	0.841	*t* = –0.951	0.337
	Other	49(13.1)	2.2	0.70				
Type of organization	Public hospital	225 (61.6)	2.1	0.76	1.245	0.265	*t* = –1.42	0.165
	Private hospital	140 (38.5)	2.2	0.66				
Gender	Male	l32 (36.6)	2.1	0.75	0.029	0.865	*t* = -1.21	0.225
	Female	233 (63.4)	2.2	0.70				
Age	Up to 35	124 (34.4)	2.07	0.683	0.136	0.873	*F* = 1.38	0.253
	35–45	121 (33.6)	2.17	0.747				
	Above 45	115 (31.9)	2.23	0.716				
Experience	5 years and less	99 (28.0)	2.l	0.68	0.198	0.897	*F* = 0.337	0.799
	6–15 years	115 (32.5)	2.1	0.70				
	16–25	83 (23.4)	2.2	0.78				
	>25	57 (16.1)	2.2	0.74				
Position	Doctor/physician	78 (21.3)	2.0	0.76	0.473	0.623	*F* = 3.299	0.038
	Nurse	150 (40.9)	2.l	0.74				
	Other	l39 (37.9)	2.3	0.66				
Education	MBBS	99 (27.7)	2.2	0.75	0.470	0.703	*F* = 0.834	0.476
	Postgraduate	60 (16.8)	2.l	0.68				
	Bachelor	109 (30.4)	2.1	0.73				
	Diploma & other	90 (25.3)	2.2	0.68				

As can been seen from Table 9.12, the *t*-test/*F*-test analysis indicates that 63.4% of the female health professionals had a mean of 2.16, and 36.6 % of males had a mean of 2.09. This shows that participants did not differ significantly at the $p > 0.05$ level, ($p = 0.346$). Levene's test for equality of variance also indicates that the variance for males and females did not differ significantly from each other ($p > 0.05$). It can be assumed that the population variance is relatively equal; the two groups come from the same population as no significant differences exist, t (350) = –.094, $p > 0.05$.

In the case of profession/position, it was found that the *p*-value was < 0.05, which means that there was a significant difference between the chosen professions (Doctors/physicians, Nurses, and Other). In order to determine which group was actually different from the *Other* category, a post-hoc test was conducted.

This post-hoc test showed that there was no significant difference between the Doctor/Physician and the Nurse groups. While the *F*-test showed there was a significant difference among the group, the post-hoc test revealed that the difference was not significant ($p = 0.727$ and $p = 0.087$).

In addition, a one-way analysis of variance was conducted, as shown in Table 9.11. Levene's test for homogeneity of variance had a significance value of 0.655, which indicates that variance for ITU for each of the groups in the qualification category did not differ significantly, as the values ranged from 0.67^2 (= 0.45) to 0.76^2 (= 0.57) of variance. This affirms the homogeneity of the variance. The population variances for each group were approximately equal. The significance value for ANOVA was $p = 0.465$, so no significant difference exists within the different education levels, $F = 0.90$ with $p > 0.47$. Therefore, the analysis of the degree of freedom, $F(0.4, 340) = 0.90$, $p > 0.05$, shows that perception of intention to use the wireless handheld technology in the Australian healthcare environment was not different across the different levels of education.

9.5 Reliability and validity

For any research instrument, it is critical to establish its reliability. This is normally ascertained through Cronbach's alpha, calculated from SPSS procedures. The value of Cronbach's alpha ranges from 0 (no reliability) to 1 (perfectly reliability). Generally, a value of 0.70 is considered an acceptable level of reliability in social science research (Gregory, 2000). Hair et al. (1998) suggested that an acceptable limit can be reduced to 0.60 in exploratory research (Hair et al., 1998). In this research, the reliability of the complete questionnaire (all the items were included for this test) was 0.922, which translates into an "excellent reliability" (Gregory, 2000).

Questionnaire items from 1 to 46 in the survey instrument were used to create a composite variable as shown in the initial model (six composite variables will be created as per the initial framework shown in the previous chapter). The reliability of these composite variables was also calculated. The value of Cronbach's alpha for the composite variables in the context of the initial framework was also very high as shown in Table 9.13.

Table 9.13: Summary of Reliability Statistics

Descriptions	**Cronbach's Alpha**	**No of Items**
Reliability of all the items in the instrument (full questionnaire)	0.926	56
Reliability of only Likert scale items in the instrument (from questions 1 to 46)	0.936	46

Table 9.13 shows the value of Cronbach's alpha for the non-demographic variables in the survey instrument. Items 1 to 46 were used to measure responses on a 5-point Likert scale. These questions were the only questions used to measure the responses that would identify the determinants of adoption of wireless handheld devices in a healthcare environment. Hair (et al. 1998) suggested that this Cronbach's alpha (α = 0.934) represents an excellent level of reliability for the instrument.

Another approach used in ensuring the validity of the instrument is the *Content validity index* (CVI). Two content experts — an academic researcher in the domain of healthcare and methodology, and a healthcare professional with research background — were identified to derive this index. These two experts independently rated the relevance of each question with the specific construct they were measuring. Each item was measured on a scale of 1 to 4, where 1 means *Not relevant*, 2 means *Broadly relevant*, 3 means *Relevant*, and 4 means *Very relevant*. The objective was to identify specialist opinion about the relevance of each item of the specific variables. In this exercise, the content validity index was determined as being *Relevant* or *Very relevant*. The content validity for the original questionnaire was 0.70 and the content validity was 0.90 for the revised instrument.

Furthermore, correlation analysis for the constructs and their associated items ranged from 0.65 to 0.85. The correlations of the items not associated to a specific construct were lower than the correlation associated with specific constructs. The values range from 0.2 to 0.5. Based on these, it is safe to assume that the instrument used in this research was reliable. The constructs and the associated items are also reliable measures of what they are meant to measure.

9.6 Exploratory factor analysis

In order to identify the determinants of adoption of wireless handheld technology in a healthcare environment, a data reduction technique provided by SPSS was employed. The purpose of conducting a factor analysis is to help reduce the number of context factor variables to a meaningful, interpretable and manageable set of factors and to identify any outliers.

Initially, factor analysis was conducted through “Principal Components” and “Rotated Component Matrix” techniques with “Varimax” rotation. In addition to this, the groups were not limited to any number, and “maximum interaction for convergence” was limited to 0.5. The literature indicates that if the sample size is 150–200, a factor loading of 0.45 or higher is considered significant (Hair et al., 1998). This exercise was repeated several times until a meaningful group of related items was found. The output of this factor analysis is provided in Table 9.14.

Table 9.14: Factor analysis, rotated Component Matrix

	CP	ITU	TR	C	OR	PR	SC
WHT improve time management	0.838						
WHT improve reporting procedures	0.826						
WHT improve quality of care	0.806						
WHT error reduction	0.798						
WHT enhance clinical communication	0.788						
WHT high quality of information	0.750						
WHT resolves workload issues	0.699						
WHT improve evidence base practice	0.672						
I will use if I believe we are ready		0.828					
I will use if WHT is compatible with existing ICT		0.817					
I will use if organization is technically ready		0.813					
I will use if integrated with organization culture		0.802					
I will use if organization is ready		0.774					
I will use if we can integrate clinical practices		0.651					
Reliability of Infrastructure			0.767				
Easy interface			0.733				
Connectivity			0.733				
Availability of local support			0.642				
Size, weight and compactness			0.618				
Access to technical people			0.556				
Access to clinical data				0.756			
Integration with other devices				0.738			
Clear standards				0.693			
Integration of business process				0.597			
Reliability of WHT				0.530			
Leadership role					0.808		
Strategic direction					0.768		
Lack of management commitment					0.719		
Organizational support					0.543		
Healthcare environment						0.801	
Existing work practices						0.617	
Proper planning and procedures						0.616	
Support from colleagues						0.541	
Organizational policies							0.672
Social values							0.635
Organizational culture							0.602

Extraction Method: Principal Component Analysis. , Rotation Method: Varimax with Kaiser

The factor analysis indicated that factors can be grouped together in six meaningful ways. Items relating to these factors were grouped together and, on the bases of these groups, themes were identified. These themes were named *Organizational readiness* (OR), *Technological readiness* (TR), *Perceived readiness* (PR), *Clinical practices* (CP), *Compatibility* (C), and *Social context* (SC). Table 9.15 provides details of items used to construct the composite variables and their reliability measures.

Table 9.15: Item descriptions and their reliability for the development of composite variables

No.	**Composite variable**	**Questions included**	**Cronbach's alpha**
1	Technical readiness	Q2, Q3, Q4, Q5, Q6, & Q7	0.82
2	Perceived readiness	Q9, Q10, Q11, & Q12	0.69
3	Organizational readiness	Q19, Q20, Q21, & Q22	0.81
4	Clinical practices	Q23, Q24, Q25, Q26, Q27, Q28, Q29, & Q30	0.93
5	Social context	Q31, Q33, & Q34	0.66
6	Compatibility	Q36, Q37, Q38, Q39, & Q40	0.80
7	Intention to use	Q41, Q42, Q43, Q44, Q45, & Q46	0.90

The reliability of the composite variables developed through the data reduction technique shows that their corresponding reliability is high, ranging from 0.66 to 0.93, indicating that the items are homogenous. The value of Cronbach's alpha is of an acceptable level (Hair et al., 2006). For further statistical analysis, composite variables will be developed by finding the means through using the actual loading of each item in the factor analysis. The reliability of the seven composite variables was greater than 0.8; for the whole instrument from question 1 to 46 it was 0.935. According to Hair et al., (1998) this value of Cronbach's alpha is judged to represent a good level of reliability (Hair et al., 1998).

9.6.1 Interclass correlation coefficient for composite variables

Another way of measuring the reliability is to do the analysis using the Interclass correlation coefficient (ICC). This assists a researcher to confirm and demonstrate the reliability of measuring the same construct, and shows that different items in the composite variable are measuring the single construct. For this study, only composite variables were used in this ICC analysis before conducting the regression analysis to make sure that the items were measuring the same construct (see Table 9.16).

Table 9.16: Summary values of Interclass correlation coefficient for the composite variables

Interclass correlation coefficient			
Variable description	Interclass correlation		Significant value
	Single measure	Average measure	
Technical readiness	0.392	0.819	0.000
Perceived readiness	0.289	0.710	0.000
Organizational readiness	0.354	0.831	0.000
Clinical practice	0.604	0.924	0.000
Social context	0.384	0.757	0.000
Compatibility	0.436	0.794	0.000
Intention to use	0.602	0.901	0.000
All composite variables	0.368	0.771	0.000

From Table 9.16, as expected, the value of *Single measure* is lower than *Average measure*, with a significant *p*-value ($p < 0.01$). Therefore, the items associated with each construct are measuring the same constructs.

9.6.2 Correlation analysis

There are six composite variables in the framework. In order to evaluate if there is a significant relationship between them, a Pearson product–moment correlation (abbreviated as Pearson *r*) was conducted. Pearson *r* is suitable as all the variables are measures on the ratio scale. As can be seen from Table 9.16, there is a positive correlation among all the variables ($p < 0.05$ for nearly all, and the *r* values are positive). The value of the correlation ranges from 0.2 to 0.5, as all the correlations are below 0.5 and most of them are quite low, except that the correlation between SC and CP is slightly above the 0.5 value (actual value is 0.507). To have significant correlation we need the *r* value to exceed 0.8 (Hair et al., 2006; Stevens, 1986). Hence, we can assume that all the composite variables are uniquely contributing to the dependent variable, *Intention to use*.

Table 9.17: Correlation analysis for the composite variable identified through factor analysis

		TR	OR	PR	CP	SC	C
TR	Pearson correlation	1	0.490**	0.477**	0.376**	0.276**	0.506**
	Sig. (2-tailed)		0.000	0.000	0.000	0.000	0.000
OR	Pearson correlation	0.490**	1	0.577**	0.369**	0.502**	0.538**
	Sig. (2-tailed)	0.000		0.000	0.000	0.000	0.000
PR	Pearson correlation	0.477**	0.577**	1	0.356**	0.412**	0.484**
	Sig. (2-tailed)	0.000	0.000		0.000	0.000	0.000
CP	Pearson correlation	0.376**	0.369**	0.356**	1	0.550**	0.402**
	Sig. (2-tailed)	0.000	0.000	0.000		0.000	0.000
SC	Pearson correlation	0.276**	0.502**	0.412**	0.550**	1	0.384**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000		0.000
C	Pearson correlation	0.506**	0.538**	0.484**	0.402**	0.384**	1
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	

**. Correlation is significant at the 0.01 level (2-tailed).

Technical readiness (TR), Perceived readiness (PR), Organizational readiness (OR), Clinical practices (CP), Social context (SC), and Compatibility (C)

9.6.3 Multicollinearity analysis for composite variables

Once the reliability of the composite variable was confirmed with respect to items used to calculate the composite variable, it was important to analyze the new composite variables for multicollinearity before further high level regression analysis. Table 9.17 provides the analysis of correlation among all the composite variables. Multicollinearity among independent variables (IV) can be determined from this table. As can been seen from Table 9.16, there are no high levels of correlation among the independent variables (OR, TR, PR, CP, SC, and C). In general, a correlation value needs to be higher than 0.8 before there are problems of multicollinearity between the independent variables (Hair et al., 2006).

Chau (1996) states that the correlation among items used to develop the composite variable will be high with the factor intended to measure them (Chau, 1996). As can be seen, the result of a high level of validity and reliability provides a high level of assurance about the research design in this study, as various items in the questionnaire are uniquely contributing to predicting the unique construct.

9.7 Test of differences for composite variables

The *t*-test and *F*-test provide analyses that show if there is a difference between two populations. Therefore, in this research, these tests were used to determine if there were statistically significant differences between the population means of the various constructs or determinants for the adoption of wireless technology in a healthcare setting, using these tests for the composite variables.

9.7.1 Determinants and gender

To test for differences in responses between males and females, Table 9.18 was constructed.

Table 9.18: Mean, SD and *t*-value of respondents based on their sex

	Sex	N	Mean	Std. Deviation	*t*-value	Sig level
TR	Male	132	1.6093	0.47622	0.835	0.404
	Female	233	1.5684	0.43498		
PR	Male	132	2.0530	0.52414	1.794	0.074
	Female	233	1.9511	0.52045		
ORR	Male	132	1.9310	0.48452	3.103	0.002
	Female	233	1.7706	0.46846		
CP	Male	132	2.1667	0.68720	–3.061	0.002
	Female	233	2.4292	0.83865		
SC	Male	132	2.3758	0.62028	–1.840	0.067
	Female	233	2.5047	0.65602		
C	Male	132	1.81	0.553	0.166	0.869
	Female	233	1.80	0.569		
Intention	Male	132	2.09	0.748	–1.214	0.225
	Female	233	2.18	0.699		

An analysis of the data from Table 9.18 indicates that there were no differences in responses between males and females on the variables TR, PR, SC, C, and ITU. However significant differences were found between males and females in their perceptions about the use of wireless technology in the context of organizational readiness and clinical practices.

9.7.2 Determinants and HC facility

An analysis was conducted to test for differences among the participants from public and private hospitals, and to understand if there were any differences between their perceptions about using wireless handheld technology in a healthcare environment (see Table 9.19).

Table 9.19: Mean, SD and *t*-value of respondents based on their work places

	Hospital	**N**	**Mean**	**Std. Deviation**	***t*-value**	**Sig level**
TR	Public	225	1.5613	0.45405	–1.036	0.301
	Private	140	1.6112	0.43758		
PR	Public	225	1.9653	0.53020	–1.043	0.298
	Private	140	2.0243	0.51647		
OR	Public	225	1.8114	0.50458	–0.840	0.402
	Private	140	1.8548	0.43818		
CP	Public	225	2.2489	0.70066	–2.796	0.005
	Private	140	2.4848	0.90170		
SC	Public	225	2.4151	0.56279	–1.828	0.068
	Private	140	2.5414	0.75197		
C	Public	225	1.76	0.559	–2.047	0.041
	Private	140	1.88	0.564		
Intention	Public	225	2.11	0.757	–1.420	0.156
	Private	140	2.22	0.664		

The analysis of data shown in Table 9.19 indicates that participants from private hospitals were more willing to use WHT than those from public hospitals. In the case of Clinical practices and Compatibility there were significant differences between public and private hospitals. Those from the private hospitals were more inclined to adopt WHT than those from the public hospitals.

9.7.3 Square multiple correlations

A factor analysis was conducted to explore the possibility of factor groupings to represent the construct for the adoption of wireless technology in healthcare. Square multiple correlations were conducted to reconfirm the reliability of the items used to measure the composite variables in this research, before conducting the regression analysis. This was done to confirm whether a theoretical factor structure could be supported in this research. Table 9.20 shows the squared multiple correlations of all items to the construct *Technical readiness*.

Table 9.20: Squared multiple correlations: (Group number 1 - Default model) for TR

Item	TR	Estimate
Q7	0.496	0.704
Q6	0.490	0.700
Q5	0.389	0.624
Q4	0.444	0.666
Q3	0.365	0.604
Q2	0.395	0.628

Table 9.20 shows that the values for all the items were greater than 0.350, indicating that these items adequately measured the technology readiness construct. The researcher followed the same process for all the remaining factors (OR, PR, CP, SC, Compatibility, and ITU), as shown in Table 9.21.

Table 9.21: Summary of squared multiple correlations for PR, PR, SC, C and ITU

No.	Variables	Items	Squared multiple correlations	Standardized regression weights	Square of SRW
2	OR	Q22	0.633	0.581	0.338
		Q21	0.684	0.827	0.684
		Q20	0.411	0.641	0.411
		Q19	0.338	0.581	0.338
3	PR	Q12	0.255	0.505	0.255
		Q11	0.404	0.636	0.404
		Q10	0.495	0.704	0.496
		Q9	0.290	0.538	0.289
4	CP	Q30	0.648	0.805	0.648
		Q29	0.710	0.843	0.711
		Q28	0.755	0.869	0.756
		Q27	0.662	0.814	0.663
		Q26	0.689	0.830	0.689
		Q25	0.620	0.787	0.619
		Q24	0.412	0.642	0.412
		Q23	0.438	0.662	0.438
5	SC	Q34	0.290	0.538	0.289
		Q33	0.718	0.847	0.717
		Q31	0.276	0.525	0.276
6	C	Q40	0.384	0.620	0.372
		Q39	0.565	0.752	0.566
		Q38	0.575	0.758	0.575
		Q37	0.430	0.656	0.430
		Q36	0.302	0.550	0.303
7	ITU	Q46	0.661	0.813	0.661
		Q45	0.647	0.804	0.646
		Q44	0.481	0.694	0.412
		Q43	0.645	0.803	0.645
		Q42	0.642	0.801	0.642
		Q41	0.540	0.735	0.540

Table 9.21 shows that all the items are adequately measuring their respective factors, except two: perceived readiness and social contacts. The value for these items is close to statistical

benchmark (0.3); consequently, they were considered for further analysis. The factor analysis confirms the factors obtained from the exploratory factor analysis mentioned above. The second-last column in Table 9.21 represents the standardized regression weight for each item to the corresponding factor, which is the correlation between each item and its associated factor. All the correlations were high, with the associated factors indicating that each of the items is contributing to the measure of its associated factor. The square of the standard regression weight in the last column in Table 9.21 provides the variance explained by each item in the nominated construct. For example, Question 28 in the survey instrument is part of the clinical process (CP) and the variance explained by this item is 0.756 in the overall factor. These tests assured that the data could be further analysed for the regression analysis.

9.8 Regression analysis

Linear regression analysis was conducted individually for all the independent variables (OR, TR, PR, CP, SC, and C) against the dependent variable *Intention to use*, through the “enter” procedure of SPSS. Linear regression analysis was used in this study to test the relationship of the dependent variable (ITU) with the independent variables (OR, TR, PR, CP, SC, and Compatibility). In this study, all variables considered as being at the metric level with one dependent as *Intention to use* and multiple independent variables as predictors, but entered in to analysis separately. In linear regressions, *R* is used to measure the strength of the relation between the criteria and the predictors. In regression, *r*-square (R^2) is used to indicate the amount of variance explained by that particular predictor. In linear regression analysis, *Adjusted* R^2 is an indicator of the validity of the predictor, and the beta value indicates the relative explanatory ability of the predictors. A summary of this analysis is shown in Table 9.22.

Table 9.22: Summary of linear regression analysis of composite variables to DV intention to use

Description of composite variable	**Intention to use**								
	***R* value**	**Adjusted R^2**	**Degree of freedom**	***F*-value**	**Sig value**	**Beta value**	**Sig level**	***t*-value**	**Sig level**
Technical readiness	0.277	0.077	1, 372	30.85	0.000	0.444	0.000	5.554	0.000
Perceived readiness	0.249	0.062	1, 372	24.53	0.000	0.343	0.000	4.953	0.000
Organizational readiness	0.286	0.082	1, 372	43.13	0.000	0.428	0.000	5.756	0.000
Clinical practices	0.408	0.166	1, 372	74.19	0.000	0.372	0.000	8.614	0.000
Social context	0.331	0.109	1, 372	45.71	0.000	0.370	0.000	6.761	0.000
Compatibility	0.373	0.139	1, 372	59.96	0.000	0.476	0.000	7.743	0.000

The correlation coefficient for all the predictors (OR, TR, PR, CP, SC, and C) to the dependent variable (ITU), ranges from 0.25 to 0.41, and the *R*-square value ranges from 0.06 to 0.17 for the independent variable and the dependent variable individually. For example, 13.9% of variation in the ITU is explained by the Compatibility variable on its own, under direct relationship ($R^2 = 0.139$). Similarly, 16.6% of the variation in the ITU can be explained by *Variable clinical practices* ($R^2 = 0.166$). The *F*-statistics with the degree of freedom also confirmed this association of the predictors with the dependent variable, $F(1, 373) = 59.96$, $p < 0.05$). The *t*-values in the linear regression analyses (ranges from $t = 3.1$ to 8.5) in Table 9.22 shows the regression coefficient for all the predictors individually. The significance level $p < 0.05$ for all the predicators confirms that these predictors uniquely contribute to the individual regression equation. Beta values in Table 9.22 also support the finding by the Beta value from the regression model.

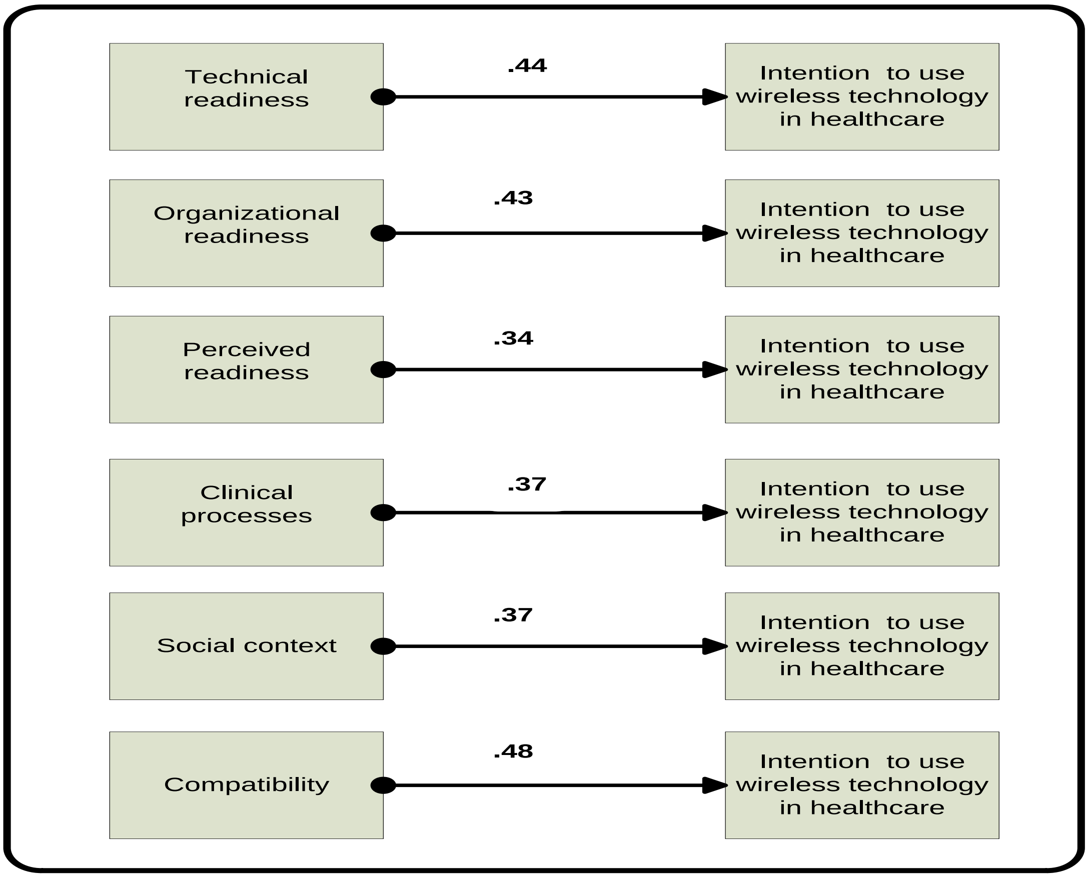


Figure 9.1: Liner relationship between the independent variables and the dependent variable (ITU)

9.8.1 Multiple regression analysis

The linear regression analysis confirms the associations of the independent variables to the dependent variable. This provided the assurance that a multiple regression analysis could be conducted.

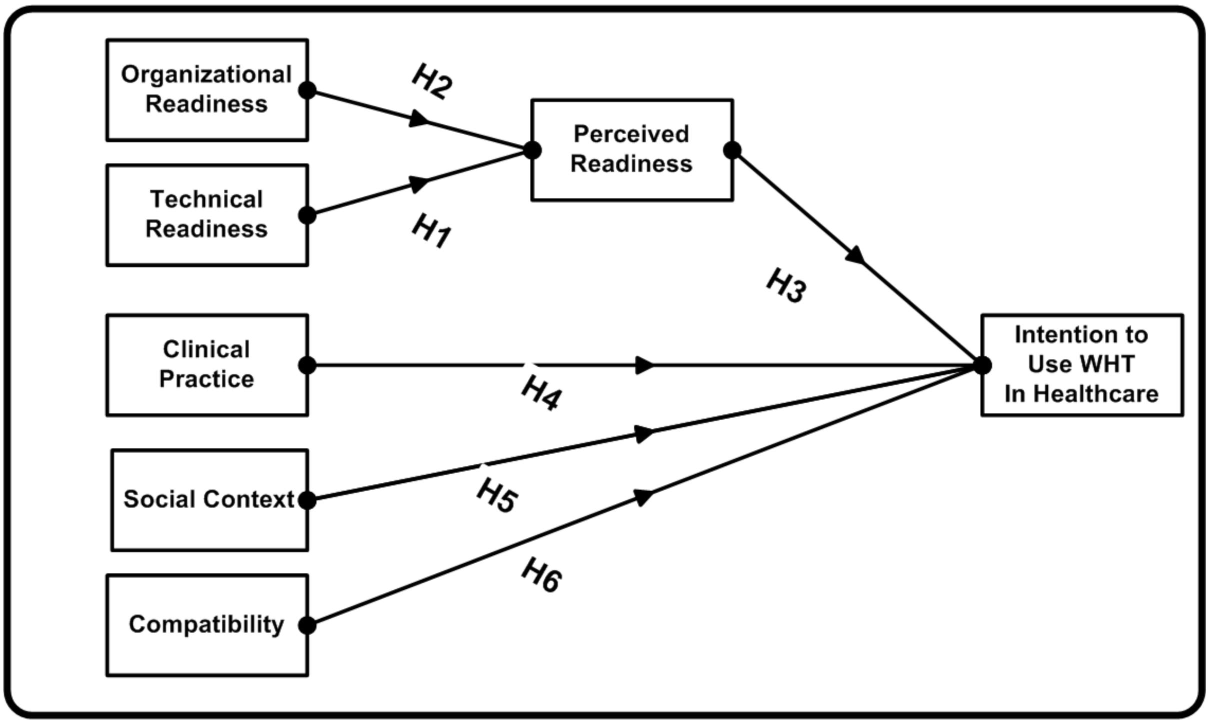


Figure 9.2: Research framework for the use of WHT in HC

Firstly, multiple regression analysis was conducted between *Technical readiness* (TR), *Organizational readiness* (OR) and *Perceived readiness* (PR) with TR and OR independent variables and PR as dependent variable.

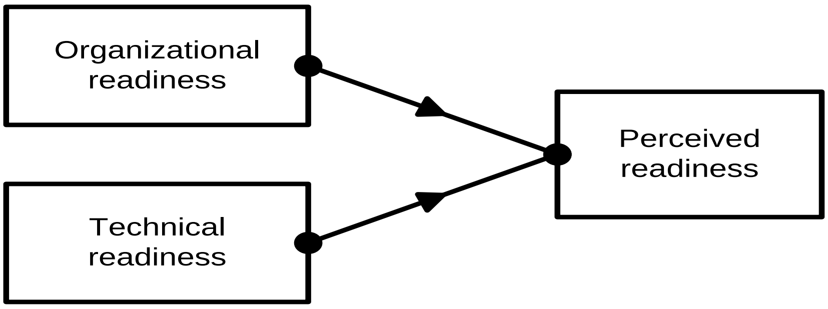


Figure 9.3: Associations between the independent variable *Organizational readiness* and *Technical readiness* with the dependent variable *Perceived readiness*

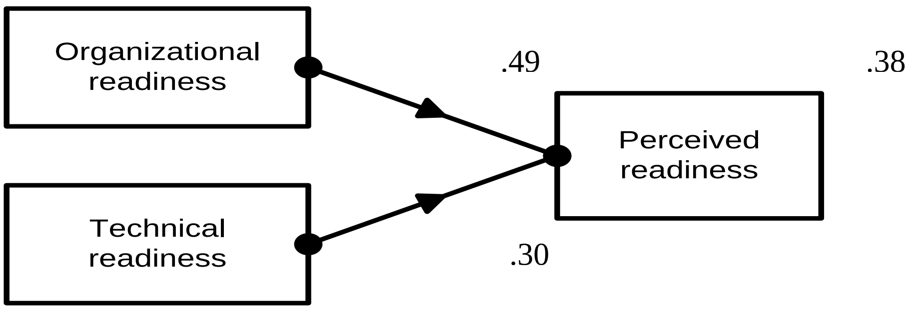


Figure 9.4: Causal relationship between the independent variables *Organizational readiness* and *Technical readiness* with the dependent variable *Perceived readiness*

Table 9.23 shows the results of multiple regression analysis between the independent variables (OR and TR) and the dependent variable (PR). The multiple correlation coefficient (R = 0.38) was significantly different from zero, $F(2, 373) = 114.87$, $p < 0.05$, and 38.2% of the variation in the perceived readiness is explained by *Organizational readiness* and *Technical readiness* (adjusted $R^2 = 0.382$).

Table 9.23: Multiple regression analysis between the dependent variable (*Perceived readiness*) and independent variables (*Organizational readiness* and *Technical readiness*)

Variables	**Model (Dependent variable: *Perceived readiness*)**			
	B	β	t	p-value
Organizational readiness	0.49	0.45	9.66	0.000
Technical readiness	0.30	0.26	5.46	0.000
R^2	0.38			

Both the *Organizational readiness* ($B = 0.49$, $t = 9.66$, $p < 0.05$) and *Technological readiness* ($B = 0.30$, $t = 5.46$, $p < 0.05$), were found to be significantly and uniquely contributing to the predictor of *Perceived readiness* as the dependent variable.

As shown in the initial conceptual model, there is a direct relationship between the IV *Perceived readiness* and the dependent variable ITU wireless technology, with an indirect effect by the independent variables TR and OR. This association of OR,TR, PR and ITU can be graphically represented (see Figure 9.5).

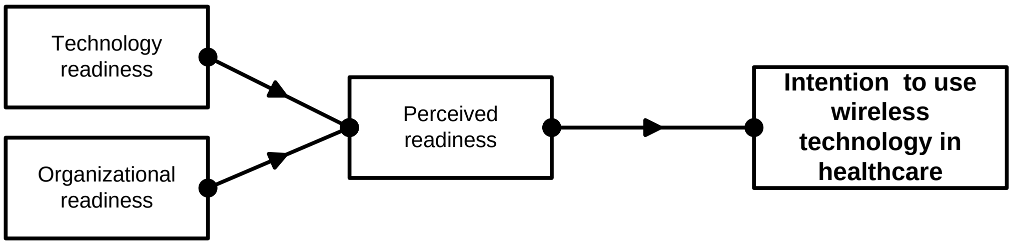


Figure 9.5: Associations between OR, TR, PR and ITU

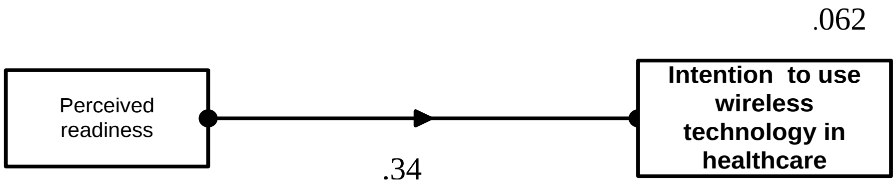


Figure 9.6: Causal associations between the OR, TR, PR, and ITU

From Table 9.24, it can be seen that *Perceived readiness* (B = 0.34, t = 4.95, $p > 0.05$) was not found to be significantly and uniquely contributing to the predictor of *Intention to use* the wireless technology in a healthcare setting. There is an indirect effect of TR and OR to ITU through PR.

Table 9.24: Multiple regression analysis between the dependent variable (*Intention to use*) and the independent variable (*Perceived readiness*)

Variables	**Model (Dependent variable: *Intention to use*)**			
	B	β	t	p-value
Perceived readiness	0.34	0.25	4.95	0.000
R^2	0.062			

Furthermore, multiple regression analysis was conducted for all the independent variables (OR, TR, PR, CP, SC, and C) against the dependent variable *Intention to use*. This is shown in Table 9.25.

Table 9.25: Multiple Regression analysis between the dependent and independent variables

Variables	**Model (Dependent variable: *Intention to use*)**			
	B	*β*	*t*	*p*-value
Organizational readiness	-0.008	-0.005	-0.084	0.933
Technical readiness	0.088	0.053	0.923	0.357
Clinical practice	0.212	0.225	3.873	0.000
Social context	0.139	0.070	1.999	0.046
Compatibility	0.271	0.205	3.464	0.001
R^2	0.217			

The *R*-square value ($R^2 = 0.22$), explains that 22% of the variation in the dependent variable (ITU) can be explained by variation in the independent variables (OR, TR, PR, CP, SC, and C), the *F* statistic with the degrees of freedom of 5 and 368, and $F = 20.365$ and a significant *p*-value ($p < 0.05$). This means that all the independent variables used together were significantly related to the dependent variable ($p < 0.05$). Therefore, it can be concluded that the multiple correlation coefficients are significant, and correlation between these variable in the population is greater than zero.

The regression coefficient values were, for *Clinical practice* ($t = 3.9$, $p < 0.05$), Social context ($t = 2.0$, $p < 0.05$), and for *Compatibility* ($t = 3.5$, $p < 0.05$). The regression coefficients (*t* values) for OR, and TR, were -0.08, and 0.92 respectively, but were not significant ($p > 0.05$ for all). Therefore, CP, SC and *Compatibility* uniquely contribute to the regression equation. The other independent variables (OR, and TR) provided no unique contribution.

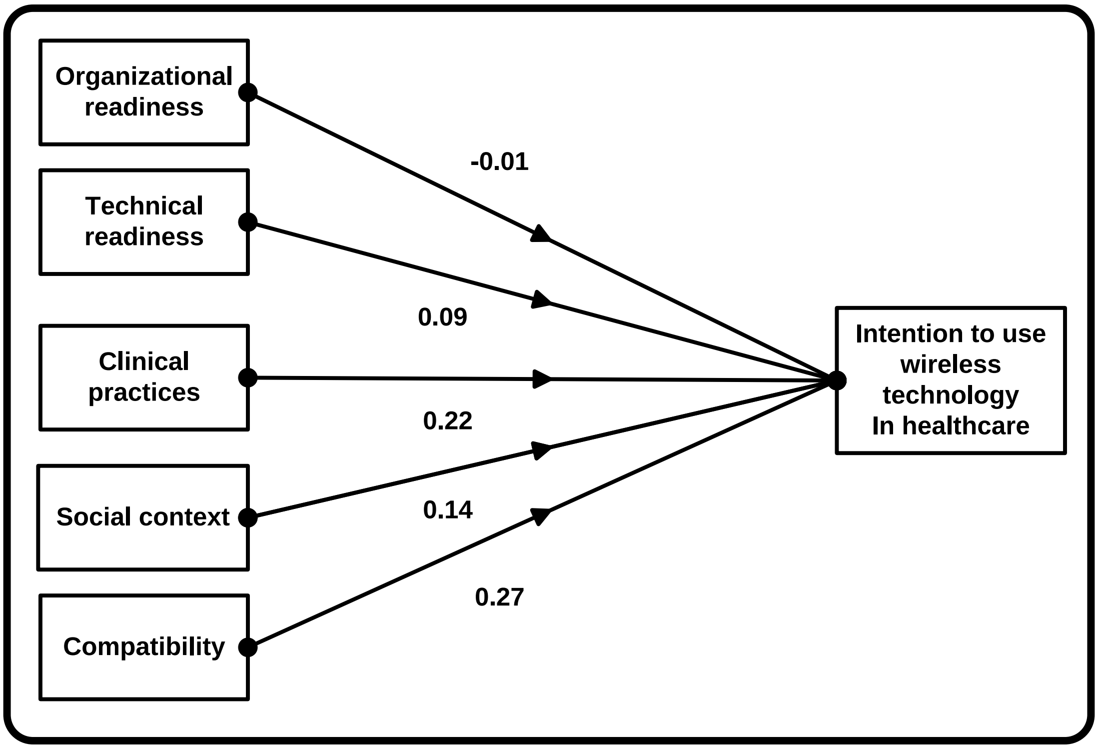


Figure 9.7: Summary of regression analysis between independent variables (OR, TR, CP. SC, and C) and the dependent variable Intention to use wireless technology in a healthcare setting

Consequently, it is now possible to conclude that a standard multiple regression analysis could be conducted between independent variables and the dependent variables. The multiple correlation coefficient (R = 0.47) was significantly different from zero, $F(5, 368) = 20.365$, $p < 0.05$, and 22% of the variation in the dependent variables was explained by the set of independent variables (adjusted R^2 = 0.217). *Clinical practice Clinical context*, and *Compatibility* were found significantly and uniquely contributing to the determination of the dependent variable, *Intention to use* wireless technology. TR and OR were found not to provide any significant unique contribution to the dependent variable.

Therefore, the standardized coefficient of multiple regression analysis describes the relationship of the independent variables — *Technical readiness, Organizational readiness, Perceived readiness, Clinical process, Social context* and *Compatibility* — with the dependent variable, *Intention to use*, as follows (see Table 9.26).

Table 9.26: Summary of regression analysis between independent variables PR, CP, SC, and C with the dependent variable *Intention to use* wireless technology in healthcare.

Variables	**Model (Dependent variable: *Intention to use*)**			
	B	*β*	*t*	*p*-value
Perceived readiness	–0.020	0.079	–0.255	0.799
Clinical practices	0.224	0.237	4.147	0.000
Social context	0.141	0.122	2.105	0.036
Compatibility	0.305	0.231	4.171	0.000
R^2	0.215			

Table 9.26 shows that only *Clinical practices*, *Social context* and *Compatibility* determinants specific to a healthcare setting are major contributors to the determination of *Intention to use* wireless technology in a healthcare environment. CP, SC and C are also the only determinants which are statistically significant as well. At the same time, the above analyses have also shown that there are significant relationships of TR, OR, and PR to the dependent variable *Intention to use* wireless technology.

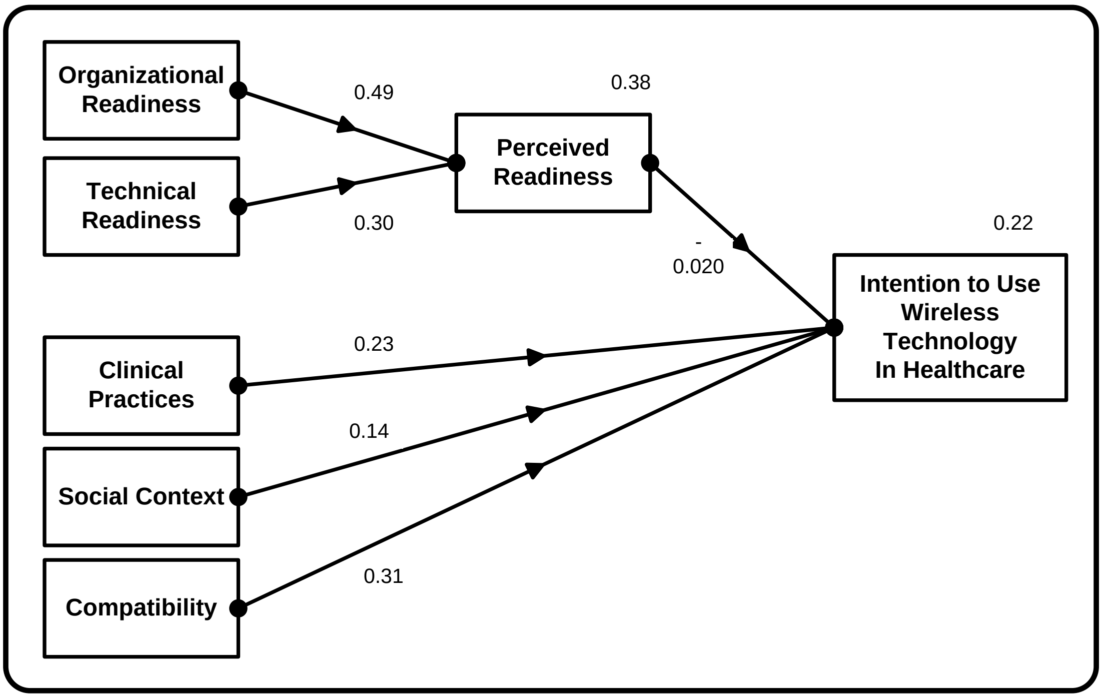


Figure 9.8: Complete model for the intention to use wireless technology in a healthcare setting

9.9 Hypotheses testing

As explained in the previous chapter, subsequent to the qualitative data analysis, the initial framework for this study was further developed to accommodate the findings from qualitative data. From this framework, the researcher developed nine hypotheses to verify the interactions among the various determinants (the detailed description of the development of the research framework and hypotheses can be found in the previous chapter). The determinants TR, PR, PR, CP, SC, and C were conceptualized as contributing towards the healthcare professionals' intention to use the wireless technology, and the relationships among these determinants was tested through multiple regression.

On the basis of multiple regression analysis, the hypotheses outlined in the initial framework development section were further analysed using higher level statistical techniques. Table 9.27 provides the summary analysis of the hypotheses formulated in this study.

Table 9.27: Summary analysis of hypothesis formulated in this study

Hypothesis	**Descriptions**	**Significant value**	**Acceptance/ rejection**
Hypothesis 1	Perceived technical readiness of the healthcare facility will not indirectly facilitate the adoption of wireless technology in the Australian healthcare systems.	$p > 0.05$, $t = 0.92$ $\beta = 0.05$	Accepted
Hypothesis 2	Perceived organizational readiness of the healthcare facility will not indirectly facilitate the adoption of wireless technology in the Australian healthcare systems.	$p > 0.05$, $t = -0.08$ $\beta = -0.005$	Accepted
Hypothesis 3	Perceived readiness of the healthcare facility will not facilitate the adoption of wireless technology in the Australian healthcare systems.	$p > 0.05$, $t = -0.26$ $\beta = -0.14$	Accepted
Hypothesis 4	Clinical practices will not affect the adoption of wireless technology in the Australian healthcare systems.	$p < 0.05$, $t = 4.15$ $\beta = 0.24$	Rejected
Hypothesis 5	Social context will not facilitate the adoption of wireless technology in the Australian healthcare systems.	$p > 0.05$, $t = 2.11$ $\beta = 0.12$	Rejected
Hypothesis 6	Compatibility issues will not affect the adoption of wireless technology in the Australian healthcare systems.	$p < 0.05$, $t = 4.17$ $\beta = 0.23$	Rejected
Hypothesis 7	Perceived usefulness of the wireless technology to the workforce will not indirectly affect the adoption of wireless technology in the Australian healthcare systems.		Not tested in this research
Hypothesis 8	Perceived ease of use of the wireless technology to the workforce will not indirectly affect the adoption of wireless technology in the Australian healthcare systems.		Not tested in this research
Hypothesis 9	Attitude of the workforce towards the wireless technology will not affect the adoption of wireless technology in the Australian healthcare systems.		Not tested in this research

9.10 Conclusion

Various constructs in this research were analyzed for validity, reliability, convergence and discriminant validity. Cronbach's alphas from SPSS helped to measure internal consistency. The Cronbach's alpha values in this research were very high, showing high levels of internal consistency. The convergent validity was also measured on the basis of correlations to confirm that the associated items were actually measuring the factor they were meant to measure. In this study, one-way ANOVA was used to test the differences between mean values; the aim was to examine participants' intention to use wireless handheld devices in a healthcare setting, and to analyze differences between various groups of healthcare professionals (such as physicians and nurses). Therefore, in the SPSS analysis, standard deviations for each group were calculated, and alpha values were set at 0.05 to test the significance levels.

Further, regression and multiple regression analyses were conducted of the independent variables TR, OR, PR, CP, SC and C, against the dependent variable *Intention to use* the wireless handheld devices. These findings have been reported in this chapter.

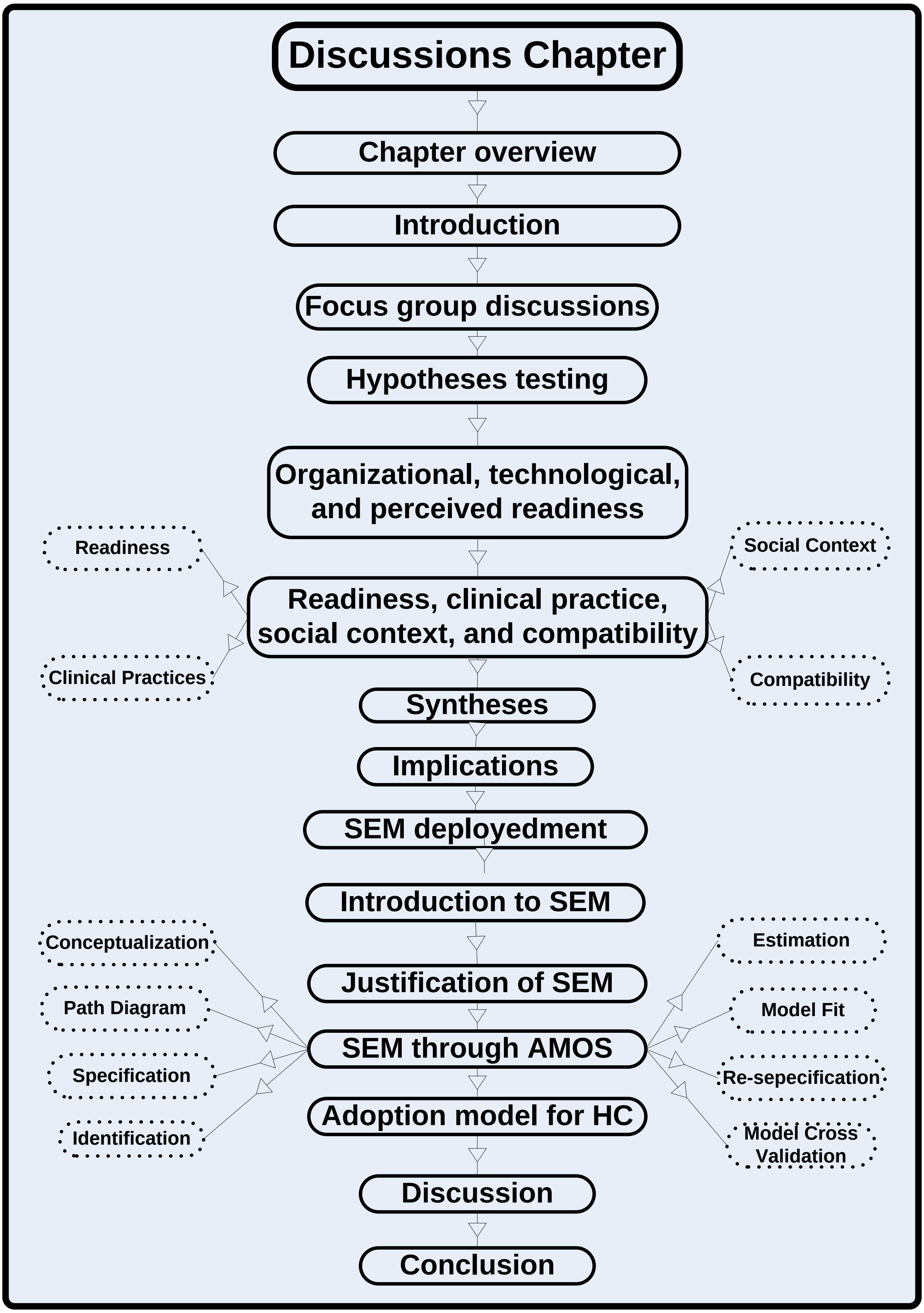
The next chapter will provide discussions of the data analysis and findings of this research study.

Chapter 10 Discussions

10.1 Chapter overview

The previous chapters provided analyses of data collected in this research through qualitative and quantitative techniques. This chapter discusses the implications of the findings of this study for the wider research community.

This chapter provides discussions arising as a result of statistical hypotheses testing. Furthermore, this chapter will also highlight the limitations of the statistical tests conducted (regression analyses) in the previous chapter and will provide a solution to redress the limitations by using the structural equation model (SEM). This technique was used to help develop the adoption model for the participants' intention to use the wireless technology in the healthcare domain.



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10.2 Introduction

The early chapters of in this thesis covered a range of topics in the domain of technology adoption and healthcare, to guide the researcher to identify gaps in the literature and so formulate the following two specific research questions.

Research question 1: What are the determinants for the use of wireless technology in the Australian healthcare environment?

Research question 2: What factors constitute a framework for the adoption of wireless technology in the Australian healthcare setting?

Following the introduction and literature review chapters, the methodology chapter provided the research methodology that was adopted to address these research questions. Chapter 6 provided comprehensive justifications and a step-by-step approach to developing the research framework for this study. The remaining chapters have provided descriptions of the procedures followed to collect both the qualitative and quantitative data, and then to analyse it. This chapter will now provide a discussion that will draw these various threads together, and provide answers to the two research questions.

10.3 Focus group discussions

The focus group data provided several valuable insights. Importantly, the healthcare professionals believed that the existing environment provided barriers to the adoption and usage of wireless handheld devices in their healthcare settings. For example, it was mentioned in almost all focus group sessions that technological integration, proper training and time available for accommodating the wireless handheld devices in a healthcare environment would all be crucially important. It was also believed that wireless handheld devices have great potential in healthcare settings. For example, it was highlighted that these devices can reduce errors, improve quality of data, provide opportunities to spend more time caring for patients and give instant access to regularly updated information. Other issues and barriers identified during discussions were security of data, privacy of patients, fear of legal liability and the difficulty of finding the time needed to understand and get to know how to use the technology.

It was also mentioned in the focus group discussions that even though nurses are not generally technically minded, the use of wireless handheld devices could influence the social network and sharing of knowledge, especially at the time of changing a shift and handing over the charge to the next shift team. The initial list of drivers and inhibitors from the focus group discussion sessions held no surprises, as previous studies have identified some of the themes. Issues such as security (Sausser, 2002), clinical process (Hu et al., 2002), wireless device characteristics (Thompson, 2005), management of technology (Dyer, 2003), suitability of devices (Atwal, 2001), and cost (Williams, 2001) are examples. The literature in this domain also supports the findings of the focus group sessions (Ammenwerth et al., 2000; Carroll et al., 2001; Chen et al., 2004; Leung et al., 2003; McAlearney et al., 2004; Thompson, 2005).

The qualitative data analysis also identified some additional issues associated with adoption. These might be specific to the Australian healthcare environment. For example, focus group participants were concerned about the standards and procedures adopted to provide services in the healthcare domain. This is quite understandable as there are many policies and procedures that healthcare professionals need to follow while providing services. Even though the concern for security and privacy is well researched and there are policies and procedure available, the participants were concerned about the use of wireless handheld technology in the context of security of data and privacy issues associated with these devices. Furthermore, legal liability associated with these mobile devices was another concern, as this domain is not well researched in the context of a healthcare setting and needs further research. For example, data and other information on the device itself, or the transmission of the data/information through an insecure wireless infrastructure could trigger legal liability issues. The cost of implementing the infrastructure associated with the wireless handheld devices was another area of concern, as most of the healthcare facilities in the Australian healthcare environment are under-funded and struggling to attract resources to support high quality care.

Focus group sessions were employed in this study to obtain firsthand knowledge about issues associated with wireless handheld technology in healthcare. The findings of the focus groups, while confirming some of the issues already highlighted in the literature, seem to be reflecting the views echoed by others as well. It was evident from the discussions and the findings that adoption of wireless technology is still in its early stages and no proper solution is available for the healthcare domain.

Themes and categories identified in the qualitative research were used to refine the framework for the adoption of wireless technology in healthcare setting. Furthermore, these themes and categories were also used to develop the survey instrument, to collect the quantitative data from the wider community, and to understand the determinants for the adoption of wireless handheld devices in the Australian healthcare environment. The following section provides a discussion on the quantitative data analysis.

10.4 Hypotheses testing

In the previous chapter, the data analysis showed that the null hypotheses relating to, clinical practices, social context and compatibility were rejected. The rejection indicates that these factors impact on the healthcare context when wireless technology is considered. However, perceived technical readiness, perceived organisational readiness, and perceived readiness do not appear to be influencing the adoption of wireless technology in the given context. (The following paragraphs discuss these factors.) This study posited nine hypotheses for testing (see Table 10.1).

Table 10.1: Summary analysis of hypothesis formulated in this study

Hypothesis	**Descriptions**	**Significance Value**	**Acceptance or Rejection**
Hypothesis 1	Perceived technical readiness of the healthcare facility will not indirectly facilitate the adoption of wireless technology in the Australian healthcare systems.	$p > 0.05$, $t = 0.92$ $\beta = 0.05$	Accepted
Hypothesis 2	Perceived organizational readiness of the healthcare facility will not indirectly facilitate the adoption of wireless technology in the Australian healthcare systems.	$p > 0.05$, $t = –0.08$ $\beta = –0.005$	Accepted
Hypothesis 3	Perceived readiness of the healthcare facility will not facilitate the adoption of wireless technology in the Australian healthcare systems.	$p > 0.05$, $t = –0.26$ $\beta = –0.14$	Accepted
Hypothesis 4	Clinical practices will not affect the adoption of wireless technology in the Australian healthcare systems.	$p < 0.05$, $t = 4.15$ $\beta = 0.24$	Rejected
Hypothesis 5	Social context will not facilitate the adoption of wireless technology in the Australian healthcare systems.	$p > 0.05$, $t = 2.11$ $\beta = 0.12$	Rejected
Hypothesis 6	Compatibility issues will not affect the adoption of wireless technology in the Australian healthcare systems.	$p < 0.05$, $t = 4.17$ $\beta = 0.23$	Rejected
Hypothesis 7	Perceived usefulness of the wireless technology to the workforce will not indirectly affect the adoption of wireless technology in the Australian healthcare systems.		Not tested in this research
Hypothesis 8	Perceived ease of use of the wireless technology to the workforce will not indirectly affect the adoption of wireless technology in the Australian healthcare systems.		Not tested in this research
Hypothesis 9	Attitude of the workforce towards the wireless technology will not affect the adoption of wireless technology in the Australian healthcare systems.		Not tested in this research

As can be seen from Table 10.1, the first three hypotheses relate to the readiness – especially technical readiness, organisational readiness and perceived readiness – in adopting wireless technology. The hypothesis testing revealed no significance. The implied meaning of this outcome can be attributed to the fact that the Australian healthcare agencies are conversant in their computer usage. Australia is one of the leading nations in electronic handling of patient records, pathology results and telemedicine settings. Therefore, it can be assumed that most of the healthcare contexts studied for this research are well equipped with computer technology, and are advanced with their organisational policies in terms of procuring computing equipment. Moreover, it is understood that the medical graduates, nursing students and other paramedical professionals are well equipped with computing technology. Even ambulances are equipped with global positioning systems (GPS), electronic communication systems and some form of computing technology to record patient health conditions. As indicated by Chau and Turner (2004), Tasmanian aged care facilities were well equipped with computing technology. Other studies also attest to the fact that Australian healthcare is well exposed to computing technology (Gururajan & Murugesan, 2005). Therefore, it is not surprising that these three hypotheses were ‘accepted’, indicating that perceived technical readiness, perceived organisational readiness and perceived readiness would have no significant influence on technology adoption. The readiness factors for technology and organisation have already been established in Australian healthcare, as evident by the investment made in the technology. Therefore, if these factors are to have any influence, the influence will be indirect and not direct as posited in this study.

10.5 Organizational, technological and perceived readiness

Pearson correlation analysis and second level regression analysis in this study show strong corrections between the dependent and independent variables. This is also confirmed by the *Variance inflation factor* (VIF), which confirms that all the three predictors – OR, PR and TR – are contributing in explaining the variation as attested by Myers (1990).

Further, the regression analysis between the composite variable TR and OR as the independent variable, and PR as the dependent variable (R = 0.451 and R^2 = 0.203) indicates that 20.3% of the variations in the dependent variable (PR) can be explained by the two combined predictors (OR and TR). Coefficient analysis also predicted significance (t = 6.01, $p < 0.05$, and t = 5.61, $p < 0.05$). The linear regression analysis between PR and ITU provided $R = 0.168$, $R^2 = 0.028$, with $t = 3.3$ and $p < 0.05$. Thus, the standardised coefficient of multiple regression analysis strongly endorses the relationship of these three determinants for the adoption of wireless handheld technology in the Australian healthcare setting.

From the above analysis, it can be inferred that in order for Australian healthcare professionals to accept the wireless technology, technological and the organisation readiness are important. These two aspects are essential in order to realise benefits offered by the wireless technology. These benefits may include technology knowhow, integration, infrastructure, clinical/business processes and consultation. While wireless technology may not help directly with clinical performance, the data associated with such clinical procedures can be managed with wireless technology, thus providing better access to data. Furthermore, this study also shows that traditional adoption methods alone are not enough to explain the wireless technology adoption phenomena in healthcare environments. These aspects are yet to emerge in the literature.

The regression analyses conducted in this study demonstrate that there is a relationship between the independent variables OR, TR and PR, and the dependent variable ITU. Even though the overall unique contributions of these independent variables to the dependent variable are low, they are uniquely contributing to an explanation of the variation in intention to use the wireless handheld devices in the healthcare environment studied. Analysis of technological, organisational, and perceived readiness has established that the Australian healthcare professionals are concerned with the technological and organisational readiness of their healthcare facility. Therefore, the intention to use wireless technology is affected by healthcare facility readiness to adopt the wireless technology. Bates et al. (2001) argued that 'while it may be easy and common to blame operators for accidents [or errors], investigation often indicates that an operator "erred" because the system was poorly designed (p. 301)'. Therefore, medical errors can also occur due to poor usability resulting from poor designs. The healthcare professionals who participated in this study did relate high quality services to reduced documentation inaccuracy, and there was a belief that wireless technology through handheld devices can reduce these inaccuracies. Therefore, this study reinforced the argument of Bates et al. (2001) that good usability is especially important to maintain the high quality expectations of these practitioners.

Early adoption models in information systems such as the Technology acceptance model (TAM) determined the factors of adoption based on individual preferences. A major flaw in such an approach is ignoring the fact that users, especially at organisation levels, use the technology in a given setting. The healthcare setting comes with a number of limitations and constraints. The variations of TAM have absorbed the same flaw (as in TAM) and ignored organisational factors that impact on technology adoption. This study has gone one step further by including healthcare-specific factors to determine the factors of adoption. Thus, this study deviates from the traditional models of technology adoption.

It is possible to mount a counter argument, that if technology adoption is to be studied, then factors external to technology, such as organisational factors, play a crucial role in determining adoption. This is even truer in health organisations. The reason for this is that end users in the health domain – for example nurses and doctors – are conversant with medical technologies. They are also familiar with ICT. Therefore, the blend of ICT with various medical technologies is crucial in their acceptance of the technology suite. In terms of wireless technologies, the handheld devices would be used to collect data arising from a number of clinical domains, and hence the capability of an organisation to introduce and maintain the service levels in terms of their preparedness is essential for adoption. Further, healthcare settings should be able to support these technologies to ensure high levels of clinical activities. This is where health professionals lack expertise. This aspect has been established in this study.

This study, perhaps for the first time, is able to show that the perceived opinions of healthcare professionals indicate that they view adoption in two different forms. The first is the direct relationship of the two groups of factors – OR and TR – on perceived readiness. This includes factors such as having the expertise to maintain the technology and the training required. While these factors have a direct bearing on organisations, the professionals also felt that these factors indirectly influence the

Intention to use determinant. The direct as well as the indirect relationship of this critical set of factors demonstrates the complex nature of adoption theory in the domain of wireless technology. Early models such as TAM have over-simplified this aspect in terms of perceived ease of use and usefulness. While usefulness is an indicator in the models used here, ease of use does not appear to be dominant.

Irrespective of the variation, it appears that organisational readiness is a key component in determining intention in using wireless technology in the healthcare domain. This involves the attitude of management, the organisation's financial position, and the support given to healthcare professionals in terms of training and technological support. While these factors are beyond technological aspects, they appear to have a dominant influence on technology usage.

10.6 Readiness, clinical practices, social context, and compatibility

This section will discuss the effects of readiness, clinical practices, social context and compatibility on adoption.

10.6.1 Readiness

Perceived readiness (PR) in this research study is defined as a healthcare professional's belief that wireless technology will enhance his or her productivity and performance. Perceived readiness is also influenced by the technological and organisational readiness of the healthcare facility.

Previous studies have clearly indicated that perceived readiness will determine adoption. Hripcsak et al. (1999) have stated that homecare nurses benefitted by using wireless technology. These nurses, when provided with technology, showed a willingness to use it. The preparedness and willingness to accept a new technology is understood to being 'ready'. The behavioural studies that were reviewed for this research highlighted the fact that once people are ready to accept a technology, the chances that it will actually be accepted will increase. In other words, perceived readiness that showed significance in this study can be considered as a factor that would motivate people to accept the technology when provided with it. Succi and Walter (1999) also observed that employing strategies to remove technology-related fears can motivate people to be ready to accept it, which therefore increases its rate of adoption. Winsnicki (2002) indicated that learning about wireless technology and device related factors would enable people to be ready to accept the technology. Littlejohns et al. (2003) reported that lack of infrastructure was a major barrier to accepting a technology. They asserted that acceptance depends on factors that go beyond mere technical aspects; rather, acceptance requires a multidimensional view. This study has found supporting evidence to their claims. For example, while technical readiness was not directly significant, perceived readiness was. Littlejohns et al. (2003) established that people should be exposed to functional aspects of a technology in order for them to accept it. When these assertions are read in conjunction with those of Winsnicki (2002) – that learning processes are crucial in getting people ready to accept technology – it can be inferred that perceived readiness must be added to technical and organisational readiness factors. Perceived readiness, in fact, can include certain mental models of how a technology can perform in a given context and its use in that context. This study has provided concrete evidence in support of this fact through the qualitative component, where participants stressed that wireless technology should be useful in a clinical context for them to adopt it. This comment was made by participants who were exposed to wireless technology either in terms of its awareness or the usage aspects. Therefore, readiness is a significant determinant in the adoption of technology.

In this study, readiness was investigated in terms of introducing electronic records, critical support extended to colleagues, the health environment, planning procedures, work practices and existing rigidity in the workplace. These aspects have been extracted from the qualitative component. As can be seen, the collective combination assists health staff to be ready in adopting wireless technology. It was established in the qualitative component that nursing staff would be able to access patient records at point of care using wireless technology. This access would also enable other practitioners to answer queries raised at critical times. However, this involves proper planning to introduce the technology and strong supporting procedures to access and disseminate information. Work practices – including how to procure the wireless technology at individual levels, how to store data and how to maintain its continuing integrity – become crucial in the acceptance and then the adoption of this technology. The participants highlighted the current rigid practices as barriers to this technology's adoption.

The perceived readiness factor (which has shown significance) should address each of the above issues. For example, providing a good wireless technology coupled with rigid practices in its use would only de-motivate people, thus discouraging its use. Further, prior to the introduction of the technology, proper learning processes should be provided in order for the health staff to develop mental models for using it. Such mental models would result in higher levels of clinical usefulness, a fact that has been highlighted in other research. This study provides evidence that perceived readiness will be a determining factor in the adoption of wireless technology in healthcare.

10.6.2 Clinical practices

Clinical practice as defined in this study refers to actual clinical procedures suitable to be used with wireless handheld technology. This is a specific healthcare factor and was extracted from the focus group data generated from discussions with healthcare professionals. Quantitative data analysis provided statistical evidence that this determinant is significant for the adoption of wireless technology in healthcare. Clinical practice in this study was measured in the context of quality of information available through wireless technology, reduction in errors, quality of care, time management, and improved reporting procedures.

Chousiadis and Pangalos (2003) provided evidence that wireless technology can be considered useful where it can be demonstrated that it improves efficiency and productivity. This study confirmed that in the context of a healthcare environment, healthcare professionals view wireless technology as having the ability to improve quality of care, quality of information available, and ability to reduce workload so as to facilitate the adoption phenomena. Lewis, Felkey and Fox (2003) demonstrated that PDAs could provide access to external and internal resources at the point of care, and so help with correct decision making. Results from this study not only confirm these findings but also reinforce the idea that health-specific determinants such as clinical practice are critical for the adoption of wireless technology in a healthcare setting.

Lu et al. (2005) reviewed healthcare studies from 1998 to 2004 and concluded that PDAs have potential in the healthcare environment if they are provided with suitable healthcare-related software such as decision support systems, administrative support systems and systems based on professional activities. While the determinants of clinical practices were extracted from the qualitative focus group discussions, this study has confirmed the suitability of processes and applications that support clinical practices, for the wireless technology and asserts that these are critical for the healthcare professionals to adopt this technology. Support for this notion can be found in Lee (2004).

10.6.3 Social context

This study shows statistical significance for social context in that it is a determinant for the adoption of wireless technology in healthcare. Social context in this study was investigated through social values, availability of wireless technology, organisational politics, organisational culture and work environment suitability. These aspects were extracted from the qualitative component.

Aspects of social context and its influence on technology adoption have already been highlighted by the MPCU (Model of PC Utilization) Triandis (1980); Moez et al., 2004). This same theory refers to the influence of facilitating conditions on technology adoption. In this study, facilitating conditions are represented by work culture and suitability of work environment. Therefore, this study is in alignment with MPCU in establishing that social context is a determinant for wireless technology adoption.

Chau and Turner (2004) have also alluded to the fact that social-technical aspects are crucial in the adoption of technology in healthcare. While this study extracted social aspects through the qualitative component, the factors were discussed in a technology context. Thus, this study confirms the findings of Chau and Turner (2004) that social context is important in technology adoption.

Similarly, Yu and Comensoli (2004) have also established that cultural resistance is a factor that may impact on adoption. While their study was on IT, this study is able to find similar sentiments that cultural aspects play a key role in determining wireless technology adoption. While Yu and Comensoli found evidence through qualitative study, this study found support for this notion through both qualitative and quantitative components (99.5% confidence).

Whang et al. (2004) also supported the view that social influence has positive effects on technology adoption. They found that the combination of social influence and usefulness of technology provide positive influences. In this study, the participants expressed the idea that the clinical usefulness of technology combined with social factors would yield a better rate of adoption. While Whang et al. (2004) identified a number of internet technology factors impacting on adoption, this study found a number of wireless technology related factors influencing adoption. The factors include hardware aspects such as size and weight as well as network-related aspects such as access and availability of network connections. Whang et al. (2004) found that TAM did not address mobile devices; however, this study considered mobile handheld devices and found their assertions to be applicable to the wireless handheld technology. Thus, social context influences adoption of wireless technology in the Australian healthcare setting.

10.6.4 Compatibility

Compatibility in this research is defined as the ability to integrate wireless technology with existing technology, work practices, and healthcare procedures. The healthcare professionals initially highlighted compatibility as one of the determinants, as they perceived that compatibility is critical to understanding the existing healthcare procedures and ICT infrastructure. This research has statistically established that compatibility is a significant determinant and would lead to better adoption of wireless technology. Furthermore, this research found that simply acquiring and implementing wireless technology alone would not be sufficient to accomplish clinical usefulness to drive adoption and diffusion. Smith (2004) concluded that wireless technology needs to be integrated with the processes of improvement and organizational change. This study confirms such notions.

Compatibility in this research was measured in terms of reliability, standards, access, integration with existing infrastructure, and integration with existing clinical processes. May (2003) identified that an innovation which is perceived to be incompatible with existing clinical processes will eventually lead to its rejection. This research confirms the assertions of May in that the compatibility and integration of wireless technology with the healthcare practices and other ICT infrastructure are influencing the adoption. Ammenwerth et al. (2000) identified that physicians were also concerned with the connectivity of the technology, data transfer rate and weight of the handheld devices; these aspects, the physicians claimed, would discourage them from using wireless technology. While Ammenwerth et al.'s study was with physicians, this study found similar sentiments with nurses, in that integration of the technology, compatibility with existing technology and clinical processes would play a key role in determining their adoption of wireless technology.

10.7 Syntheses

This study has been able to statistically establish the relationship of six independent variables (TR, OR, PR, CP, SC, and C) with the dependent determinant, ITU (*Intention to use*) for wireless technology in the Australian healthcare setting. The correlation and multiple regression analysis for PR, CP, SC, and C also provide evidence that these variables uniquely and directly contribute in determining the dependent variable, ITU. Further, the statistical analysis also showed that TR and OR indirectly contribute to ITU through PR.

The study asserted that *clinical practices*, *social context* and *compatibility* influenced the intention to adopt wireless handheld technologies in the Australian healthcare environment. The participants agreed that the technology would be useful in improving management practices associated with clinical activities, improving reporting procedures, improving quality of care, reducing errors and enhancing clinical communication. While previous studies (Gururajan, 2007a; Lu et al., 2005;

McAlearney et al., 2004; Smithline, 2002; Spigel, 2004; Thompson, 2005; Tseng & Heui-huang, 2007; Wilcox & Whitham, 2003) have highlighted these aspects since 2002, perhaps this is the first time that empirical evidence is presented to assert this aspect.

What transpires from the data analysis, especially the regression analysis, is that in order for Australian healthcare professionals to accept the wireless handheld devices and for them to use it, *Perceived readiness*, *Clinical practices*, *Social context* and *Compatibility* are important. These variables are essential in order to realise the benefits offered by the technology. These benefits may include integration of clinical data, clinical processes, perceptions about wireless technology, the ability of the healthcare organisation to facilitate wireless technology, culture, practices, quality of care, technological integration, infrastructure and reliability. The mere *adoption* of wireless technology may not be sufficient to ensure that the organisation is able to take advantage of all its features; however, the data from various sources will be integrated, and with this improved communication environment, the wireless technology will provide better access to information and the quality of care provided. This study deviated from traditional adoption models as these methods alone are not sufficient to explain the adoption phenomena when it comes to the healthcare environment (Athey & Stern, 2002; Stuart & Bawany, 2001; Turisco, 2000; Wisnicki, 2002).

While the technology itself may not be directly useful in clinical operations and clinical procedures, the added value provided by technology in information management and information quality appears to be a driving factor to influence adoption. Similarly, in terms of compatibility, respondents expressed the view that the compatibility of hardware and software applications was crucial in the adoption of technology. While this is not surprising, our knowledge indicates that health departments have not yet considered this aspect seriously. For example, it was understood from the focus group discussions that some health agencies did not comply with HL7 standards, as technologies that were then being procured came from certain overseas countries where different standards were being used (an example was the US Health Insurance Portability and Accountability Act). Aspects such as these appear to inhibit adoption (Chen et al., 2004). Therefore, it is essential that technology developers study the context prior to development. While the operating systems and other generic applications may be compatible with health organisations, clinical communications fall under the auspices of certain standards such as the IT16 standard in Australia. Therefore, compliance with these regulatory aspects is essential for successful implementation and then adoption.

The impact of social context is a new finding in this study. The healthcare environment is quite cohesive in many countries and peer influence is a key driver in technology adoption. This study has provided empirical evidence that organisational policies, social culture and organisational culture are all influential. While these aspects can vary from context to context in their granularity, it appears that these factors do influence adoption (McAlearney et al., 2004).

While controlling the CP, SC and C, the study also indicated that *Perceived readiness* is acting like a mediating variable, and that there is an indirect influence of *Organisational readiness* and *Technical readiness* on *Intention to use* wireless technology in the healthcare environment. It is possible to find evidence that *Organisational readiness* and *Technical readiness* have an influence on *Perceived readiness*, which directly influences adoption. Therefore, it is possible to argue that due to technical aspects associated with technology, that is still emerging, *Perceived readiness* can play a crucial role in influencing the clinical uses of technology. This aspect needs further investigation, as there was no evidence in the literature that this has been significantly researched.

The intention to use a technology is driven by aspects such as the technical readiness of an organisation to support it, the integration of the technology into the organisation's culture and the integration of the technology with the organisation's clinical practices. These aspects clearly indicate the infant and emerging nature of wireless handheld technology in a clinical environment; they are also dictated to some extent by the social context. The reason for this appears to be that the healthcare professionals understand how the technology can be used in a health context, based on presentations given by their peers and conversations in social settings. These appear to be influencing their mental models of technology usage and hence adoption.

In summary, the study was able to provide strong evidence that the determinants for the adoption of wireless technology in healthcare – *Technological readiness, Organisational readiness, Social context, Clinical practices* and *Compatibility* of wireless technology – influence the intention to use this technology. To the knowledge of this researcher, this is the first study in an Australian context to come up with empirical evidence to assert the importance of these determinants. Due to the relative newness of these factors, further investigations are needed to identify specific aspects that contribute to the adoption factors; in this way, the IS and health communities can gain an understanding of how to develop and implement wireless handheld technologies in healthcare.

10.8 Implications

From the above discussions it can be summarised that the perception of Australian healthcare professionals is that they will use wireless technology if it provides efficiency gains and has the ability to improve their day-to-day activities. Such gains include time savings, integration of clinical processes, quality of information, and ability to provide quality of care. Apparently, the determinants of wireless technology do not pose a threat to the professionals' intention to use wireless technology in their healthcare setting. Such a view may be due to the nature of their work and their level of confidence in handling wireless technology.

However, it is evident from the data analysis that there are differences in how they see the variable *Intention to use*. This can be explained by the differing suitability of wireless technology for clinical practices, perceptions of healthcare professionals, and positive benefits offered by the use of wireless technology in the healthcare setting. In brief, six factors identified by the factor analysis and confirmatory factor analysis (TR, OR, PR, CP, SC, and C) cover a wide range of issues relating to (a) wireless technology, (b) clinical practices, (c) social environment, (d) ICT integration and (e) organisational and management issues in the context of the healthcare environment. Even though the multiple regression analysis showed that some variables were not significant for the direct relationship (TR and OR), it is important to understand that Australian healthcare professionals are looking for immediate outcomes as a result of implementing wireless technology. Such perceptions and beliefs can be crucial for any implementation strategy of wireless technology in the Australian healthcare environment (see data analysis in Chapter 9). Another implication from the data analysis is that the Australian healthcare professionals believe that the usefulness of the wireless technology is essential in the clinical domain, and that the ability of any wireless technology to be perceived as useful will have a positive impact on managements and on the attitudes of healthcare professionals.

Therefore, it can be concluded that if the wireless technology is useful in clinical settings, then the healthcare professionals will be motivated to use it, which can be transformed into wireless technology adoption. This study has a number of implications for the healthcare providers, and these can be summarised as follows.

1. Wireless technology can be used to facilitate the workflow of healthcare professionals.
2. Wireless technology has the potential to provide access to information rapidly and on the move.
3. Wireless technology can assist to accomplish the strategic and business goals of the healthcare facility.
4. Wireless technology can have a direct impact on the productivity and efficiencies of the healthcare professionals.

However, the adoption of wireless technology and its ability to achieve usefulness are complex and challenging issues. For example, it is important to address the security concerns, the privacy and confidentiality of patient data, the availability of applications and the modes of interaction with the wireless technology. It is important to understand that merely securing and implementing wireless technology alone would not be enough to achieve its usefulness in the healthcare environment; this, consequently, will affect the adoption of the wireless technology in healthcare settings. Wireless technology adoption is complex and needs to be integrated through the processes of identifying clinical improvements and benefits to management.

The literature in this research domain clearly shows (and has been confirmed by this study) that wireless technology in a healthcare domain has the potential to improve the quality of patient care. Smith (2004) found that acquiring and implementing wireless technology alone would be insufficient to accomplish clinical performance and subsequently to drive adoption and diffusion. Wireless technology should be integrated with improvements to processes and organisational change. Process improvement requires the optimisation of clinical processes and should be supported by technology, rather than driven by it (Smith 2004). This research study reinforces these sentiments but goes one step further to assert that adoption of wireless technology is a complex process for the healthcare environment and should be undertaken carefully to guarantee its successful uptake. Therefore, an improved adoption model for wireless technology in the Australian healthcare environment has been constructed (see Figure 10.1).

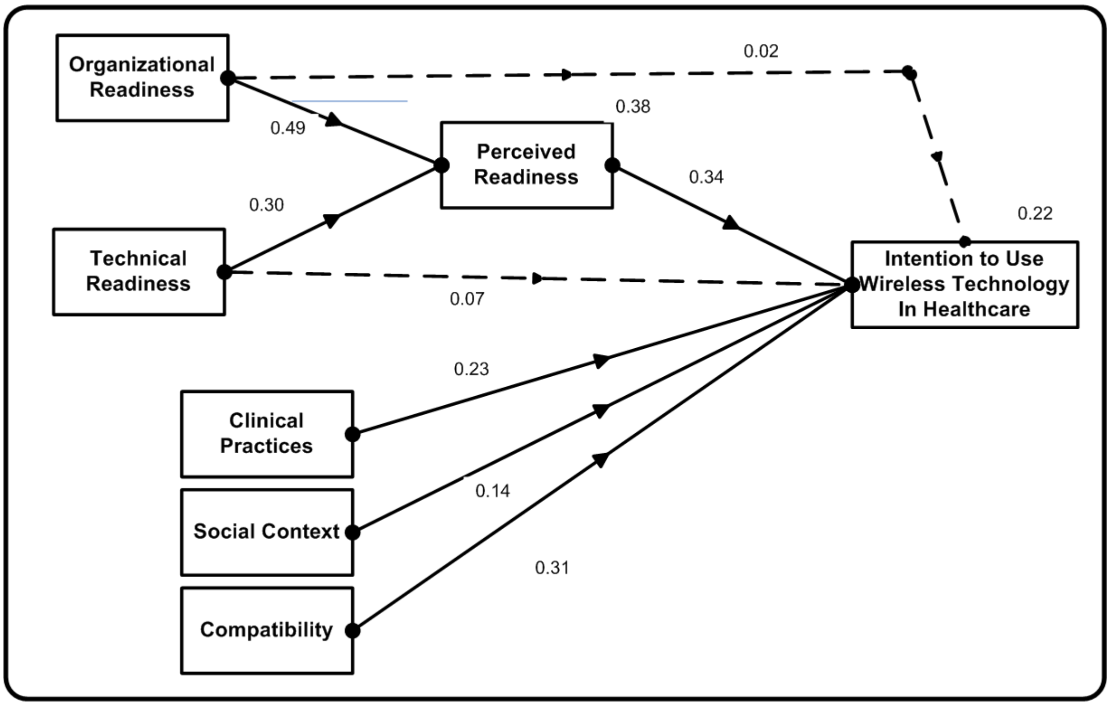


Figure 10.1: Adoption model for wireless technology in a healthcare setting

Through the regression analysis described in Chapter 9, it was evident that TR, OR, PR, CP, SC and C are the determinants for the adoption of wireless technology in a healthcare environment. Despite these arguments, the suggested model asserted in this study did not provide evidence showing why determinants such as TR and OR were not able to explain the variation in the intention to use wireless technology independently. Regression analysis, by controlling the determinates CP, SC and C, showed a strong relationship of the predictor PR with the intention to use wireless technology; however, when CP, SC and C were not controlled in the model, the predictor PR did not show a strong relationship with the intention to use wireless technology. One of the reasons for this could be that variation in ITU explained by PR independently, is explained by CP, SC and C (see Figures 9.6, 9.7 and 9.8) Similar situations were found with the predictors TR and OR while controlling the PR determinant, even though multiple regression analysis confirmed that OR, TR, PR, CP, SC and C are the determinants of ITU and variation in ITU is explained by these determinants.

Therefore, the causal relationship between dependent variables and the independent variables are not strongly demonstrated by the first-order regression model built in this research. This has already been highlighted by Black et al. (1982), who suggested that one of the limitations of regression analysis is that it assumes the relationship between the dependent and independent variables, but it cannot be sure about the casual mechanism (Black et al., 1982). Consequently, in the above model alternative causal explanations are often not considered, as the model does not explore the indirect effect of determinants such as CP, SC, and C on PR, TR, and OR to predict the actual effect of these determinants on the intention to use wireless technology. As the multiple regression analysis confirms, some variation in ITU is explained by PR, but can also be explained by CP, SC, and C. Some of there variations, as well as the causal relationships between these variables, can be explained by building a structural equation model (SEM) as suggested by Hunt (1990), Hair et al. (1998) and Hoyle (1995). In the domain of information systems, an SEM technique can be used to predict such a relationship among the determinants (Byrne, 2001; Hair et al., 1998; Hoyle, 1995; Hunt, 1990).

The next section of this thesis will provide further justification for the use of SEM before developing a model to explain the direct and indirect casual effects of the determinants on the intention to use wireless technology in a healthcare environment.

10.9 SEM Deployed for this study

The previous section of this chapter provided discussions about the determinants and the relationships among the determinants that influence healthcare professionals in accepting the use of wireless technology. Even though multiple regression analysis was used to identify relationships, this technique was limited in its ability to simultaneously identify simple direct and indirect relationships among the dependent and independent variables. Therefore, there is a need (a) to explore the direct and indirect relationships of all independent variables to the dependent variable, (b) to identify determinants which directly explain the variations related to their intention to use the wireless technology, and (c) to explore whether some determinants have indirect effects on the direct determinants. This can be achieved through the SEM technique.

10.9.1 Introduction

Structural equation modelling (SEM) is a statistical technique that has gained popularity for analysing the cause and effect relationships in a framework. The appropriateness of the SEM technique in this research can be justified by the fact that unobserved variables were not properly investigated through standard regression models. Previous research suggests that theories involving unobservable variables in the domain of social science research could play important roles in explaining social phenomena (Deshpande, 1983; Hunt, 1990).

SEM is also known as *Latent variable analysis*, *Analysis of covariance structure* or the *Causal modelling technique* (Byrne, 2001; Hoyle, 1995). This technique has the ability to combine factor analysis with path analysis; it also incorporates analysis of variance, covariance, and principal component analysis. Through SEM techniques, a researcher can use the factor analysis technique, or related items measuring the same variable, to create latent variables from multiple observed variables, as is the case in this research study.

In the SEM model there are two types of relationships between the latent variables. The first type is represented by directional arrows pointing towards the measured variables, indicating a directional causal relationship from one variable to another, the direction of the arrow indicating the direction of the causal relationship. The other type of relationship is between the latent variable and the correlation between the latent variables; this is represented by curved lines with arrows on both ends (MacCallum, 1995).

SEM has many advantages as compared to multiple regression analysis. For example, SEM allows a researcher to combine multiple observed measures of a latent variable and helps to identify the casual relationships. SEM also has the ability to explain the error residual as an unexplained variance, as independent variables do not explain all the variance in the dependent variables.

In terms of SEM and sample size, according to Bentler (1995), the ratio of sample size to the number of free parameters could be as low as 5:1, whereas the ratio of 10:1 is considered appropriate. This study employed a ratio of 8:1 and, consequently, was expected to result in an acceptable model.

10.9.2 Justification of SEM

SEM provides a second generation of analysis and provides individual relationships for dependent variables. In contrast to regression analysis, SEM helps to measure multiple regression equations estimated simultaneously. The two basic components are the *structural model* and the *measurement model*. The structural model provides information on how independent variables are related to dependent variables; the measurement model provides an opportunity to use several variables for a single dependent variable or independent variables.

SEM provides a platform to test the theory with latent variables with multilevel measures as described through the initial framework for the adoption of wireless devices in a healthcare setting (Hunt, 1990). Furthermore, this research being exploratory in nature, SEM provides an opportunity to explore the relationships among the various constructs mentioned in the initial research framework (independent variables and between the dependent and independent variables). The initial framework clearly shows that constructs are only unobserved variables and can be measured only through other measurable variables. It is understood that no framework can predict the adoption phenomena completely, as there would be some unknown factors or measurement errors. SEM is known to uncover such phenomena (Hair et al., 2006; Kline, 2005; Schumacker & Lomax, 1996). On these statistical grounds, the survey instrument used in this research is suitable for measuring the variance for all the observed variables, thus providing an opportunity to use SEM to estimate the total effect or to explain the variation in the dependent variable that is due to the independent variables (Hair et al., 1998).

The decision to use SEM in this research was taken because of its ability to analyse the multiple relationships and its ability to provide a transition from exploratory to confirmatory analysis. Therefore, SEM was found suitable to study the multiple relationships in a single comprehensive manner, and so understand the dependent relationships simultaneously. As can be observed from the research framework, the variable *Perceived readiness* is a dependent variable in one relationship, and is acting as an independent variable in another relationship (Hair et al., 2006). This is shown in Figure 10.2.

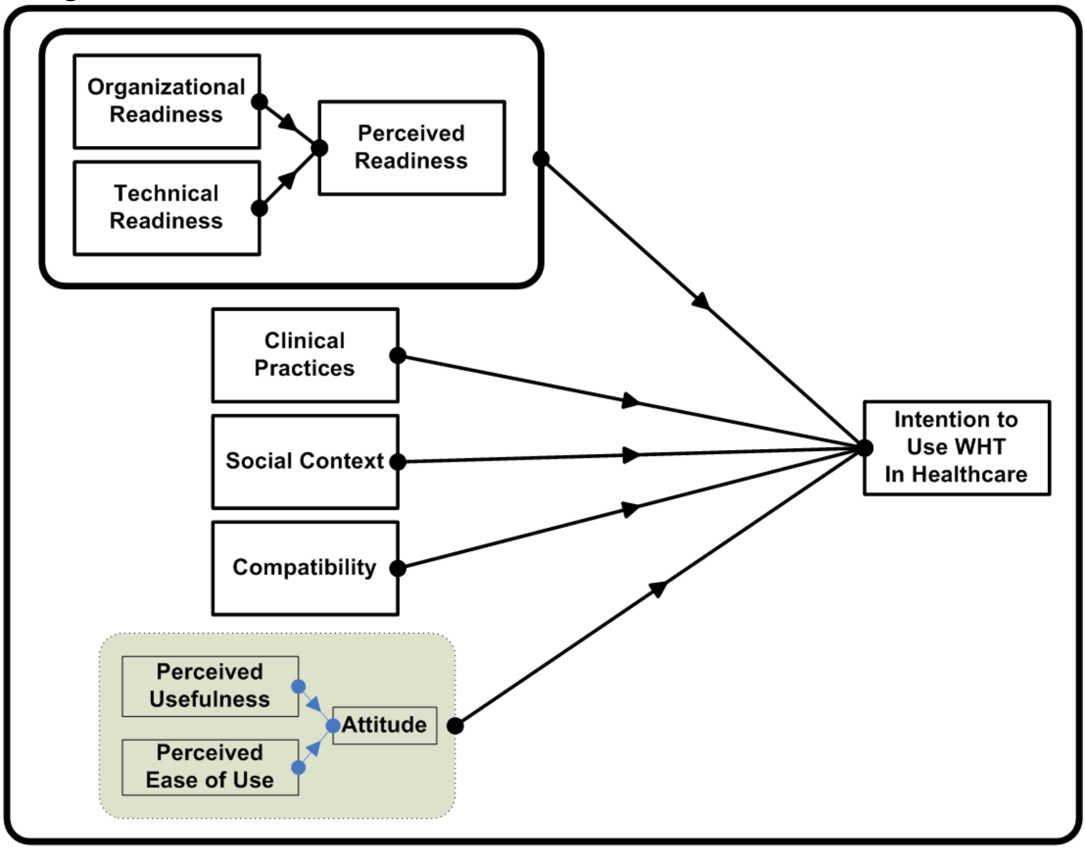


Figure 10.2: Complete adoption model for wireless handheld devices in Australian healthcare setting.

As discussed earlier, the lower part of the research model is actually the Technology acceptance model (TAM). This model, on its own, has been tested with some variations specific to the research domain, especially the two main constructs *Perceived usefulness* and *Perceived ease of use* (Davis, 1989). There has been some criticism, especially in the healthcare domain, that the two constructs of TAM are not sufficient to predict adoption phenomena in the healthcare environment for wireless handheld technology (Chau, 2002; Chismar & Wiley-Patton, 2006; Dixon & Stewart, 2000; Hu et al., 1999; Jayasuriya, 1998). As mentioned in the previous chapter, due to the length of the survey instrument and feedback received from the pilot study, a conscious decision was taken not to test or validate the TAM in this research study (a previous chapter provided detailed reasoning on this).

10.9.3 SEM through AMOS

SEM is often associated with an application called the *Analysis of moment structures* (AMOS), which is used to analyse direct and indirect relationships simultaneously. Researchers who have used structural equation modelling (SEM) have described up to eight steps for the development of SEM analysis (Bollen, 1989a; Diamantopoulos & Siguaw, 2000; Holmes-Smith, 2009; Hoyle, 1995; Kline, 2005; Schumaker & Lomax, 2004). In this study, the researcher has employed these eight steps to develop the SEM model for the adoption of wireless technology in the healthcare environment. The steps are Model conceptualisation, Path diagram construction, Model specification, Model identification, Model estimation, Assessment of model fit, Model re-specification and Model cross-validation.

Model conceptualization

Conceptualization of the model involves development of a strong theoretical background for the variables involved, and how these variables relate to each other. In this research a complete chapter has been devoted to demonstrate the theoretical aspects and interactions among the variables used in the final conceptual model.

Path diagram construction

Path diagrams visually represent the theoretical hypotheses and measurement proposal. Path diagrams also provide visual representations of the relationships among variables and how these variables are measured (Diamantopoulos & Siguaw, 2000). In this study, the researcher used the AMOS application to convert the conceptual framework into a path diagram.

Model specification

In this step a conceptual research framework is developed and the data analysis converts this into a path diagram, which is the transformation of the conceptual model to a SEM path diagram. The transformed path diagram will identify the relationships among the various variables involved in the conceptual model (Hoyle, 1995). In this research, (see Chapter 7 *Preliminary framework development*) two competing research models were developed. After an initial examination of the basic requirements for the SEM, the refined conceptual frame work was converted into the path diagrams to represent the relationships between the variables (Hoyle, 1995). The initial model from the path diagram is shown in Figure 10.3.

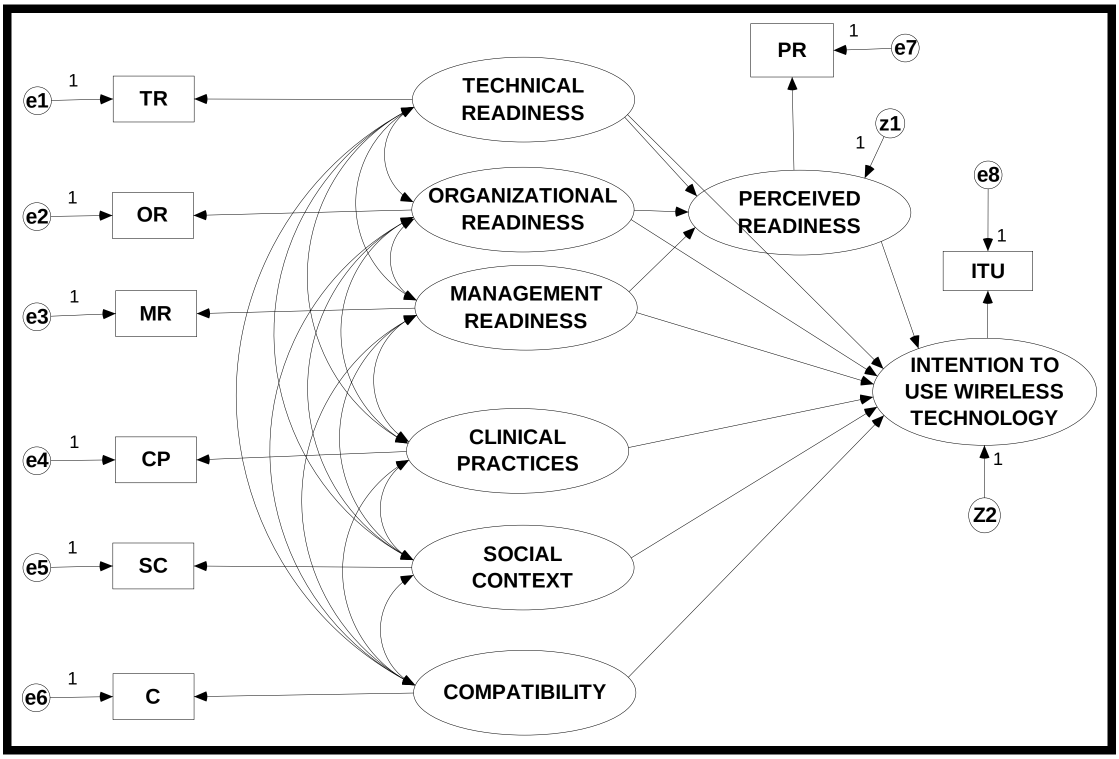


Figure 10.3: Initial model from the AMOS path diagram

There are two main constructs in this diagram, *Latent variables* and *Observed variables*. Observed variables are directly measured through the survey instrument but latent variables are not. SEM is capable of measuring these latent variables. Two types of relationship specified in the model are *Directional causal relationship* and *Associated correlation* between the connected variables. Directional causal relationship is represented by straight arrows, such as the relationship between *Clinical practices* and *Intention to use*, as shown in Figure 10.3. The associated correlation between the two related variables is shown by double-headed, curved arrows (MacCallum, 1995). In this model, necessary caution was exercised to minimize the specification errors, as the relationships between predictors were identified through the literature review and the data analysis (Hair et al., 2006). These relationships were also supported by the multiple regression analysis discussed in the previous chapter.

Further, to avoid misspecification of the model, two competing versions were developed to incorporate relationships between the constructs. The researcher identified that misspecification of the model can also affect the model fit indices (Fan et al., 1999). The strategy to develop two competing models was adopted to minimize the probability that data might fit the model by chance, and to ascertain that the final model was theoretically sound (Bagozzi, 1996).

A brief summary of measured variables and latent variables is provided in Table 10.2.

Table 10.2: summary of variables involved in the SEM modelling

No.	Variables	Category	Measure through
1	TR	Measured variable	Survey Items
2	PR		
3	OR		
4	MR		
5	CP		
6	SC		
7	C		
8	Technical readiness	Latent variable	AMOS SEM Model
9	Perceived readiness		
10	Organizational readiness		
11	Management readiness		
12	Clinical practices		
13	Social context		
14	Compatibility		
15	Error term	Unexplained variance	SEM
16	Residual		

Residuals were introduced as the endogenous variables cannot be fully measured by the directional influences of exogenous variables in the model (MacCallum, 1995).

Further, an error term is associated with each of the measurable variables as measures of theoretical constructs always accounted for the measurement error (Steenkamp & Baumgartner, 2000). As can been seen from Figure 10.3, the path diagram is a visual representation of hypotheses and measurable variables (Kline, 2005).

Model identification

Identification of the model is the process of checking that the parameters required to be estimated in the model can be, in fact, estimated. In SEM, parameters are measured by solving a set of simultaneous equations. In this research, AMOS was used to test the model; the model identification provides a set of rules for checking this.

Model estimation

The outcome of the above step assists in acquiring the specified conceptual model. Under model estimation, the objective is to acquire the estimates for the free parameters from the collected data (Hoyle, 1995).

Assessment of model fit

A model is considered to be a good fit if the difference between the sample variances and covariances, and the implied variances and covariances derived from the parameter estimates, is small (Holmes-Smith, 2000). The number of 'fit' statistics have been used by researchers to assess how well the model fits the data (Byrne, 2001; Hair et al., 2006). The fit statistics used in this research can be summarised as follows.

- Chi-square (For χ^2, an acceptable level of fit is $p > 0.05$; a reasonable level of fit is $p > 0.001$)
- Normed Chi-square (For χ^2/df, an acceptable level of fit is $1 < \chi^2/df < 2$; a reasonable level of fit is $\chi^2/df < 3$)
- Goodness-of-fit index (For GFI, and acceptable level of fit is $0.95 < GFI < 1$; a reasonable fit value would be $0.90 < GFI < 0.95$)
- Tucker-Lewis Index (For TLI, an acceptable value is TLI > 0.95; a reasonable value of fit is 0.9 < TLI < 0.95; a lack of model parsimony would be TLI > 1)

- Root-Mean-Square Error of Approximation (For RMSEA, an acceptable fit value is RMSEA < 0.05; a reasonable level of fit would be $0.05 < \text{RMSEA} < 0.08$).

(Byrne, 2001; Holmes-Smith, 2000)

Model re-specification

When the model does not provide a good fit, it is possible to modify it to improve the fit indices. SEM programs such as AMOS and LISREL applications have the ability to suggest modification indices so that the model can be improved. In this research, modification indices were not followed blindly; rather, most of the modifications were guided by theoretical backing to improve the fit.

As stated earlier, two competing models were developed in this research to avoid misrepresentation of the model and misspecifications of the causal relationships between the independent variables and the dependent variables. Such misspecifications can influence the model fit indices (Fan et al., 1999). Hair also suggested that comparing alternative models is an effective strategy as it provides an opportunity for competition of theories (Hair et al., 1998; Hall et al., 2003). A possible competing model was developed through a three-stage process.

These three stages were as follows.

1. Composite variables were derived through confirmatory factor analysis to ensure that all the items associated with each constructs were measuring the same construct.
2. Once items associated with the constructs were verified, composite variables were calculated by using factor scores (Regression method) to weight each contributing variable to the composite set.
3. Once composite variables were developed through regression weighting, a one-factor congeneric model was developed for each of the composite variables. According to Holmes-Smith and Rowe (1994), in a one-factor congeneric model, parameters can be fixed by calculating the lambda (λ) and error term theta (θ) to simplify the complex model (Holmes-Smith & Rowe, 1994).

The section below provides the details of each stage mentioned above.

Stage one: From the exploratory factor analysis, seven factors were identified: *Technical readiness* (TR), *Organizational readiness* (OR), *Perceived readiness* (PR), *Clinical practices* (CP), *Social context* (SC), *Compatibility* (C), and the dependent variable *Intention to use* (ITU).

In this research, the SEM model was analysed for data fit to the model through *Fit indices* (assessment of model fit indices). Fit indices and chi-square, *p*-vale, and ratio of chi-square to degree of freedom criteria were used to analyse the data fit for each of the constructs before computing the composite variables. Figure 10.4 shows the values of each variable separately for the improved acceptable model. Confirmatory factor analysis through AMOS produces the results shown in the Figure 10.4.

This figure shows how each construct was conceptualised through the theory and findings of the focus group discussion sessions. In the actual model, these constructs would appear as latent variables; the above exercise confirms that the items used to construct composite variables were the best measure of each latent variable. As can be seen, all the constructs and their associated items measuring the construct have been uniquely measuring that particular construct and the model fitted the data as well. In according with the criteria stated by Byrne (2001), the fit indices for each of the constructs were within the acceptable values; i.e. the p-value > 0.000, RMSEA is between 0.000 and 0.073, and GFI ranges between 0.995 and 0.986 (Byrne, 2001). This shows that the model fits the data, the models are acceptable, and the items are uniquely measuring the composite variables.

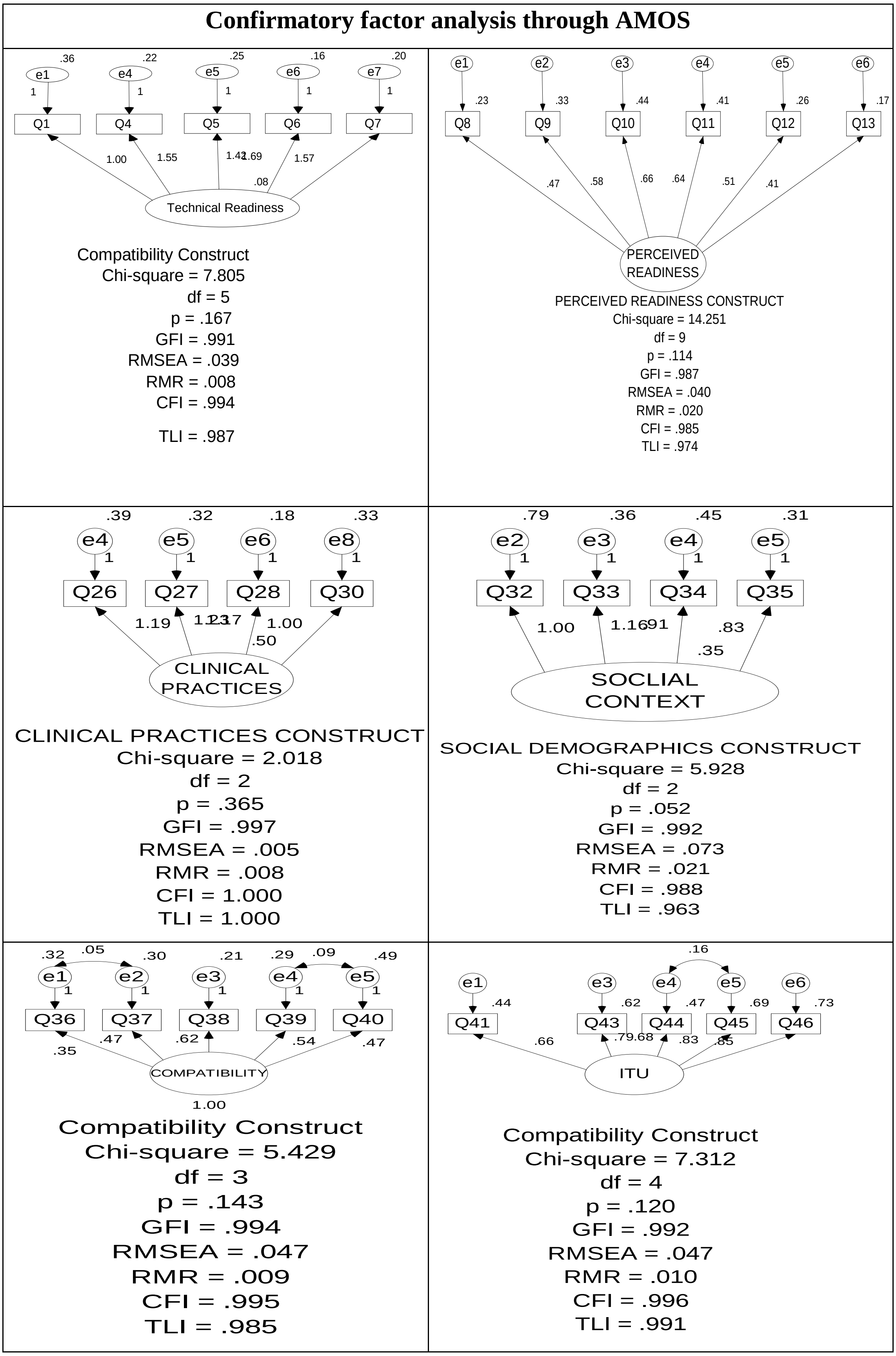


Figure 10.4: Summary of confirmatory factor analysis with fit indices

As stated earlier, exploratory factor analysis through SPSS reduced the data into seven groups, namely TR, OR, PR, CP, SC, C and ITU (see Chapter 9 for details of this process). The confirmatory factor analysis confirmed that all the exploratory factors except *Organizational readiness* were valid. As can be seen in Figure 10.5, the data did not fit, and the fit indices were not at acceptable levels. For example, the *p*-value is not greater than 0.000, GFI, TLI, and CFI range from 0.749 to 0.873, and RMSEA is 0.140, which is not acceptable.

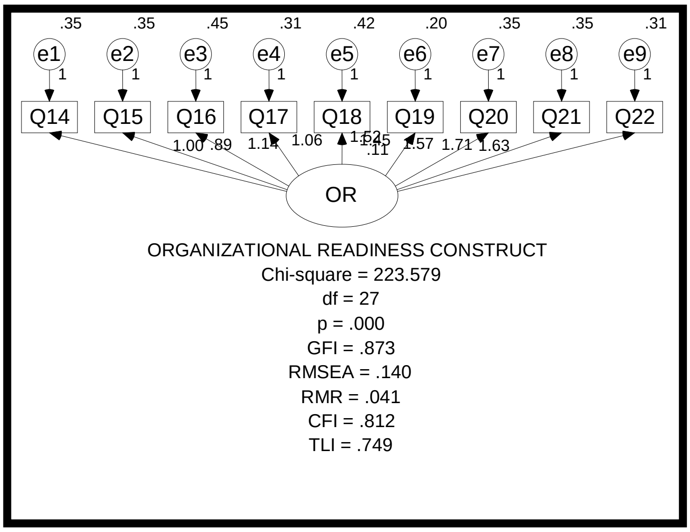
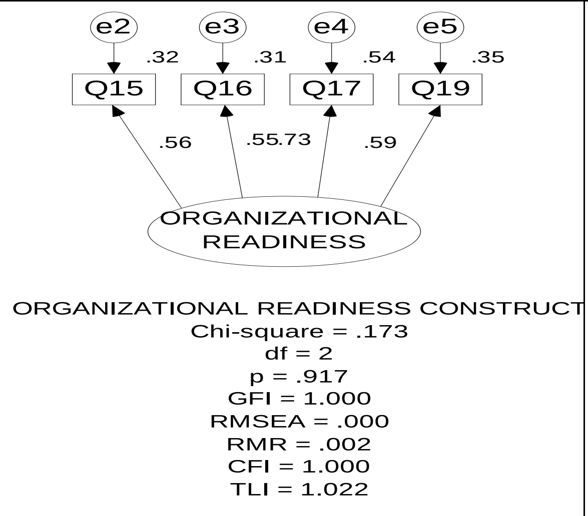


Figure 10.5 : Unimproved model for organizational readiness

Figure 10.5 also shows that five of the popular measures (Chi-square, Normed Chi-square, Goodness-of-fit index, Tucker-Lewis index and Root-mean-square error of approximation) provided by Holmes-Smith (2000) were not at acceptable levels (Holmes-Smith, 2000). Therefore, it was concluded that the data did not adequately fit the model. The model was further refined, and this was achieved by analysis of the adequacy of the theoretical support and suggestions provided by *Modification indices* in SEM. The objective was to achieve an improved measure of data fit for the empirical data while keeping the integrity of the theoretical support.

Questions 14 to 22 are associated with two individual factors, Confirmatory analysis through AMOS



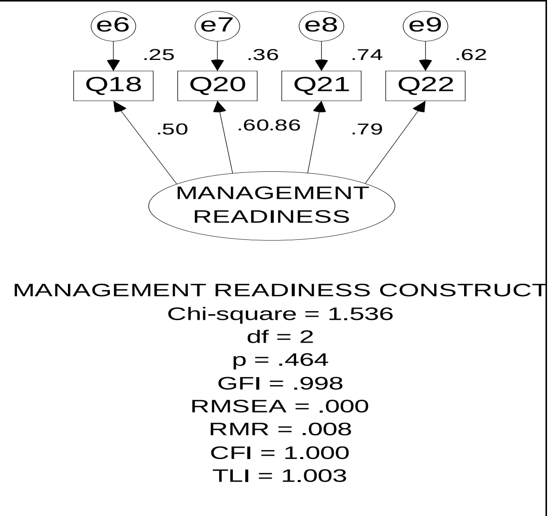


Figure 10.6: Improved two-factor model for OR and MR

The results showed that items 14 to 22 of AMOS were measuring two different constructs (see Figure 10.6). On the basis of the items used to measure the OR constructs from the original factor analysis, AMOS confirmatory factor analysis subdivided items 14 to 22 into two groups: *Organizational readiness* and *Management readiness*. This is also verified through the correlation analysis. Items 15, 16, 17 and 19 were measuring *Organizational readiness*, and items from 18, 20, 21, and 22 were measuring *Management readiness*. Both these constructs were aligned with the focus group findings. On the basis of the confirmatory factor analysis, TR, OR, MR, PR, CP, SC and C constructs were used as independent variables and ITU as the dependent variable to develop the SEM model.

Stage two: There were seven independent variables, TR, OR, MR, PR, CP, SC and C, and one dependent variable, ITU. A path diagram is the formulization of these dependent and independent variables and how these variables can best be measured. In this research, composite variables were formulated by using regression weight values calculated in the first stage of this process. These composite variables were used subsequently to develop one-factor congeneric measure modelling, to be then used in SEM modelling. Munck (1979) suggested that for complicated models, it is possible to build a model where each latent variable is measured by a single composite variable to reduce the model's size and complexity (Munck, 1979).

Once items associated with the constructs were verified, composite variables were calculated by using factor scores (Regression method) to weight each contributing variable to the composite set as suggested by Joreskog and Sorbom (1989). The actual regression weight of each item was used from the confirmatory factor analysis to calculate the composite variable.

$$\hat{\xi} = \omega X \quad \text{---} \quad (1)$$

Where ω is the factor score regression weight for each of the indicator items, and X is the observed indicator variable score for the item. Therefore, according to Joreskog and Sorbom (1989), factor score regression weight (ω) can be calculated as follows:

$$\boldsymbol{\omega} = \hat{\boldsymbol{\Phi}}\hat{\boldsymbol{\Lambda}}'_x\hat{\boldsymbol{\Sigma}}^{-1} \quad \text{---} \quad (2)$$

Where $\hat{\Phi}$ is the variance of the factors, $\hat{\Lambda}$ represents the factor loadings for each item, and $\hat{\Sigma}$ is the estimated covariance matrix.

This approach is superior to just finding the mean or average of all the items used to develop a composite variable. By using the actual regression weight associated with each item in the composite variable, it is possible to maintain a unique reliability of the item and unique contribution to the composite variable. This is shown in Table 10.3 to provide the reliability of the composite variables used to develop the SEM model.

Table 10.3: Summary of items used to develop the composite variable and their reliability

No.	Description of composite variable	Questions included	Cronbach's Alpha
1	Technical readiness	Q2, Q4, Q5, Q6, Q7	0.80
2	Perceived readiness	Q8, Q9, Q10, Q11, Q12, Q13	0.72
3	Organizational readiness	Q15, Q16, Q17, Q19	0.70
2	Management readiness	Q18, Q20, Q21, Q22	0.78
4	Clinical practices	Q26, Q27, Q28, Q30	0.90
5	Social context	Q32, Q33, Q34, Q35	0.75
6	Compatibility	Q36, Q37, Q38, Q39, Q40	0.80
7	Intention to use	Q41, Q43, Q44, Q45, Q46	0.90

According to Hair (2006) overall reliability for all the composite variables is very high (Hair et al., 2006). Table 10.3 also shows higher reliability for the composite variable for *Organizational readiness* and *Management readiness* individually from the reliability of composite variable extracted from factor analysis.

The fit indices for the composite variables developed in this stage (Stage 2) may be summarised as follows. The goodness of fit statistics for all the composite variables – the measures of Chi Square (X^2), Degree of freedom (df), X^2/df, Goodness of fit index (GFI), Normed fit index (NFI), Non-normed fit index (NNFI), Comparative fit index (CFI), Root mean square residual (RMSR) and Root mean square error of approximation (RMSER) –were within acceptables (see Table 10.4).

Table 10.4: Summary of fit indices for the composite variables

	X^2/df	***p***	**GFI**	**NFI**	**TLI**	**CFI**	**RMR**	**RMSEA**
Recommended values	< 2.00	> 0.05	≥ 0.9	≥ 0.9	≥ 0.9	≥ 0.9	≤ 0.05	≤ 0.05
Technical readiness	1.56	0.167	0.991	0.974	0.987	0.994	0.008	0.039
Organizational readiness	0.917	0.917	1.00	0.999	1.00	1.00	0.002	0.000
Management readiness	0.768	0.464	0.998	0.997	1.00	1.00	0.008	0.000
Perceived readiness	1.583	0.114	0.987	0.960	0.974	0.985	0.020	0.040
Clinical practices	1.009	0.365	0.997	0.996	1.00	1.00	0.008	0.005
Social context	2.964	0.052	0.992	0.982	0.963	0.988	0.020	0.073
Compatibility	1.80	0.143	0.994	0.990	0.985	0.994	0.009	0.047
Intention to use WHD	1.828	0.120	0.992	0.992	0.991	0.996	0.010	0.047

Table 10.4 presents fit indices for the data and shows good fit between the data and the proposed individual model for the composite variable used to predict the adoption of wireless handheld devices in the Australian healthcare setting. All the prominent statistics show a good fit between the data and the model for each of the composite variables. For example, the value of the *Goodness-of-fit index* (GFI), a measure of the relative amount of variance and covariance, for all the composite variables was well above the benchmark value (≥ 0.9) and is considered as being a good fit (Joreskog and Sorbom, 1993); the *Root mean square residual* (RMR) values for all the composite variables were less than the benchmark value (≤ 0.05) as suggested by Hair

et al., (2006) and Wu et al., (2007). This means that the model explains the correlation to be within an average error of RMR values (ranges from 0.002 to 0.011, way below 0.05) (Hu & Bentler, 1995). These results show that the measurement model used to calculate the composite variables has a good fit with the data based on GFI, RMSER and AGFI. In addition to these, other indices of fit such as NFI, CFI and RMR also support the view that the model for each composite variable fits the sample data fairly well (Bentler, 1990; Hu & Bentler, 1999).

Stage three: As mentioned above, in the complex SEM it is recommended to use a one-factor congeneric model. This done by calculating the lamda (λ) and error term theta (θ) for the one-factor congeneric measurable model as recommended by Munck (1979).

$$\lambda = SD\sqrt{\alpha} \quad \text{--} \quad (3)$$

$$\theta = Var(1-\alpha) \quad \text{--} \quad (4)$$

In the above equations, SD represents the standard deviation, α the internal consistency, θ the error term and λ the loading.

In order for the model to be evaluated on the basis of chi-square (X^2) probabilities, parameters were fixed and measured by a one-factor congeneric model. The reliability of the one-factor congeneric model was calculated through the following formula:

$$r_c = \frac{\omega\left(\hat{\Sigma} - \Theta_\delta\right)\omega'}{\omega\hat{\Sigma}\omega'} \quad \text{--} \quad (5)$$

In equation (5):

$\mathbf{r_c}$ is the reliability of the congeneric composite variable,

$\boldsymbol{\omega}$ represents the set of arbitrary weights (usually the factor score regression weights).

$\hat{\boldsymbol{\Sigma}}$ is the estimated covariance matrix,

$\hat{\boldsymbol{\Theta}}_\delta$ is the matrix of variance and covariances among the error terms.

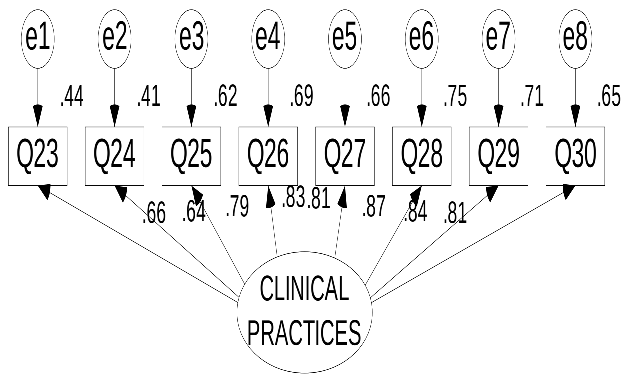
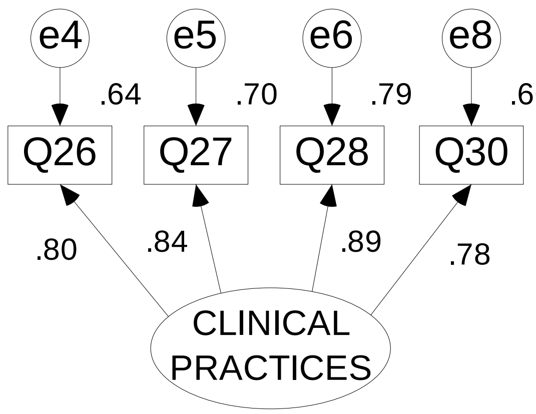
Parameters used for this were TR, MR, OR, PR, CP, SC, C and ITU, and the error variances for these eight were fixed to one minus the square root of the corresponding lambda value of each variable (Loehlin, 1992). The error path was fixed to one. A brief summary of these is shown in Table 10.5.

Table 10.5: Summary of composite variables with lambda and error values

Variable	**α**	**√α**	**1-α**	**SD**	**Variance (SD^2)**	**λ = SD√α**	**Error = Var(1-α)**
ITU	0.8920	0.9445	0.1080	0.74291	0.5519	0.7016	0.0596
OR	0.7240	0.8509	0.2760	0.50433	0.2544	0.4291	0.0702
TR	0.8060	0.8978	0.1940	0.47214	0.2229	0.4239	0.0432
MR	0.8450	0.9192	0.1550	0.67162	0.4511	0.6174	0.0699
PR	0.7390	0.8597	0.2610	0.53982	0.2914	0.4641	0.0761
CP	0.9100	0.9539	0.0900	0.86420	0.7468	0.8244	0.0672
SC	0.7620	0.8729	0.2380	0.67084	0.4500	0.5856	0.1071
C	0.8020	0.8955	0.1980	0.61414	0.3772	0.5500	0.0747

Sing and Smith (2001) used a three-stage process to develop a one-factor congeneric model composite variable. A three-stages data reduction technique was constructed in diagrammatic form for the composite variable *Clinical practices*, where all the items in the questionnaire measuring the variable were considered as non-unifactorial, and the measurement error variances of the items were not considered to be equal. It was noticed in this process that the regression weights and the measurement error variances were shown to be dissimilar (Sing & Smith, 2001) (see Figure 10.7).

Following Figure 10.7, a summary analysis of this three-stage approach to developing the one-factor congeneric model is provided in Table 10.6. This shows the fit indices for the remaining composite variables.

<table>
<tr><th>Stage 1</th><th>Initial measurement model</th></tr>
<tr><td>
</td><td>X² = 165.738, df = 20, p = 0.000
X²/df = 5.161
GFI = 0.897
TLI = 0.903
RMR = 0.042
RMSEA = 0.140
Does not adequately fit the initial model</td></tr>
<tr><th>Stage 2</th><th>Improved Measurement Model</th></tr>
<tr><td>
</td><td>X² = 2.018, df = 2, p = 0.365
X²/df = 1.009
GFI = 0.997
TLI = 1.0
RMR = 0.008
RMSEA = 0.005

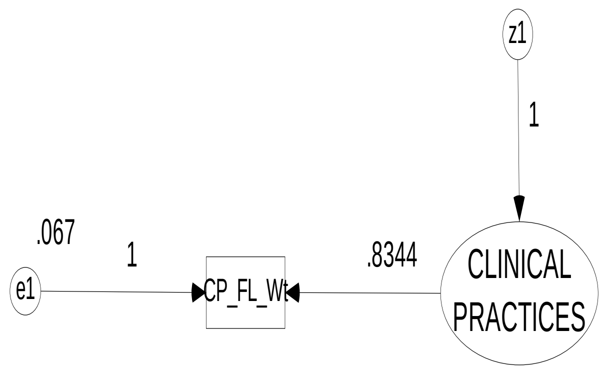
Data fit the improved model</td></tr>
<tr><th>Stage 3</th><th>Composite measurement model</th></tr>
<tr><td>
</td><td>Composite reliability = 0.90
Lambda = 0.8244
Error = 0.067
Mean of composite measure = 2.28
Variance = 0.746
Standard deviation = 0.864</td></tr>
</table>

Figure 10.7: Summary of the one-factor congeneric model and outcome of using a three-step technique for *Clinical practices* for WHT

Table 10.6: Summary of one-factor congeneric analysis

Constructs Measures	**Stage 1** (Data do not adequately fit the initial model	**Stage 2** Data fit the improved model	**Stage 3**
Technical readiness	$X^2 = 75.040$, df = 14, $p = 0.000$ $X^2/df = 5.52$ GFI = 0.939 TLI = 0.880 RMSEA = 0.108	$X^2 = 7.805$, df = 5, $p = 0.167$ $X^2/df = 1.56$ GFI = 0.991 TLI = 0.987 RMSEA = 0.039	Composite reliability = 0.806 Mean of composite measure = 1.563 Variance = 0.223 Standard deviation = 0.472
Organizational readiness	$X^2 = 57.588$, df = 9, $p = 0.000$ $X^2/df = 18.65$ GFI = 0.953 TLI = 0.836 RMSEA = 0.120	$X^2 = 0.173$, df = 2, $p = 0.917$ $X^2/df = 0.086$ GFI = 1.00 TLI = 1.00 RMSEA = 0.000	Composite reliability = 0.724 Mean of composite measure = 1.776 Variance = 0.254 Standard deviation = 0.504
Management readiness	$X^2 = 72.991$, df = 5, $p = 0.000$ $X^2/df = 18.65$ GFI = 0.928 TLI = 0.792 RMSEA = 0.191	$X^2 = 1.536$, df = 2, $p = 0.464$ $X^2/df = 0.768$ GFI = 0.998 TLI = 1.00 RMSEA = 0.00	Composite reliability = 0.845 Mean of composite measure = 1.928 Variance = 0.451 Standard deviation = 0.672
Perceived readiness	$X^2 = 14.251$, df = 9, $p = 0.114$ $X^2/df = 0.925$ GFI = 0.987 TLI = 0.974 RMSEA = 0.040	$X^2 = 14.251$, df = 9, $p = 0.114$ $X^2/df = 0.925$ GFI = 0.987 TLI = 0.974 RMSEA = 0.040	Composite reliability = 0.739 Mean of composite measure = 2.002 Variance = 0.291 Standard deviation = 0.540
Social context	$X^2 = 20.00$, df = 5, $p = 0.000$ $X^2/df = 0.00$ GFI = 0.979 TLI = 0.924 RMSEA = 0.031	$X^2 = 5.928$, df = 2, $p = 0.052$ $X^2/df = 2.9$ GFI = 0.992 TLI = 0.963 RMSEA = 0.073	Composite reliability = 0.762 Mean of composite measure = 2.336 Variance = 0.550 Standard deviation = 0.671
Compatibility	$X^2 = 25.874$, df = 5, $p = 0.000$ $X^2/df = 5.161$ GFI = 0.973 TLI = 0.922 RMSEA = 0.106	$X^2 = 5.429$, df = 3, $p = 0.143$ $X^2/df = 1.8$ GFI = 0.994 TLI = 0.985 RMSEA = 0.047	Composite reliability = 0.802 Mean of composite measure = 1.814 Variance = 0.377 Standard deviation = 0.614
Intention to Use	$X^2 = 143.531$, df = 9, $p = 0.000$ $X^2/df = 15.906$ GFI = 0.884 TLI = 0.834 RMSEA = 0.200	$X^2 = 7.314$, df = 4, $p = 0.120$ $X^2/df = 1.82$ GFI = 0.992 TLI = 0.991 RMSEA = 0.047	Composite reliability = 0.892 Mean of composite measure = 2.177 Variance = 0.552 Standard deviation = 0.743

Table 10.6 shows that the overall chi-square test revealed non-significance in stage two of the process for all the composite variables. According to Dion (2008) a non-significant *p*-value represents a good fit. In the above table all the composite variables' *p*-values are non-significant ($p > 0.000$) as shown in the third column (Dion, 2008). In stage two the ratio of X^2/df is below the value of 2 for all the composite variables. As suggested by Bollen (1989b) and Dion (2008) any value less than 3 indicates an acceptable model (Bollen, 1989b, Dion, 2008). This is also supported by *Comparative fit indices* which are different statistically from TLI (Tucker-Lewis coefficient). The value of TLI for all the composite variables is above 0.96 and this represents that the data are fitting the model, whereas most of them are above the value of 0.98 or closer to 1.00, this being indicative of good fit (Byrne, 2001; Hu & Bentler, 1995, 1999). The value of RMSEA in the above table also provides evidence of a good fit for the model, the value ranging from 0.000 to 0.06; whereas most of the values are either 0.000 or close to 0.000. According to Brown and Cudeck (1993), if the value of RMSEA is below 0.08 it represents that the model is fitting the data (Browne & Cudeck, 1993). The sections below provide the analysis of fit indices for the constructs.

Therefore, before developing the path diagram for the conceptual model developed earlier, a similar process was followed to calculate the lambda (λ) and error (r) for the one-factor congeneric model for the remaining composite variables TR, MR, OR, PR, SC, C and ITU. A brief summary of this analysis is provided in Table 10.7.

Table 10.7: Summary analysis of reliability and lambda measurements

Composite variables	**Brief name**	**Reliability coefficient**	**Lambda**	**Error variance**
Technical readiness	TR	0.806	0.424	0.043
Perceived readiness	PR	0.739	0.464	0.076
Organizational readiness	OR	0.724	0.429	0.070
Management readiness	MR	0.845	0.617	0.070
Clinical practices	CP	0.910	0.824	0.067
Social context	SC	0.762	0.586	0.107
Compatibility	C	0.802	0.550	0.075
Intention to use	ITU	0.892	0.702	0.060

Model cross-validation

Cross validation of the model involved fitting the improved model acquired in the previous model to the new sample of data. Normally, researchers adopt strategies to achieve such an objective by either splitting their original data randomly into a calibration sample for model development, or they collect two or more samples of data to be used as one set for model development and the other for the testing of the model (Holmes-Smith, 2009). Cross modification is normally required when substantial modifications have been made to fit the model to the data (Holmes-Smith, 2009). In this research, modifications to the original model were not substantial, and any modification was well supported by the collected data.

10.10 Adoption model of wireless technology in healthcare

While conceptualizing the research framework, the researcher attempted to accommodate all the themes emerging from the qualitative research and the literature; the details of this have clearly been provided in the previous chapters. This strategy provided strength to the structural part of the model. For example, most of the literature suggested that TAM’s *Ease of use* and *Usefulness* are critical in the decision to adopt a technology. This aspect was incorporated in the final research model. Healthcare professionals, through the focus group discussions, identified that healthcare is a unique environment and health-specific variables are important in decision making about the use of wireless technology in a healthcare environment. This aspect was also included in the development of the research framework for this study.

Discriminant validity of the constructs based on correlation can be seen in Figure 10.8. Only one value exceeded 0.7 and most of them were below 0.5. This implies that latent constructs in the model were different from each other (Hair et al., 2006). Construct validity in this research was measured through the goodness-of-fit measures from Table 10.6; all the constructs in the research were a good representation of the variables they were meant to measure in the research model.

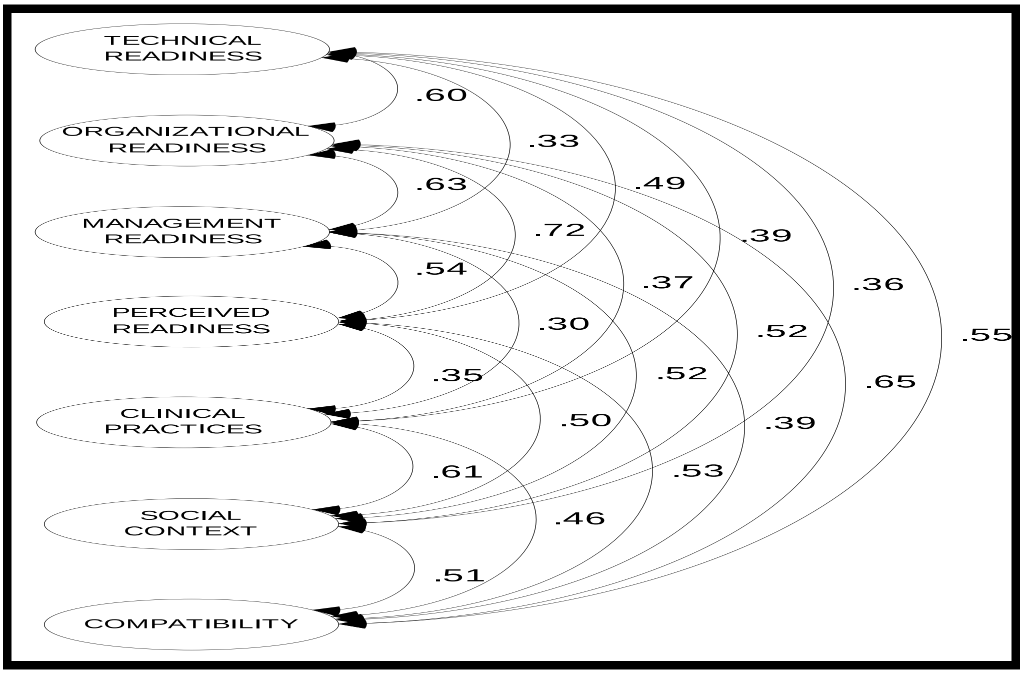


Figure 10.8: Brief summary of covariance's between the constructs.

Once the discriminant validity was established, and it was confirmed that all independent variables were different, the researcher used the AMOS to test the initial research framework developed in the previous chapter. As this research was exploratory, and the researcher wanted to explore the interactions among the variables to identify the direct and indirect effects of the determinants on the intention to use wireless technology, a three-phase approach was employed.

1. **The first phase** developed a simple initial framework that was tested with two main categories of factors (organizational and healthcare) which affect the use of wireless technology in a healthcare domain.
2. **The second phase** measured variables (TR, OR, MR) that were affecting the ITU indirectly through PR and PR, CP, SC and C and considered as having a direct effect on the ITU.
3. **The third phase** was arrived at by further refining the model from Stage 2 by incorporating the indirect effects of the determinants on the intention to use wireless technology in healthcare.

10.10.1 Phase 1

The proposed research framework for this study has composite variables TR, OR, MR and PR in the research model as observable measures for the latent variable *Organizational factors*. Variables CP, SC, and C are measurable variables for the latent variable *Healthcare factors*. The framework will be tested through SEM in three stages to explain the development of the final model as discussed in the previous chapter. The interaction among the observed variables (TR, OR, MR, PR, CP, SC and C), latent variables (*Organizational factors* and *Healthcare factors*), and dependent variable *Intention to use* wireless technology is shown in Figure 10.9.

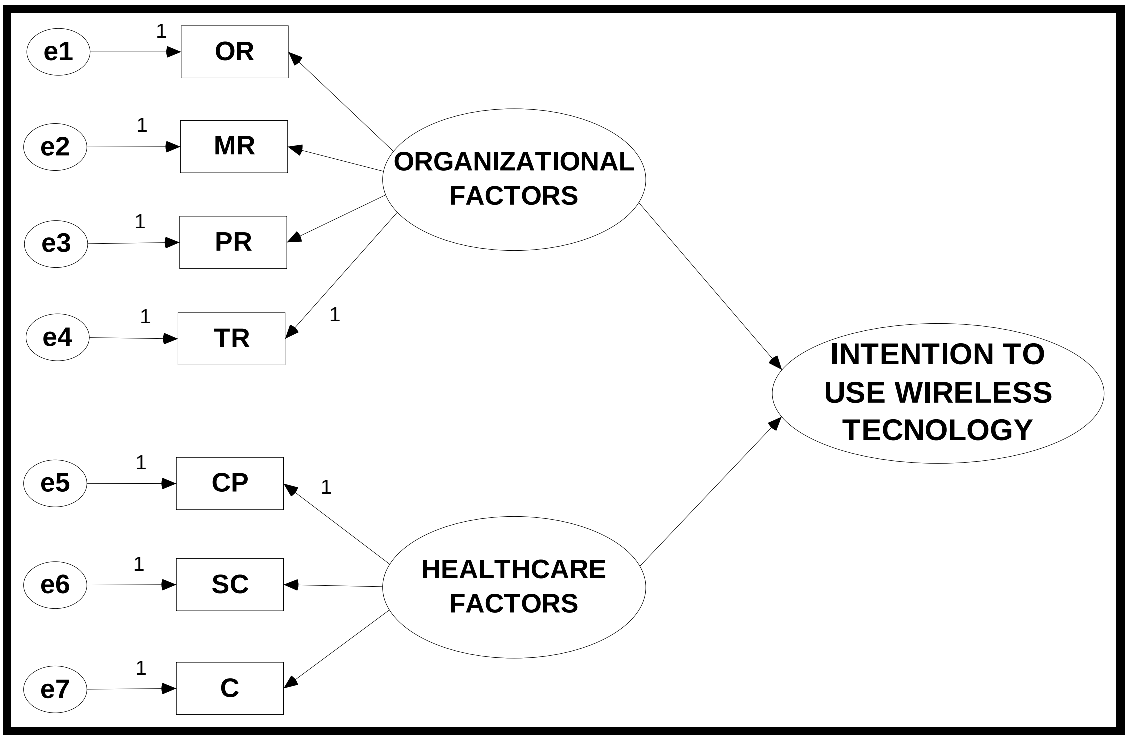


Figure 10.9: Initial SEM model

In Figure 10.9 there are two or more reflective indicators for the latent variables *Organizational factors* (OR), *Healthcare factors* (HF) to boost its reliability. It was also conceptualized that organizational and healthcare factors represented two categories of determinants. The conceptual model for these is shown in Figure 10.10.

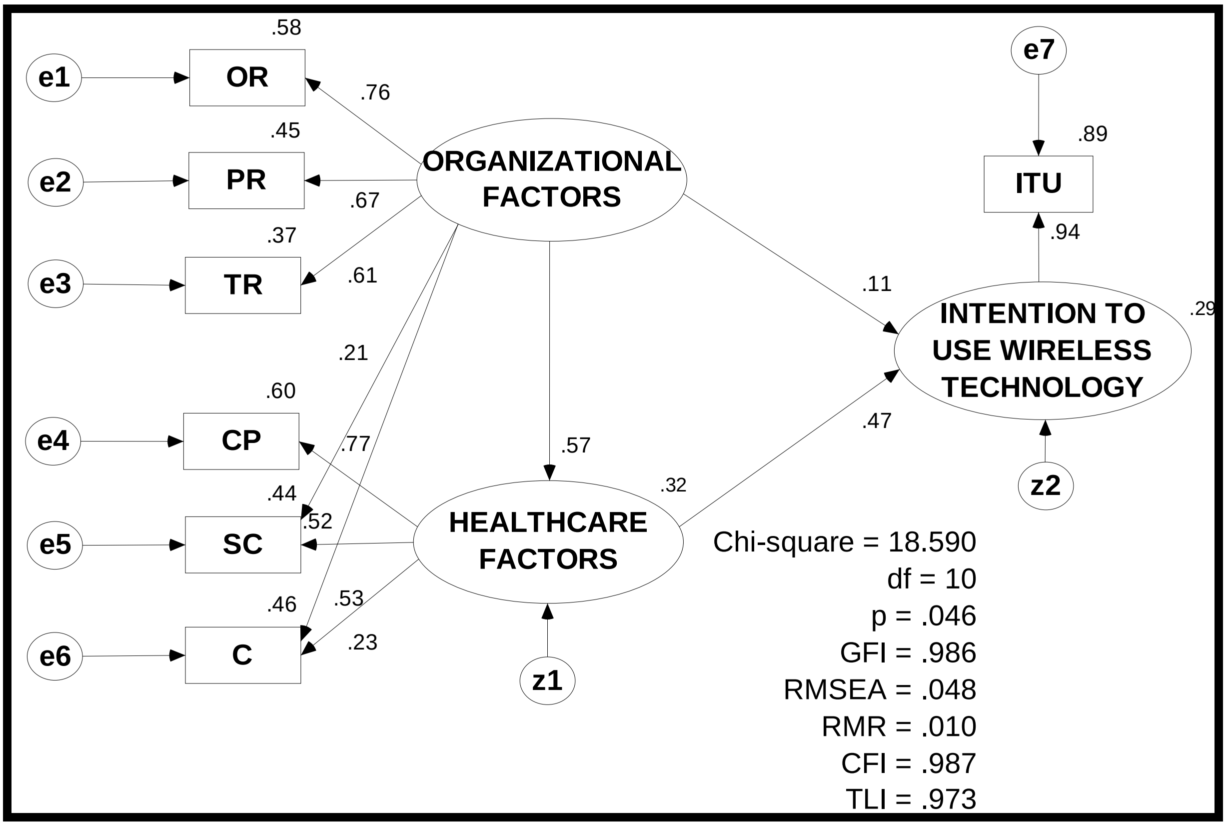


Figure 10.10: Standardized estimate for the initial model for the intention to use wireless technology in a healthcare setting

In this model there is one exogenous latent construct (*Organizational factors*), two endogenous latent constructs (*Healthcare factors* and *Intention to use* wireless technology), seven observed endogenous variables (TR, OR, PR, CP, SC, C and ITU), ten unobserved exogenous variables (e1 to e6, Z1, Z2, and *Organizational factors*), and two unobserved endogenous variables (*Intention to use* wireless technology and *Healthcare factors*). Initially, *management readiness* was also included, but the data did not fit the model. On further analysis of parameter estimates and their critical ratio, *management readiness* was deemed to be a poor indicator, so it was incorporated into *organizational readiness*. This did not seem to provide any significant contribution to explain the variation in ITU when organizational readiness was presented in the model. This finding was aligned with the exploratory factor analysis conducted in a previous chapter. Therefore, management readiness was eliminated from further analysis and the revised model was acceptable with fit indices and literature in the domain.

Chi-square ($\chi^2 = 18.59$), ratio of chi-square and degree of freedom (χ^2/df = 1.85) were all non-significant ($p > 0.05$). Measure indices RMSES, GFI, TLI, CFI and RMR were well below the acceptable level (RMSES = 0.048, GFI = 0.987, TLI = 0.973, CFI = 0.987 and RMR = 0.010). This shows that the data fit the model. Square multiple correlations (SMC) of the initial model are s presented in Table 10.8.

Table 10.8: Analysis of SMC for Phase 1 of the model

Determinants	**Estimate**
Healthcare factors	0.320
Intention to use wireless technology	0.288
PR	0.446
TR	0.374
C	0.464
CP	0.599
SC	0.444
OR	0.584
ITU	0.888

Table 10.8 shows the strength of the structural paths; 29% of the variance is explained by organizational and healthcare factors for intention to use the wireless technology. It also shows that a proportion of its variance is accounted for by the predictors in the model; for example 32% of the variance is of healthcare factors. The standardised model for technology adoption in healthcare also shows that regression weights and paths between the predictors and intention to use are all statistically significant ($p > 0.05$), except for the organizational factors on intention to use ($p > 0.05$) (see Table 10.9).

Table 10.9: Regression weights (Group number 1 - default model)

Determinants			**Estimate**	**S.E.**	**C.R.**	***p***
Healthcare factors	←	Organizational factors	0.205	0.075	20.731	0.006
Intention to use wireless technology	←	Organizational factors	0.278	0.260	10.070	0.284
Intention to use wireless technology	←	Healthcare factors	3.318	10.161	20.857	0.004
ITU	←	Intention to use wireless technology	0.708			
OR	←	Organizational factors	1.000			
SC	←	Healthcare factors	2.523	0.828	3.048	0.002
TR	←	Organizational factors	0.749	0.074	10.182	***
CP	←	Healthcare factors	4.797	1.731	2.772	0.006
C	←	Healthcare factors	1.000			
C	←	Organizational factors	0.840	0.128	6.562	***
PR	←	Organizational factors	0.936	0.085	10.951	***
SC	←	Organizational factors	0.367	0.174	2.112	0.035

Standard regression weights provide the ability to compare the relative effect of individual independent variables on the dependent variables (Hair et al., 2006).

Table 10.10: Standardized regression weights (Group number 1 - default model)

Determinants			**Estimate**
Healthcare factors	←	Organizational factors	0.565
Intention to use wireless technology	←	Organizational factors	0.108
Intention to use wireless technology	←	Healthcare factors	0.468
ITU	←	Intention to use wireless technology	0.942
OR	←	Organizational factors	0.764
SC	←	Healthcare factors	0.524
TR	←	Organizational factors	0.612
CP	←	Healthcare factors	0.774
C	←	Healthcare factors	0.227
C	←	Organizational factors	0.527
PR	←	Organizational factors	0.668
SC	←	Organizational factors	0.211

The relative effect of healthcare factors on intention on use shows stronger paths with statistical significance (0.468, $p < 0.05$) as compared to the organizational factors on intention to use showing no statistical significance (0.108, $p > 0.05$). This suggests that factors such as CP, SC and C contribute highly towards intention to use wireless technology in healthcare. The causal relationship between healthcare factors and ITU (0.47) is positively associated at higher levels. On the other hand, organizational factors and ITU (0.11) are positively associated at lower levels.

10.10.2 Phase 2

The model developed through Phase 1 was further refined to explore the health-specific and organizational-specific variables and their interactions. The research framework developed in the previous chapter incorporated many theories and models from the domain of technology acceptance, with healthcare factors incorporated by this research study.

As can been seen from Figure 10.11, the SEM model contains a total of 23 variables: 7 measurable variables, 7 latent variables, 2 residual terms and 7 error terms.

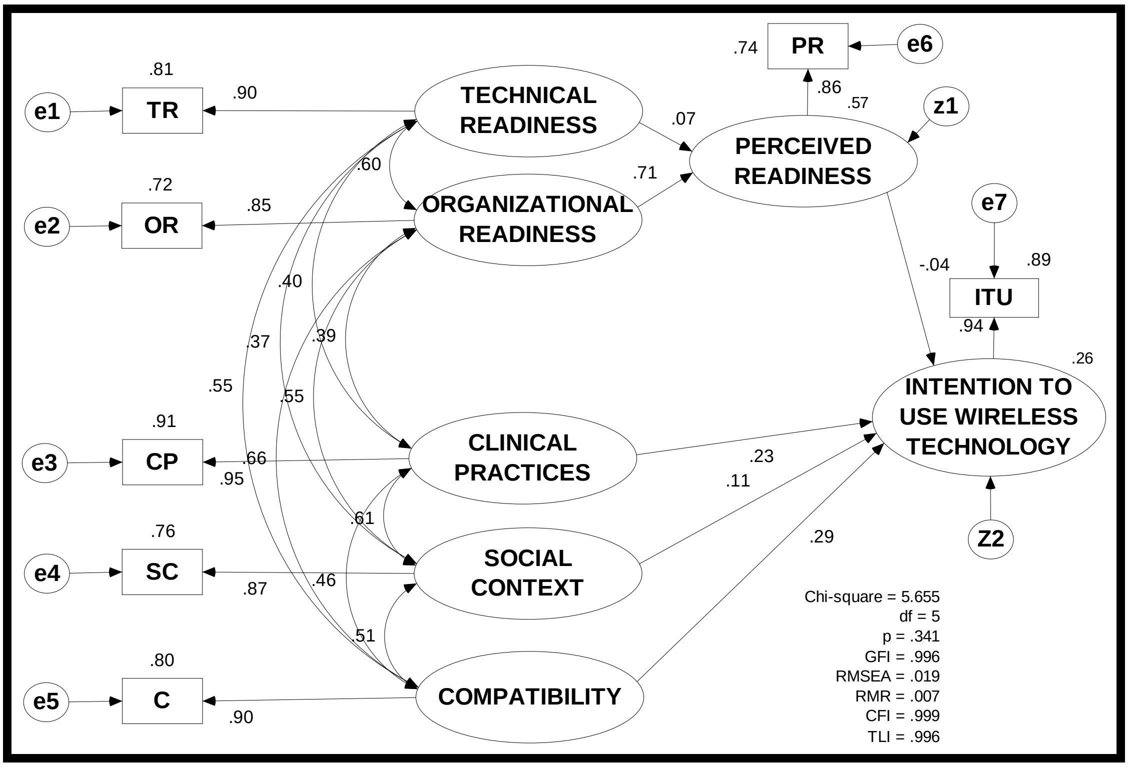


Figure 10.11: Standardized estimate (second phase) of research framework model for the intention to use wireless technology in a healthcare setting

In the model shown in Figure 10.11, there are 7 measurable variables, 5 exogenous latent constructs, 2 endogenous latent constructs, 7 error terms, and 2 residuals for the endogenous latent constructs. Figure 10.11 also shows that the correlations among the five exogenous latent constructs were less than 0.8. This confirms that exogenous latent constructs in the model are different (Hair et al., 2006).

Further, to test how well the data fit the framework a 'fit indices' was used. There are various fit measures (GFI, RMR, TLI, CFI and RMSEA) and each fit measure has a specific capability in the model evaluation (Bollen, 1989a; Browne & Cudeck, 1993; Holmes-Smith, 2000; Hoyle, 1995; Kline, 2005; MacCallum, 1995). The above model resulted in a χ^2 value of 5.66 for the model with degrees of freedom = 5, p = 0.341, and ratio of χ^2/df is less than 2 (χ^2/df = 1.131) p-value is not significant ($p > 0.05$) and this indicates that the model fits the data well. As the χ^2 test is very sensitive to the size of the data used, the analysis of the measurement indices also support the finding (CMIN/df = 1.131, RMSEA = 0.019, TLI = 0.996, RMR = 0.007 and GFI = 0.996).

Measurement fit indices help to evaluate how well the data fit the model, and relationships between the independent and dependent variables are measured by *square multiple correlations* (SMC). SMC helps to measure the proportion of the variance explained by the independent variables in the model. SMC is also considered a very useful measure in structural equation modelling as it is independent of all units of measurement (Arbuckle, 2005; Byrne, 2001; Hair et al., 2006).

Table 10.11: Squared multiple correlations: (Group number 1 - default model)

Descriptions	Estimate
Perceived readiness	0.571
Intention to use wireless technology	0.261
MR	0.844
ITU	0.892
TR	0.806
OR	0.722
SC	0.761
C	0.801
PR	0.738
CP	0.910

The *Estimate* term in Table 10.11 corresponds to the value of R^2 in the multiple regression analysis and is independent of all units of measurement (Arbuckle, 2005). For example, 57% of perceived readiness is determined by variations in TR and OR.

10.10.3 Phase 3

The model developed in Phase 2 was further investigated to explore the complex direct and indirect causal effects of independent variables (TR, MR, OR, PR, CP, SC and C) on the dependent variable (ITU). The results of this are shown in Figure 10.12.

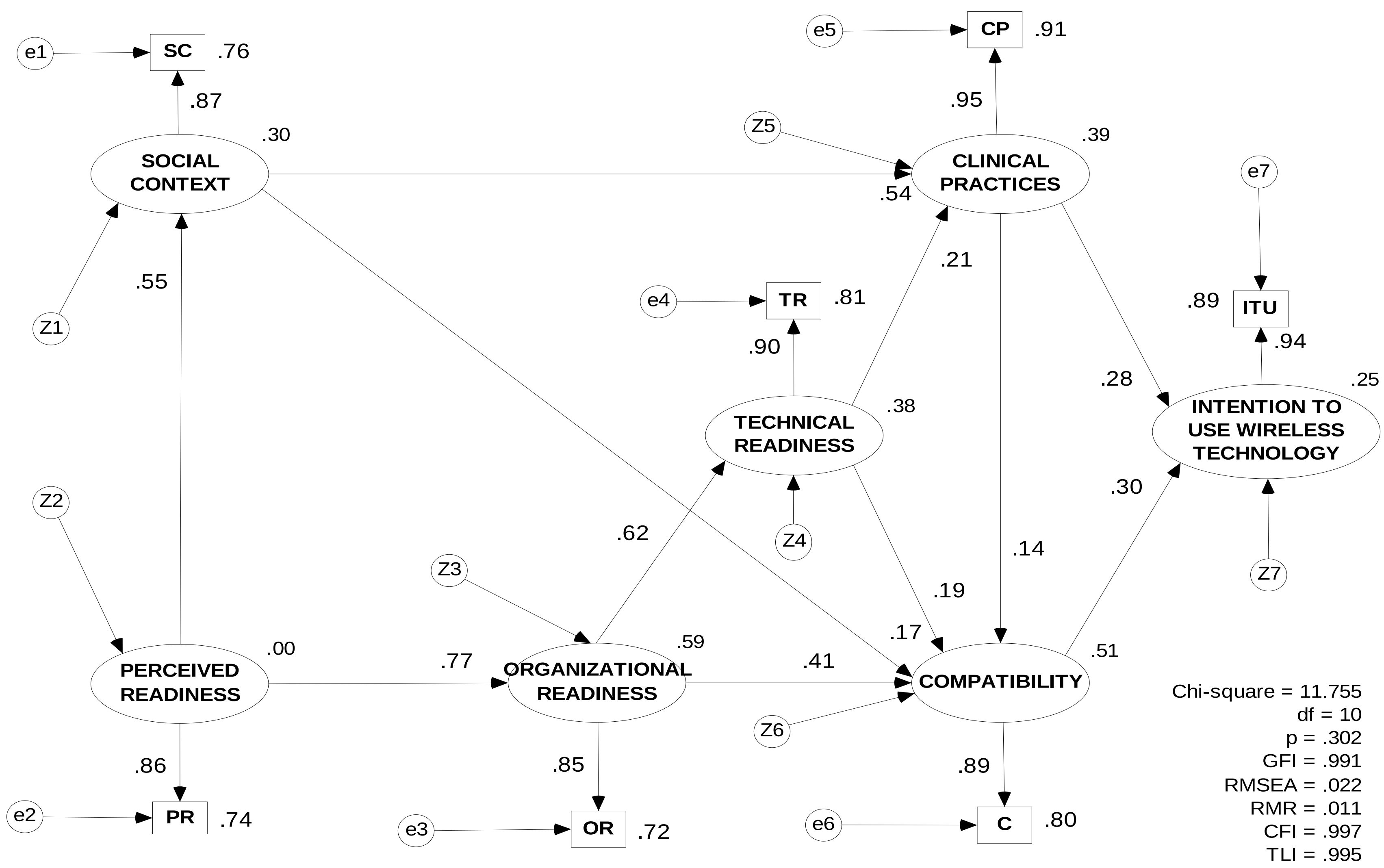


Figure 10.12: Standardised Estimate with indirect affects of the determinants for the model for the intention to use the wireless technology in healthcare setting

In the model shown in Figure 10.12, there is one exogenous latent construct (*Perceived readiness*), six endogenous latent constructs (*Social context*, *Organizational readiness*, *Technical readiness*, *Compatibility*, *Clinical practices*, and *Intention to use* wireless technology), seven measurable variables (TR, PR, OR, CP, SC and ITU), seven error terms for the measurable variables and six residuals for the endogenous latent constructs. The χ^2 value, *p*-value, χ^2/df value and root mean square error of approximation are at acceptable levels (χ^2/df = 1.1755, $p > 0.05$, RMSEA = 0.022). This implies that the model provided a good fit to the data. Other measurement indices also supported these findings (RMR = 0.011, GFI = 0.991. TLE = 0.995, and CFI = 0.991).

Table 10.12: Regression weights: (Group number 1 - default model)

Determinants			**Estimate**	**S.e.**	**C.r.**	**P**
Organizational readiness	←	Perceived readiness	0.770	0.061	12.718	***
Social context	←	Perceived readiness	0.551	0.063	8.794	***
Technical readiness	←	Organizational readiness	0.622	0.060	10.361	***
Clinical practices	←	Social context	0.534	0.056	9.566	***
Clinical practices	←	Technical readiness	0.212	0.053	3.975	***
Compatibility	←	Organizational readiness	0.409	0.085	4.834	***
Compatibility	←	Clinical practices	0.138	0.069	2.001	0.045
Compatibility	←	Technical readiness	0.185	0.077	2.417	0.016
Compatibility	←	Social context	0.170	0.077	2.217	0.027
Intention to use wireless technology	←	Clinical practices	0.285	0.060	4.730	***
Intention to use wireless technology	←	Compatibility	0.304	0.063	4.784	***
ITU	←	Intention to use wireless technology	0.702			
CP	←	Clinical practices	0.824			
C	←	Compatibility	0.550			
OR	←	Organizational readiness	0.429			
SC	←	Social context	0.586			
PR	←	Perceived readiness	0.464			
TR	←	Technical readiness	0.424			

Table 10.13: Squared Multiple Correlations: (Group number 1 - Default model)

Determinants	Estimate
Organizational readiness	0.589
Technical readiness	0.384
Social context	0.298
Clinical practices	0.395
Compatibility	0.507
Intention to use wireless technology	0.249
TR	0.806
PR	0.735
SC	0.762
OR	0.721
C	0.799
CP	0.909
ITU	0.891

Findings of Phase 3 are similar to the findings of Phases 1 and 2. Thus, this model provides a comprehensive confirmation of direct and indirect effects of determinants on intention to use wireless technology in a healthcare setting. For example, the critical ratio for all the paths in the model are statistically significant (cr > 2, $p < 0.05$).

10.11 Discussion

As mentioned above, a three-stage process was used to develop seven independent constructs and one dependent construct. Before investigating the relationships between the dependent variable *Intention to use* (ITU) and the seven independent variables *Technical readiness* (TR), *Organizational readiness* (OR), *Management readiness* (MR), *Perceived readiness* (PR), *Clinical process* (CP), *Social context* (SC) and *Compatibility* (C), it was important to understand that all the independent variables were related to the dependent variable ITU. Tamini (1998) suggested a second order confirmatory factor analysis (CFA) to accomplish this. Through the exploratory factor analysis (EFA) it was determined that the extent to which the items in the instrument were related to all constructs. Validity of the constructs and their reliability was reconfirmed through CFA, as wireless usage in healthcare is a relatively new research domain and limited prior knowledge is available on these constructs specific to this domain (Gururajan, 2007b, Tseng and Heui-huang, 2007, Byrne, 2001).

The underlying latent variable structure was tested using confirmatory factor analysis (CFA). CFA analysis was based on the EFA loading of items, and designed to measure specifically one single factor. Therefore, a prior specification of the CFA model would allow variables to be free to load on to a particular factor, while restricted the remaining factors to having zero loadings. In this process such a model was evaluated by statistical means to determine the adequacy of its goodness of fit (Bollen, 1989a; Byrne, 2001).

A third stage of analysis provided the visual results of aggregating the items of the measurement model in the previous two stages of the process. This provided the evidence for the data to fit the model. As a result, a one-factor congeneric model for the independent variable *Clinical practices* (CP) was developed. As explained earlier, for the composite variable CP, reliability was calculated using Wert's formula. Furthermore, composite variables for CP were developed through actual regression weights in Stage 2 and composite measurement error was calculated by using Munck's formula in Stage 3. A similar process was used to produce composite measures for a one-factor congeneric model for the rest of the constructs in the model.

This process was adopted to ascertain the reliability of the determinants used to test the model through the SEM technique. Through this technique, a three-stage process was again adopted to explore the interaction of the determinants with the dependent variable ITU. The researcher adopted the philosophy to test a very simple model in Phase 1, some direct and indirect relationships in Phase 2, and a complex model in Phase 3.

The above three-stages approach provided a reliable strategy to minimize the mis-specification of the model, and the findings from the three models evaluated through

SEM seem to confirm the findings of the previous stages. Furthermore, the fit indices are also within the acceptable range for all the critical indicators. The model in the third phase was developed to explore any underlying interrelationships between the constructs by repeatedly evaluating the model: one causal relationship was added each time between the constructs, with the number of constructs and indicators remaining the same. This particular strategy involved model re-specifications while maintaining the underlying theory each time a new estimated coefficient was added (Hair et al., 2006). For example, clinical practices and compatibility of the wireless technology with the healthcare process were considered to have only direct effects on intention to use the wireless technology. Furthermore, all the competing models tested in this chapter through the SEM technique were aligned with each other's findings; all provided similar findings.

Therefore, the determinants *Clinical practices* and *Compatibility* are specific to healthcare domain determinants which have strong direct effects on the healthcare professionals' intention to use the wireless technology. While *Social context* is another health specific determinant, it does not have a direct impact on the intention to use, but significantly contributes toward the *Compatibility* and *Clinical practices* determinants. The readiness factor is determined by three determinants; namely, *Technical readiness*, *Organizational readiness*, and *Perceived readiness*. These determinants do not directly contribute to explaining the variation in the intention to use the wireless technology in healthcare, but have significant influences on the determinants CP and C indirectly to explain the variations in intention to use wireless technology in a healthcare environment.

10.12 Conclusion

In this chapter, a structural model was developed and tested for the wireless technology adoption factor in the Australian healthcare context. The SEM was used to explore the relationships among and between factors and constructs identified in the initial model, and to test the validity of the model through AMOS 16 (Schumacker and Lomax, 1996). Analyses of all three models tested through the SEM technique supported the findings of each other, and provided further insight about the determinants affecting the adoption of wireless technology in a healthcare setting. Table 10.14 provides a summary of direct and indirect effects on the determinants of adoption for wireless technology in the Australian healthcare context.

Table 10.14: Summary of determinants and their direct and indirect influences in the adoption of wireless technology in healthcare

No.	**Determinants**	**Directly related to ITU**	**Indirectly related to ITU**	**Effecting determinants**
1	Technical readiness	No	Yes	CP and C
2	Perceived readiness	No	Yes	OR and SC
3	Organizational readiness	No	Yes	TR and C
4	Clinical practices	Yes	No	ITU
5	Social context	No	Yes	CP and C
7	Compatibility	Yes	No	ITU

The next chapter provides conclusions and recommendations derived from this research study about the healthcare professionals' intention to use wireless technology in healthcare settings.

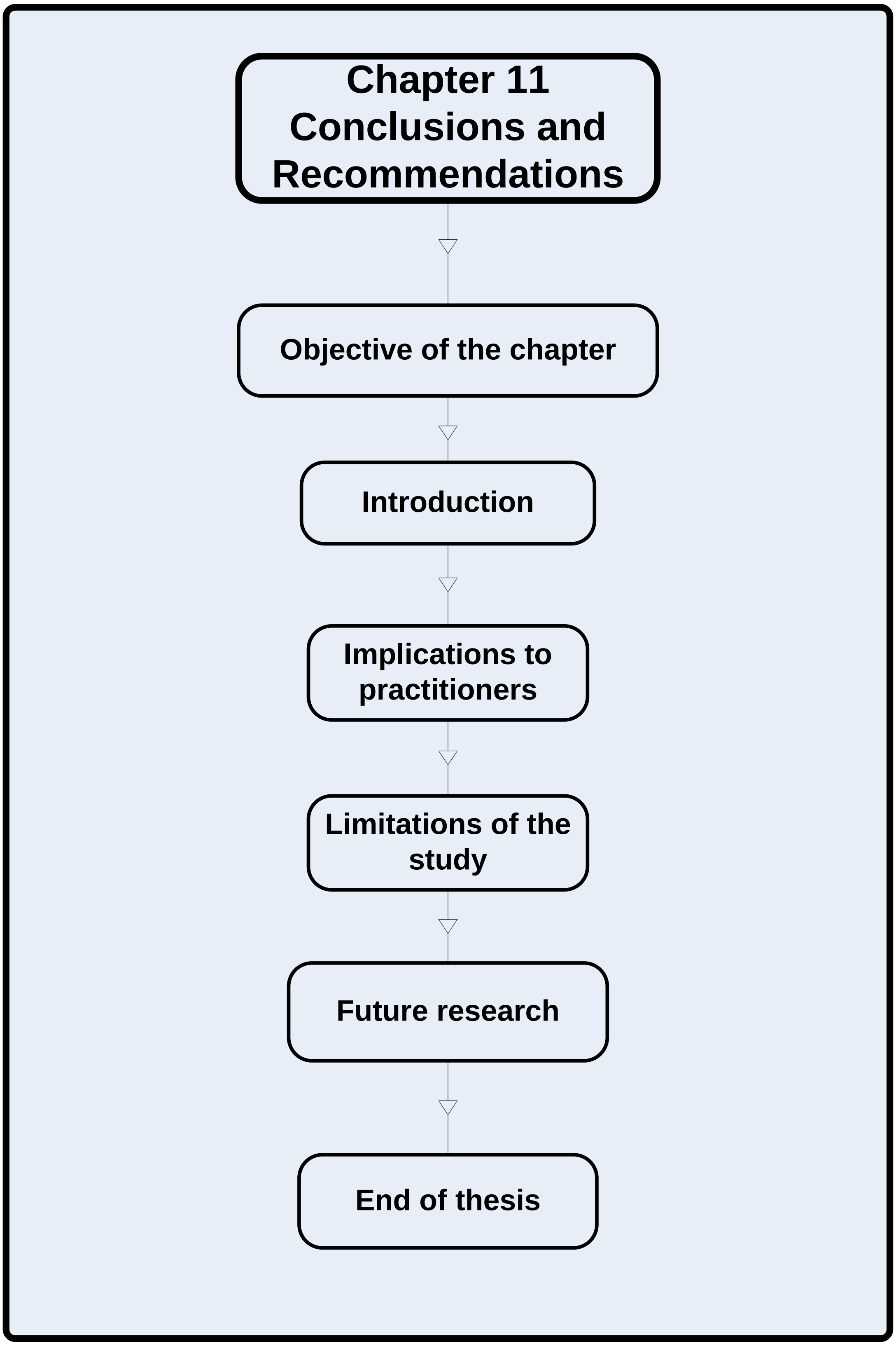
Chapter 11- Conclusions and Recommendations

11.1 Chapter overview

The previous chapter provided a detailed discussion about the findings of the qualitative and quantitative data analysis conducted in this study. The chapter also provided results for hypotheses formulated in this study and confirmed the provisional model as a result of the regression analyses conducted. The model was further verified through structural equations modelling.

This chapter is the final chapter in the thesis, and provides concluding remarks and recommendations for researchers, practitioners, and healthcare professionals in the context of adoption of wireless technology in a healthcare environment. Furthermore, this chapter also provides implications from the findings of this study before providing suggestions directions for future research directions.

The brief layout of the structure of this chapter is shown below.


Chapter 11
Conclusions and
Recommendations
Objective of the chapter
Introduction
Implications to practitioners
Limitations of the study
Future research
End of thesis

11.2 Introduction

As established in this study, with the development of the digital economy and technological improvements – especially in the domain of mobile computing and wireless technologies – the use of wireless technology and its adoption are critical for successful implementation of these emerging technologies in any environment. The case of the combined healthcare environment and the use of wireless technology in this environment is unique. This uniqueness poses specifics risks as discussed in the previous chapters; it is one of the reasons why researchers, practitioners, and bureaucrats are interested in this domain. These are the circumstances that motivated this researcher to investigate the determinants for the adoption of wireless technology in a healthcare setting. The two research questions answered in this research study are as follows.

Research question 1: What are the determinants for the use of wireless technology in the Australian healthcare environment?

Research question 2: What factors constitute a framework for the adoption of wireless technology in the Australian healthcare setting?

The answers to the above questions and how they were derived have been published in major international venues, including the Australian Conference of Information Systems (ACIS) and the European Conference on Information Systems (ECIS). Furthermore, as can been seen from the list provided in the beginning of this thesis, the outcomes of this study have been published in peer reviewed journals as well.

Thus, the outcomes of this study can lead to more-robust and successful implementations of wireless technology in service and non-service provider organisations and businesses.

This study adopted a mixed mode (both qualitative and quantitative) methodology in a unique way in answering the research questions posited. The qualitative component established the initial factors as well as the survey instrument. The transcripts of focus group meetings were used to derive the survey instrument, which is unique. Further, the regression analyses were taken to a structural equation modelling level to establish relationships among the various constructs. This has given strength to the model and findings.

While establishing the determinants of wireless technology, this study asserted that *Technical readiness* (TR), *Organisational readiness* (OR), *Perceived readiness* (PR), *Clinical practices* (CP), *Social context* (SC) and *Compatibility* (C) are the determinants for the *Intention to use* (ITU) wireless technology in the Australian healthcare environment. This study also concluded that there is a direct relationship between determinants *Clinical practices* and *Compatibility* to the dependent variable *Intention to use*. These empirical outcomes have not yet been reported in the literature.

Further, from the literature review, there was evidence that none of the existing adoption models or theories were able to fully explain the adoption phenomena for wireless technology in the healthcare domain. This study not only identified the determinants for the use of wireless technology in a healthcare setting, it also provided an adoption model for the use of wireless technology in a healthcare setting; this was developed through second order regression analysis, and further refined through structural education modelling in identifying interactions among the determinants. The study has established that there are strong relationships among the predictors; namely, *Clinical practices*, *Social context*, and *Compatibility* to the dependent variable *Intention to use* wireless technology in a healthcare setting.

The findings of this study also indicate that for the successful implementation of wireless technology in a healthcare environment, it is important to consider factors associated with the wireless technology and business aspects, in addition to the healthcare environment and working practices. These findings will help healthcare service providers in properly implementing wireless technology efficiently in their work environments.

Thus, this study has provided a theoretical model for the adoption of wireless technology in the healthcare domain for public and private hospitals. not only by incorporating the existing models and theories, but also by incorporating health-specific determinants. This is the contribution of this research to the broader domain of adoption phenomena.

There is one key recommendation from this study for healthcare professionals, administrators, researchers, academics, bureaucrats, and healthcare service providers in the private and public sectors: they will benefit by considering these determinants when formulating their strategic directions and ICT strategies; in this way wireless technology can be implemented smoothly and successfully. The specific finding of this study is that health-specific determinants such as clinical practices, social contexts and compatibility are critically related to any intention to use wireless technology. Healthcare service providers should consider relevant organisational changes so that these factors can facilitate better usages of wireless technology in their respective domains. For example, the compatibility issues associated with wireless devices in the existing infrastructure of a healthcare facility can determine the uptake of wireless technology in Australian healthcare systems. The participants of this study also stressed that proper synchronisation of clinical procedures and processes with the uses to which the wireless technology was to be put could play a critical role in the successful acceptance of wireless technology in the healthcare setting.

11.3 Implication to practitioners

- Practitioners can use the determinants to understand the phenomena of adoption before the implementation of handheld devices for healthcare professionals.
- It is quite evident from the finding of this research study that practitioners are concerned about the role of wireless handheld devices and their uses with the existing clinical process and procedures.
- This research study also highlights that there is evidence that the use of wireless handheld devices by healthcare professionals can improve the decision making process and quality of care provided in healthcare environment.

- This research study also identified that the availability of technical and organizational resources can improve the acceptance by the healthcare professionals, whereas the determinants such as Clinical practices, Social context, and Compatibility play a critical role for the adoption of wireless handheld devices in the healthcare setting.
- The determinants and relationship identified by this research study have implications on healthcare professionals, administrators, researchers, academics, bureaucrats, and healthcare service providers in the private and public sectors for future strategic direction.

11.4 Limitations of the study

There are several limitations associated with this study. For example, due to financial constraints, participants were selected only from the state of Queensland; that is, the researcher was unable to conduct the data collection at a national level. Consequently, the findings of this study are based only on views and opinions of participants in Queensland. Most of these participants had limited exposure to the use of wireless technology in clinical settings, so the findings of the study cannot be generalised.

Another limitation of this study is that wireless in the healthcare domain is a relatively new area, and research information about this combined domain is limited. Furthermore, the healthcare professionals in Queensland had only limited experience with wireless technology, and this may have introduced undetected bias in the outcomes of this study.

This study made no attempt to measure the effects of demographic characteristics of the participants (such as gender, education, age and experience), on their perceived intention to use wireless technology in their healthcare domain. Due to the limited sample size and response rate, there may be some non-response bias in the generalisation of the findings of this study; for example, the small public and private hospitals were excluded from the potential population from which participants were selected for this study.

At no time did this study attempt to measure the actual use of wireless technology in a healthcare environment. Whereas finding of this research study may be transferable to other similar settings.

11.5 Future research

One of the contributions of this study has been to add to the existing knowledge of adoption in the field of information systems by developing an adoption model for those intending to use wireless technology in the healthcare domain. Future studies can improve the outcomes of this study in the following ways.

- The research was conducted in the state of Queensland, and is yet to be tested in other states and territories of Australia. This may be important, as most of them have rules and regulations that are different from Queensland's.
- The research shows that there is sufficient evidence that the use and uptake of the technology may differ between the private and the public sectors of the healthcare industry. This study can be further extended by comparing these two entities separately.
- This study concentrated only on handheld devices such as PDAs and smart phones. There are other kinds of wireless technologies, such as RFID, Bluetooth, and Wi-Max. Future studies can test these technologies as well.
- This study did not test the actual use of wireless devices. Future studies can test this aspect.
- Future studies can investigate the applications of the model asserted in this study to other industries.
- Adoption of wireless technology in the healthcare domain is a relatively new area; future studies can explore the model asserted in this study with different countries.
- Future research studies can investigate the adoption phenomena established in this study to other contexts such as insurance.
- Further testing for the theoretical model developed in this study can be conducted by comparing the findings with some other groups of healthcare

professionals, for example individuals working in medical, surgical, or emergency units.

Finally, the main objective of this research was to understand the determinants of, and to develop an adoption model for, the use of wireless technology in the Australian healthcare system. The model could also be applied to other service-oriented industries such as aged care and nursing homes.

References

AAKER, D., A (1996) *Building Strong Brands,* New York, Free Press.

ADAMS, D. A., NELSON, R. R. & TODD, P. A. (1992) Perceived usefulness, ease of use, and usage of information technology: A replication. *MIS Quarterly,* 16**,** 227-250.

AGARWAL, R. & KARAHANNA, E. (2000) Time flies when you're having fun: Cognitive absorption and belief about information technology. *MIS Quarterly,* 24**,** 665-694.

AGARWAL, R. & PRASAD, J. (1999) Are Individual differences germane to the acceptance of new information technology? *Decision Science,* 30**,** 361-391.

AJZEN, I. & DRIVER, B. L. (1992) Application of the theory of planned behavior to leisure choice. *Journal of Leisure Research,* 24**,** 207-224.

AJZEN, I. & FISHBEIN, M. (1975) Belief, Attitude, Intention and Behavior: An introduction to theory and research, Addison-Wesley Reading, MA, 1975.

AJZEN, I. & FISHBEIN, M. (1980) *Understanding attitudes and predicting social behavior,* Englewood Cliffs, Prentice Hall Inc.

AJZEN, I. & MADDEN, T. J. (1986) Prediction of goal-directed behavior: Attitudes, intentions, and perceived behavioral control. *Journal of Experimental Social Psychology* 22**,** 453-474.

AJZEN, I. (1985) From intentions to action: A theory of planned behavior. IN KUHL, J. & BECKMANN, J. (Eds.) *Action control: From cognition to behavior* New York, Springer Verlag.

AJZEN, I. (1991a) The Theory of Planned Behaviour *Organizational Behaviour and Human Decision Processe,* 50**,** 179-211.

AJZEN, I. (2006) Theory of Planned Behaviour. http://www.people.umass.edu/aizen/tpb.diag.html.

AJZEN, I., TIMKO, C. & WHITE, J. B. (1982) Self-monitoring and the attitude-behavior relation. *Journal of Personality and Social Psychology,* 42**,** 426-435.

ALEXANDER, I. (2003) The impact of future trends in electronic data collection on musculoskeletal research and evidence-based orthopaedic care. *The Journal of Arthroscopic and Related Surgery,* 19**,** 1007-1011.

AL-GAHTANI, S. & KING, M. (1999) Attitudes, satisfaction and usage: factors contributing to each in the acceptance of information technology. *Behaviour & Information Technology,* 18**,** 277-297.

ALRECK, P. & SETTLE, R. (1985) *The Survey Research Handbook*, Illinois, Irwin.

ALRECK, P. & SETTLE, R. (1995) The Survey Research Handbook: Guidelines and Strategies for Conducting a Survey, Chicago, Irwin.

AMMENWERTH, E., BUCHAUER, A., BLUDAU, B. & HAUX, R. (2000) Mobile information and communication tools in the hospital. *International Journal of Medical Informatics,* 57**,** 21-40.

ANDERSON, P. F. (1983) Marketing scientific progress and scientific method. *Journal of Marketing,* 47**,** 28-31.

ANGUS, B. L. (1986) Developments in ethnographic research in education: From interpretive to critical ethnography. *Journal of Research and Development in Education,* 20**,** 59-67.

ANOGEIANAKI, A., ILONIDIS, G., ANOGEIANAKI, G., LIANGURIS, J., KATSAROS, K., PSEFTOGIANNI, D., KLISAROVA, A. & NEGREV, N. (2004) A training network for introducing telemedicine, telecare and hospital informatics in the Adriatic-Danube-Black Sea region. In WOTTON, R. (Ed.) *Success and Failures in telehealth.* Brisbane, Australia, Centre for Online Health, University of Queensland.

ARBUCKLE, J. L. (2005) *AMOS 4.0 User Guide,* Chicago, IL, AMOS Developer Corporation.

ATHEY, S. & STERN, S. (2002) The impact of information technology on emergency health care outcomes. *RAND Journal of Economics,* 33**,** 399 - 388.

ATWAL, R. (2001) The wireless office: Evolution, revolution or bust. Gartner Research.

BABBIE, E. (2004) *The practice of social research*, Thomson Wadsworth Australia.

BAGOZZI, R. P. (1996) Measurement in marketing research: basic principels of questionnaire design. *Principles of Marketing Research***,** 1-49.

BAGOZZI, R. P., BAUMGARTNER, H. & YOUJAE, Y. (1992a) State versus action orientation and theory of reasoned action: An application to coupon usage. *Journal of Consumer Research,* 18**,** 505-518.

BAGOZZI, R. P., DAVIS, F. D. & WARSHAW, P. R. (1992b) Development and test of a theory of technological learning and usage. *Human Relations,* 45**,** 659-686.

BAKER, B. D. (2002) Wireless (in) security for health care. In CORPORATION, S. A. I. (Ed.). Healthcare Information and Management System Society.

BANDURA, A. & JOURDEN, F. (1991) Self-regulatory mechanisms governing social comparison effects on complex decision making. *Journal of Personality and Social Psychology,* 60**,** 941-951.

BANDURA, A. (1977) Sef-efficacy: Toward a unifying theory of behavioral change. *Psychology Review,* 84**,** 191-215.

BANDURA, A. (1986) Social Foundation of thought and action: A social cognitive theory, Englewood Cliffs, N.J., Prentice Hall.

BARTLETT, JAAMESS E., KOTRLIK, J. W. & HIGGINS, C. C. (2001) Organizational research: Determining appropriate sample size in survey research. *Information Technology, Learning, and Performance Journal,* 19.

BASKERVILLE, R. & PRIES-HEJE, J. (2001) A multiple-theory analysis of a diffusion of information technology case. *Information Systems Journal,* 11**,** 181-212.

BATES, D. W. & GAWANDE, A. A. (2003) Improving safety with information technology. *The New England journal of medicine,* 348**,** 2526-2534.

BAUER, M. W. & CASKELL, G. (2006) Qualitative researching with text, image, and sound: A practical handbook, London, Sage Publications.

BEATTY, R. C., SHIM, J. P. & JONES, M. C. (2001) Factors Infuencing Corporate Web Site Adoption: A Time-Based Assessment. *Information & Management,* 38**,** 337-354.

BENAMATI, J. & RAJKUMAR, T. M. (2002) A design of an empirical study of the applicability of the technology acceptance model to outsourcing decisions. *Proceedings of the 2002 ACM SIGCPR conference on Computer personnel research.* Kristiansand, Norway, ACM Press.

BENNETT, C. (2009) A healthier future for all Australians. Final report of the National Health and Hospitals Reform Commission. June 2009.

BENSINK, M., ARMFIELD, N., RUSSEL, T., IRVING, H. & WOTTON, R. (2004) Paediatric palliative home care with internet based videophones: Lessons learnt. In WOTTON, R. (Ed.) *Success and failure in telehealth.* Brisbane, Australia, The Centre for online health, University of Queensland.

BENTLER, P. M. (1990) Comparative fit indexex in structural models. *Psychological Bulletin,* 107**,** 238-246.

BENTLER, P. M. (1995) EQS Structural Equation Program Manual. *Multivariate Software.* Encino.

BERGER, I. (193) A framework for understanding the relationship between environmental attitude and consumer behaviour in marketing theory and application. *American Marketing Association,* 4**,** 157-163.

BEVAN, N. (2001) International standards for HCI and usability. *International Journal of Human-Computer Studies,* 55**,** 533-552.

BLACK, M. S., PHIL, M. A., FOÉX, P. & PHIL, A. M. (1982). Some capabilities and limitations of multiple regression analysis: Application to canine coronary blood flow. *British Journal of Anaesthesia, ,* 54**,** 1319-1329.

BOLLEN, K. A. (1989a) *Structural Equations with Latent Variables.* New York, John Wiley & Sons.

BOURQUE, L. B. & FIELDER, E. P. (1995) *How to conduct self-administered and mail surveys* Thousand Oaks, California.

BROTHERSON, M. J. & GOLDSTEIN, B. L. (1992) Quality design of focus groups in early childhood special education research. *Journal of Early Intervention,* 16**,** 334-342.

BROWNE, M. W. & CUDECK, R. (1993) Alternative ways of assessing model fit. . IN NEWBURY PARK, C. S. (Ed.) Testing structural equation models (1993) Bollen, Kenneth A.; Long, J. Scott. Newbury Park: Sage Publications.

BRYMAN, A. (2004) *Social Research Methods,* Oxford, Oxford University Press.

BURLEY, L., SACHEEPERS, H. & FISHER, J. (2005) Diffusion of Mobile Technology in Healthcare. *First European Conference on Mobile Government (EURO mGOV 2005),*. Brigton, UK.

BURNS, R., B. (1997) *Introduction to Research Methods,* South Melbourne, Australia, Addison wesley Longman.

BURTON-JONES, A. & HUBONA, G. S. (2005) Individual differences and usage behavior: revisiting a technology acceptance model assumption. *SIGMIS Database,* 36**,** 58-77.

BUSCH, P. & RICHARDS, D. (2002) Tacit Knowledge Characteristic: a research methodology. IN WENN, A., MCGRATH, M. & BURSTEIN, F. (Eds.) *Thirteenth Australaian conference on Information System.* Melbourne, School of Information System, Victoria University.

BYERS, P. Y. & WILCOX, J. R. (1991) Focus Groups: a qualitative approach for researcher. *The Journal of Business Communication,* 28**,** 63-78.

BYRNE, B. M. (2001) *Structural equation modeling with AMOS,* Mahwah, NJ, Lawrence Erlbaum Associates.

CAIN, M. & TODD, P. A. (1995) On the use, usefulness, and ease of use of structural equaction modeling in mis research: A note of caution. *MIS Quarterly,* 19**,** 273-246.

CALDER, B. J. (1977) Focus group research and nature of qualitative marketing research. *Journal of Marketing Research,* 14**,** 353-364.

CAO, T. Y. (2003) What is Ontological Synthesis? – A Reply to Simon Saunders *Synthese* 136-141**,** 107-126.

CARLSSON, C., CARLSSON, J., HYVÖNEN, K., PUHAKAINEN, J. & WALDEN, P. (2006) Adoption of mobile devices/services — Searching for answers with the UTAUT. *Proceedings of the 39th Annual Hawaii International Conference on System Sciences (HICSS'06) Track 6.* Hawaii, IEEE Computer Society.

CARLSSON, C., HYVÖNEN, K., REPO, P. & WALDEN, P. (2005) Asynchronous Adoption Patterns of Mobile Services. *Proceeding of the 38th Hawaii Iinternational Conference on Systems Science.* Islans of Hawaii, USA.

CARROLL, A. E., SALUJA, S. & TARCZY-HORNOCH, P. (2001) Development of a Personal Digital Assistant (PDA) based client/server NICU patient data and charting system. *Proceedings / AMIA ... Annual Symposium. AMIA Symposium.*

CARSON, D., GILMORE, A., PERRY, C. & GRONHAUG, K. (2001) *Qualitative Marketing Research,* London, Sage Publications.

CASEBEER, A. L. & VERHOEF, M. J. (1997) Combining Quantitative and Qualitative Research ethods: Considerating the possibilities for enhancing the study of chronic Diseases.

CAVANA, R., Y, DELAHAYE, B., L & SEKARAN, U. (2001) *Applied Business Research: Qualitative and Quantitative Methods,* Milton, John Wiley & Sons Australia, .

CHAU, P. Y. K. & HU, P. J. (2002a) Examining a model of information technology acceptance by individual professionals: an exploratory study',. *Journal of Management Information Systems,* 18**,** 191-229.

CHAU, P. Y. K. & HU, P. J. H. (2002b) Investigating healthcare professionals' decision to accept telemedicine technology: An empirical test of competing theories. *Information and Management,* 39**,** 297-311.

CHAU, P. Y. K. (1996) An empirical assessment of a modified technology acceptance model. *Journal of Management Information Systems,* 13**,** 185-204.

CHAU, S. & TURNER, P. (2004) Implementing and evaluating a wireless handheld clinical care management system at an Australian aged care facility. *HIC 2004.* Brisbane, Australia.

CHEN, E., MENDONCA, E., MCKNIGHT, L., STETSON, P., LEI, J. & CIMINO, J. (2004) A wireless handheld application for satisfying clinician information needs. *Journal of the American Medical Informatics Association* 11**,** 19-28.

CHEUNG, S. F., CHAN, D. K. S. & WONG, Z. S. Y. (1999) Reexamining the theory of planned behavior in understanding wastepaper recycling. *Environment and Behavior,* 31**,** 587-612.

CHIA, R. (1997) Essai: Thirty years on: from organizational structures to the organization of thought, . *Organizational Studies,* 18**,** 685-707.

CHISMAR, W. R. & WILEY-PATTON, S. (2006) Predicting Internet use: Applying the extended technology acceptance model to the healthcare environment. IN SPIL, T. A. M. & SCHURING, R. W. (Eds.) *E-health systems diffusion and use: The innovation , the user and the USE IT model.* Hershey, PA, USA, Idea Group Inc.

CHIU, I. & BRENNAN, M. (1990) The effectiveness of some techniques for improving mail survey response rate: a meta analyses. *Marketing Bulletin,* 1**,** 13-18.

CHOUSIADIS, C. & PANGALOS, G. (2003) Implementing authentication and mointoring in healthcare information sysytems. *Health Informatics Journal,* 9**,** 79-87.

CODY-ALLEN, E. & KISHORE, R. (2006) An extension of the UTAUT model with e-quality, trust, and satisfaction constructs. Proceedings of the 2006 ACM SIGMIS CPR conference on computer personnel research: Forty four years of computer personnel research: achievements, challenges & the future. Claremont, California, USA, ACM Press.

COHEN, W. M. & LEVINTHAL, D. A. (1990) Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quaterly,* 35**,** 128-152.

COMPEAU, D. R. & HIGGINS, C. A. (1991) A social cognitive theory perspective on individual reactions to computing technology. *Conference Proceding of 12th Internatal conference on information systems.* New York.

COMPEAU, D. R., HIGGINS, C. A. & HUFF, S. (1999) Social cognitive theory and individual reactions to computing technology: a longitudinal study. *MIS Quarterly,* 23**,** 145-158.

COOPER, D., R & SCHINDLER, P., S (1998) *Business Research Methods*, Irwin.

CORNFORD, A. & SMITHSON, S. (1996) *Project Research in Information Systems,* Hampshire, Macmillan Press Ltd.

COX, K. K., HIGGINBOTHAM, J. B. & BURTON, J. (1976) Application of focus group interviews in marketing. *Journal of Marketing,* 40**,** 77-80.

CRAIG, J. & JULTA, D. (2001) e-Business Readyiness: A Customer Focused Framework, Boston, Addison Wesley.

CRAMP, D. G. & CARSON, E. R. (2001) A model-based framework for assessing the value of ICT-driven healthcare delivery. *Health Informatics Journal,* 7**,** 90-95.

CRESSWELL, A. M. (2004) Return on Investment in It: A Guide for Managers. In GOVERNMENT, C. F. T. I. (Ed.). University of ALBANY, State University of New York.

CRESSWELL, J. W. (2003) Research Design: Qualitative, Quantitative and Mixed Methods Approaches (Second ed.). Thousand Oaks, California: Sage Publications.

CRESSWELL, J., W. (1994) Research Design: Qualitative and Quantitative Approaches, California, SAGE Publications.

CROTTY, M. (1998) The Foundations of Social Research: Meaning and Perspective in the Research Process, Sydney, Australia, Allen and Unwin.

CZAJA, R. & BLAIR, J. (2003) *Designing surveys: A guide to decisions and procedures,* Thousand Oaks, California, SAGE Publications.

DANE, F., C. (1990) *Research Methods,* Belmont, California, Brooks/Cole Publishing Company.

DAUME JR, W. H. (1988) Focus group do not have to be expensive. *Marketing News,* 22**,** 23-26.

DAVID, B. & SPELL, N. (1997) The cost of adverse drug events in hospitalized patients: Adverse drug events prevention study group. *JAMA,* 277**,** 307- 311.

DAVIS, D. F. (1986) A Technology Accceptance Model for empirically testing new end-user information systems: Theory and results. *Sloan School of Management.*

DAVIS, D. F. (1989a) Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly,* 13**,** 319-340.

DAVIS, D. F., BAGOZZI, P. R. & WARSHAW, R. P. (1989a) User Acceptance of Computer Technology: A comparison of two Theoretical Models. *Managemenr Science,* 35**,** 982-2003.

DAVIS, F. D. (1989b) Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly,* 13**,** 318-340.

DAVIS, F. D., BAGOZZI, R. P. & WARSHAW, P. R. (1989b) User acceptance of computer technology: a comparison of two theoretical models *Manage. Sci.,* 35 982-1003

DAVIS, F. D., BAGOZZI, R. P. & WARSHAW, P. R. (1992) Extrinsic and intrinisic motivation to use computers in the workplace. *Journal of Applied Social Psychology,* 22**,** 1111-1132.

DAVIS, R. (2002) Pursue front end solutions to revenue problems. *Healthcare Financial Management,* 56**,** 30 - 36.

DE GROOTE, S. & DORANSKI, M. (2004) The use of personal digital assistants in the health sciences: Result of a survey. *Journal of the Medical Library Association,* 93**,** 341-348.

DENNIS, R. A., VENKATESH, V. & RAMESH, V. (2003) Adoption of collaboration technologies: Integrating technology acceptance and collaboration technology research.

DESHPANDE, R. (1983) "Paradigms Lost" on theory and method in research in marketing. *Journal of Marketing*, 47**,** 101-110.

DIAMANTOPOULOS, A. & SIGUAW, A. J. (2000) *Introducing Lisrel,* London, SAGE Publications Inc.

DIAS, D. D. S. (1998) Managers' motivation for using information technology. *Industrial Management + Data Systems,* 98**,** 338-342.

DICK, R. (1990) *Convergent Interviewing*, Chapel Hill, Qld. : Interchange,.

DICK, W. & CAREY, L. (1990) *The systematic design of instruction,* 3rd ed., Glenview, IL:Scott.

DILLON, A. & MORRIS, M. G. (1996) User Acceptance of Information Technology: Theories and Models. *Journal of American Society for Information Science*, 31**,** 3-32.

DION, A. P. (2008) Interpreting Structural Equation Modeling Resylts: A Reply to Martin and Cullen. *Journal of Business Ethics*.

DITSA, G. (2004) A research design and Methodological Approach to an Exploratory User Behaviour Testing: Lessons Learnt. *Information Resource anagement Association International conference.* New Orleans, USA.

DIXON, D. R. & STEWART, M. (2000) Exploring Information Technology Adoption by Family Physicians: Survey Instrument Validation. *American Medical informatics Association Four Year Cumulative Symposium Proceedings***,** 1977-2000, Bethesda, MD.

DURLACHER (2001) UMTS Report. IN LTD., D. R. (Ed.).

DYER, O. (2003) Patients will be reminded of appointments by text messages. *British Medical Journal,* 326**,** 281.

EASTERBY-SMITH, M., THORPE, R. & LOWE, A. (1991) *Management Research: An Introduction,* London, Sage.

EMORY, C., W & COOPER, D., R (1991) *Business Research Methods,* Homewood, IL, Irwin.

ENGSBO, M., SAARINEN, T., SALMI, H. & SCUPOLA, A. (2001) A framework of adoption of e-commerce in networks of SMEs. *The 24th Information Systems Research Seminar in Scandinavia.* Ulvik in Hardanger, Norway, University of Bergen, Department of Infomation Science, Norway.

FALCONER, D. J. & MACKAY, D. R. (1999) The key to the mixed method dilemma. IN SYSTEMS, A. C. O. I. (Ed.) *Wellington.*

FAN, X., THOMPSON, B. & WANG, L. (1999) Effects of sample size, estimation methods and model specification on structural equation modeling fit indexes. *Structural Equation Modeling,* 16**,** 56-83.

FARHOOMAND, A. F., KIRA, D. & WILLIAMS, J. (1990) Managers' perceptions towards automation in manufacturing. *IEEE Transactions on Engineering Management* 37**,** 228-232.

FEDRICK, A. L. & DOSSETT, D. L. (1983) Attitude behaviour Relations: A comparision of the Fishbein-Ajzen and Bentler-Speckart Models. *Journal of Personality and Social Psychology,* 45**,** 501-512.

FERN, E. F. (1982) The use of focus group for idea generation: the effects of group size, acquaintanceship, and moderator on response quantity and quality. *Journal of Marketing Reasarch,* 19**,** 1-13.

FINK, A. & KOSECOFF, J. (1998) *How to Conduct Survey: A step-by-Step Guide,* Thousand Oaka, Sage Publication.

FINK, A. (1995a) *How to analyse survey data,* Thousand Oaks, California, Sage Publications.

FINK, A. (1995b) *How to design survey,* Thousand Oaks, California, Sage Publications.

FISHBEIN, M. & AJZEN, I. (1975) Belief, attitude intention and behavior: An introduction to theory and research, Reading, USA, Addison-Wesley.

FLORES, J. G. & ALONSO, C. G. (1995) Using focus groups in educational research. *Evaluation Review,* 19**,** 84-101.

FODDY, W. (1993) Constructing Quesrtions for Interviews and Questionnaire: Theory and Practice in Social Research, Melbourne, Cambridge University Press.

FOWLER, F., J. (1993) *Survey Research Methods,* London, SAGE Publication.

GAGE, N. L. (1994) The Scientific Status of Research on Teaching: Educational Researcher. 44**,** 371-383.

GATIGNON, H. & ROBERTSON, T. S. (1989) Technology Diffusion: an empirical test of competitive effects. *Journal of Marketing,* 53**,** 35-49.

GOLDBERG, S. & WICKRAMASINGHE, N. (2003a) 21st Century healthcare - The Wireless Panacea. *Proceeding of the 36th Hawaii International Conference on System Sciences.*

GORDON, W. & LANGMAID, R. (1988) Chapter 6 the individual "depth" interview in Qualitative Market Research: A practitioner's and Buyer's Guide, Aldershot, England, Gower Publishing Company.

GRAZIANO, A. M. & RAULIN, M. L. (2000) *Research Methods: a process of inquiry,* Boston, Allyn and Bacon.

GREENBAUM, T. L. (1988) *The Practical Handbook and Guide to focus Group Research*, D. C. Heath and Company, Lexington.

GREENBAUM, T. L. (1993) Who's leading your focus group? *Bank Marketing*, 25**,** 31.

GREGORY, R. J. (2000) *Psychological Testing,* Allyn & Bacon: MA.

GRIFFITHS, J.-M., RONALD, G. H., ELLEN, A. S. & PAT, C. (1986) Diffusion of innovations in library and information science. Final report. Rockville, Maryland, King Research Inc.

GRIST, S., HAFEEZ-BAIG, A., GURURAJAN, R. & KHAN, S. A. K. S. (2007) Clinical Usefulness is the Key Common Determinant of Adoption of Wireless Technology in Healthcare for India and Australia. IN HAFEEZ-BAIG, A. (Ed.) *Management of Mobile Business, 2007. ICMB 2007. International Conference on the.*

GUADAGNO, L., VANDEWEERD, C., STEVENS, D., ABRAHAM, I., PAVEZA, J. G. & FULMER, T. (2004) Using PDAs for data collection. *Elsevier Inc.,* 17**,** 283-291.

GUBA, E. G. & LINCOLN, Y. S. (1994) Competing Paradigms in Quantative Research, in Handbook of Qualitative Research, Sage Publication.

GUPTA, A. K. & GOVINDARAJAN, V. (2000) Knowledge Flows within Multionaltional corportations. *Strategic Management Journal***,** 473-496.

GURURAJAN, R. & MURUGESAN, S. (2005) Wireless Solutions Developed for the Australian Healthcare: A Review. *Proceedings of the International Conference on Mobile Business.* IEEE Computer Society Washington, DC, USA

GURURAJAN, R. & VUORI, T. (2003) Experiences in Wireless Application Development in a Healthcare Setting. In BURN, J. (Ed.) *WeB 2003.* Perth, Australia, WeB Center, Edith Cowan University.

GURURAJAN, R. (2004a) An Exploratory Qualitative Study to determine factors influencing the adoption of mobile learning for tertiary education.

GURURAJAN, R. (2004b) A Study of the use of Hand-Held Devices in an Emergency Department. *Journal of Telehealth,* 1**,** 31-34.

GURURAJAN, R. (2007a) Drivers of wireless technology in healthcare: an Indian Study. IN (ED.), I. R. W. (Ed.) *Proceedings of the 15th European Conference on Information Systems (ECIS2007), University of St Gallen.* St Gallen, Switzerland.

GURURAJAN, R. (2007b) Factors influencing the intention to use wireless technology in healthcare: an Indian study. *Journal of Telemedicine and Telecare,* 13**,** 40-41.

GURURAJAN, R., HAFEEZ-BAIG, A. & GURURJAN, V. (2008) Clinical factors and technological barriers as determinants for the intention to use wireless handheld technology in healthcare environment: An Indian case study. *16th European Conference on Information Systems.* National University of Ireland, Galway.

GURURAJAN, R., HAFEEZ-BAIG, A. & KERR, D. (2007) Reactions and perceptions of healthcare professional towards wireless devices in healthcare environment in the developing world: a case of Pakistan. *ACIS 2007 18th Australasian Conference on Information Systems: the 3 Rs: Research, Relevance and Rigour - Coming of Age.* Toowoomba, Australia, University of Southern Queensland.

GURURAJAN, R., MOLONEY, C. & KERR, D. (2005a) Drivers for wireless handheld technology: Views from Queensland nurses. *Australian Business & Behavioural Sciences Association (ABBSA) Conference.* Cairns, Australia, James Cook University.

GURURAJAN, R., QUADDUS, M., FINK, D., VUORI, T. & SOAR, J. (2005) Drivers and barriers to adoption of wireless handheld system in WA healthcare: Selected views. *HIC 2005.* Melbourne, HISA.

HAIR, J. F., BLACK, W. C., BABIN, B. J., ANDERSON, R. E. & TATHAM, R. L. (2006) *Multivariate data analysis,* Upper Saddle River, NJ, Pearson Education Inc.

HAIR, J., ANDERSON, R., TATHAM, R. & BLACK, W. (1998) *Multivariate Data Analysis,* Sydney, Prentice Hall International Inc.

HALL, E., VAWDREY, D., KNUTSON, C. & ARCHIBALD, J. (2003) Enabling remote access to personal electronic medical records. *IEEE Eng Med Biol Mag,* 23**,** 133-139.

HAN, S. (2003) Individual Adoption of Information Systems in Organizations: a literature review of technology acceptance model. TUCS Technical Report 540.

HARRIS, L. M. (1995) Technology, techniques drive focus group trends. *Marketing News,* 29**,** 8.

HART, M. & PORTER, G. (2004) The impact of cognitive and other factors on the perceived usefulness of olap. *Journal of Computer Information Systems,* 45**,** 47-56.

HAUSER, J. R. & SHUGAN, M. S. (1980) Intensity measure of consumer perference. *Opererational Research,* 28**,** 279-320.

HENDRICKSON, R. & COLLINS, M. R. (1996) An Assessment of Structure and Causation of IS Usage. *Database,* 27.

HESSE, M. (1980) Revolutions and Reconstructions in the Philosophy of Science, Brighton, Harvester.

HISRICH, R. D. & PETERS, M. P. (1982) Focus groups: an innovative marketing research technique. *Hospital and Health Services Administration,* 27**,** 8-21.

HOLAK, S. L. & LEHMAN, D. R. (1990) Purchase Intentions and the Dimensions of Innovation: An Exploratory Model. *Journal of Product Innovation Management,* 7**,** 59-73.

HOLMES-SMITH, P. & ROWE, K. J. (1994) The development and use of congeneric measurement models in school effectiveness research: Improving the reliability and validity of composite and latent variables for fitting multilevel and structural equation models. *International Congress for School Effectiveness and Improvement.* World Congress Centre, Melbourne.

HOLMES-SMITH, P. (2000) Introduction to Structural Equation Modeling Using AMOS 4.0: Course Notes. Melbourne, SREAMS.

HOLMES-SMITH, P. (2009) Structural Equation Modeling From the Fundamentas to Advanced Topics: ACSPRI Course Notes. Victoria, Australia, Scsool Research, Evaluation and Measurement Services.

HOLZMAN, T. (May and June 1999) Computer-Human Interface Solutions for Emergency Medical Care; Interactions of the ACM.

HORAN, T. A., TULU, B. & HILTON, B. N. (2006) Understanding physician use of online systems: An empirical assessmenst of an electronic disability evaluation system. IN SPIL, T. A. M. & SCHURING, R. W. (Eds.) *E-health systems diffusion and use: The innovation , the user and the USE IT model.* Hershey, PA, USA, Idea Group Inc.

HOWARD, A., HAFEEZ-BAIG, A., HOWARD, S. & GURURAJAN, R. (2006) A Framework for the Adoption of wireless Technology in Healthcare: An Indian Study. *Australian Conference of Information Systems.*

HOYLE, R. (1995) Structural Equaction Modeling: Concepts, Issues, and Applications, Sage Publications, Thousand Oaks.

HU, L. & BENTLER, P. M. (1995) Evaluating model fit. In R. H. Hoyle, Ed. Structural equation modeling: Concepts, issues and applications, Thousand Oaks: Sage.

HU, L. T. & BENTLER, P. M. (1999) Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Structural Equation Modeling. *Multidisciplinary Journal,* 6**,** 1-55.

HU, P. J., CHAU, P. Y. K. & LIU SHENG, O. R. (2002a) Adoption of telemedicine technology by health care organisations: An exploratory study. *Journal of organisational computing and electronic commerce,* 12**,** 197-222.

HU, P. J., CHAU, P. Y. K., OLIVIA R. LIU SHENG & KAR, Y. T. (1999) Examining the technology acceptance model using physician acceptance of telemedicine technology. *Journal of Management Information Systems* 16**,** 91-112.

HUNT, S. D. (1990) Truth in marketing theory and research, Journal of Marketing 54**,** 1-15.

IACOVOU, C. L., BENBASAT, I. & DEXTER, A. (1995) Electronic data interchange and small organizations: Adoption and impact of technology. *MIS Quarterly,* 19**,** 466-485.

IGBARIA, M., GUIMARAES, T. & DAVIS, G., B., (1995) Testing the determinants of microcomputer usage via a structural equation model. *Journal of Management Information Systems,* 11**,** 87-114.

IGBARIA, M., PARASURAMAN, S. & BAROUDI, J. J. (1996) A motivational model of microcomputer usage. *Journal of Management Information System,* 13**,** 127-143.

IGBARIA, M., ZINATELLI, N., CRAGG, P. & CAVAYE, A. M. (1997) Personal computing factors in small firms: A Structural Equation Model. *MIS Quarterly,* 21**,** 279-302.

IVERS, B. & GURURAJAN, R. (2006) Management issues in telecommunications: videoconferencing & telehealth. In RAMAR, D. K. (Ed.) *International Conference on Recent Trends in Information Systems Proceedings.* India, Allied Publishers Pvt Ltd.

JAYASURIYA, R. (1998) Determinants of microcomputer technology use: Implications for education and training of health staff. *International Journal of Medical Informatics***,** 187-194.

JOHNSON, R. B. & ONWUEGBUZIE, A. J. (2004) Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, 33**,** 14-26.

JOHNSTON, L., O'MALLEY, P. & BACHMAN, J. (1994) National Survey Results on Drug Use from the Monitoring the Future Study, 1975-1993, Vol I, Secondary School Students. Rockville, MD, National Institute of Drug Abuse.

JORESKOG, K. G. & SORBOM, D. (1993) LISREL 8: Structural equaction modeling with the SIMPLIS command language. Chicago, Scientific Software International.

JORMALAINEN, S. & LAINE, J. (2001) Security in the WTLS. In HTTP://WWWHUT.FI/~JTLAINE2/WTLS (Ed.).

KARUEGER, R. A. (1993) Quality control in focus group research. In *Successful Focus Groups: Advancing the State of the art.* Thousand Oaks, CA, Sage.

KASPER, C. E. (1996) Personal digital assistants and clinical practice. *Western Journal of Nursing Research,* 18**,** 717-721.

KAUSHAL, R. & BATES, D. W. (2001) Computerized physician order entry (CPOE) with clinical decision support systems (CDSSs). *Evidence Report/Technology Assessment.* Agency for Healthcare Research and Quality.

KENDALL, J., TUNG, L. L., CHUA, K. H., NG, C. H. D. & TAN, S. M. (2001) Electronic commerce adoption by SMEs in Singapore. In SPRAGUE, R. H. (Ed.) *34th Hawaii International Conferences on System Sciences (HICSS 34).* Hawaii, IEEE Computer Society.

KERLINGER, F. N. (1986) *Foundation of Behavioral Research,* Holt New York, Rinehart and Winston.

KITCHENHAM, B. & PFLEEGER, L. S. (2002) Principles of Survey Research, Part 4: Questionnaire Evalustion. *Software Engineering Notes,* 27**,** 20-22.

KITZINGER, J. (1994) The methodology of Focus Groups: The importance of interaction between research participants. *Sociology of Health and Illness,* 16**,** 103-121.

KLINE, R. B. (2005) Principles and practice of structural equation modeling, New York, Guilford Press.

KOUTKIAS, V. G., MELETIADIS, S. L. & MAGLAVERAS, N. (2001) WA-based personalized health-care systems. *Health Informatics Journal,* 7**,** 183-89.

KREJCIE, R. V. & MORGAN, D. W. (1970) Determiningsample size for research activities. . *Educational and Psychological Measurement,* 30**,** 607-610.

KRUEGER, R. A. & CASEY, M. A. (2000) *Focus Groups: A Practical Guide for Applied Research.* Thousand Oaks, Calif, Sage.

KRUEGER, R. A. (1988) *Focus Groups: A practical Guide for Applied Research,* Newbury Park, Sage Publications.

KRUEGER, R. A. (1994) *Focus Groups - A Practical Guide For Applied Research* Thousand Oaks, California: Sage Publication Inc.

KRUEGER, R. A. (1998) *Moderating Focus Groups*, Sage Publications, Thousand Oaks.

KRUEGER, R. A. (Ed.) (1993) Quality control in focus group research, in Successful Focus Groups: Advancing the State of the Art, Thousand Oaks, CA, Sage.

KWON, T. J. & ZMUD, R. W. (Eds.) (1987) Unifying the fragmented models of information systems implementation, New York, John Wiley.

LABAY, D. G. & KINNEAR, T. C. (1981) Exploring the consumer decision process in the adoption of solar energy systems. *Journal of Consumer Research,* 8**,** 271-278.

LACHIN, J. (1981) Introduction to sample size determination and power analysis for clinical trials. *Control Clin Trials,* 2**,** 93-113.

LAPOINTE, L., LAMOTHE, L. & FORTIN, J. (2006) The dynamics of IT adoption in a major change process in healthcare delivery. IN SPIL, T. A. M. & SCHURING, R. W. (Eds.) *E-Health Systems Diffusion and Use: The Innovation, the User and the USE IT Model.* London, The Idea Group Publishing.

LARCKER, D. F. & LESSIG, P. V. (1980) Perceived usefulness of information: A psychometric examination. *Decision Science,* 11**,** 121-134.

LEACH, M., HENNESSY, M. & FISHBEIN, M. (2001) Perception of Easy-Difficult: Attitude or Self-Efficacy? *Journal of Applied Social Psychology,* 31**,** 1-20.

LEE, T. T. (2004) Nurses adoption of technology: Application of Roger's Innovation-Diffusion Model. *Applied Nursing Research,* 17**,** 231-238.

LEEDY, D. P. & ORMROD, J. E. (2005) *Practical Research: Planning and design,* Upper Saddle River, N.J, Pearson/Merrill Prentice Hall.

LEUNG, G. M., JOHNSTON, J. M., TIN, K. Y. K., WONG, I. O. L., HO, L. M., LAM, W. W. T. & LAM, T. H. (2003) Randomised controlled trial of clinical decision support tools to improve learning of evidence based medicine in medical students. *BMJ,* 327**,** 1090.

LI, J. P. & KISHORE, R. (2006) How robust is the UTAUT instrument?: a multigroup invariance analysis in the context of acceptance and use of online community weblog systems. *Proceedings of the 2006 ACM SIGMIS CPR conference on computer personnel research: Forty four years of computer personnel research: achievements, challenges & the future.* Claremont, California, USA, ACM Press.

LIKER, J. K. & SINDI, A. A. (1997) User acceptance of expert systems: A test of the theory of reasoned action. *Journal of Engineering and Technology Management,* 14**,** 147-173.

LIN, A. C. (1998) Bridging positivist and interpretivist approaches to qualitative methods. *Policy Studies Journal,* 26**,** 162-180.

LIN, J. C. & LU, H. (2000) Towards an understanding of the behavioural intention to use a web site. *International Journal of Information Management,* 20**,** 197-208.

LINCOLN, Y. S. & GUBA, E. G. (1985) *Naturalistic Inquiry, Carlifornia*, Sage.

LIPSTEIN, B. (1975) In defence of small samples. *Journal of Advertising Research,* 15**,** 33-40.

LOEHLIN, J. (1992) Latent variable models: An introduction to factor, path, and structural analysis New Jersey, Lawrence Erlbaum.

LU, J., LIU, C., YU, C.-S. & YAO, E. J. (2003a) Exploring factors associated with wireless internet via mobile technology acceptance in mainland China. *Communications of International Information Management,* 3**,** 101-120.

LU, Y.-C., KYUNG LEE, J. J., XIAO, Y., SEARS, A., JACKO, J. A. & CHARTERS, K. (2003b) Why don't physicians use their personal digital assistants? *AMIA Symposium Proceedings***,** 405-409.

LU, Y.-C., XIAO, Y., SEARS, A. & JACKO, J. (2005) A review and a framework of handheld computer adoption in healthcare. *International Journal of Medical Informatics,* 74**,** 409-422.

LUBRIN, E., LAWRENCE, E., ZMIJEWSKA, A., NAVARRO, K. F. & CULJAK, G. (2006) Exploring the benefits of using motes to monitor health: An acceptance survey. *International Conference on Networking, International Conference on Systems and International Conference on Mobile Communications and Learning Technologies (ICNICONSMCL'06)* Mauritius, IEEE Computer Society.

LUCEY, T. (1996) *Quantitative Techniques,* London, DP Publications.

LWANGA, S. K. & LEMESHOW, S. (1991) *Sample size determination in health studies: A practical manual*, Geneva; World Health Organization.

MACCALLUM, R. C. (Ed.) (1995) Model Specification: procedures, strategies and related issues, in structural equation modelling: Concepts, issues, and applications, Thousand Oaks, Sage Publication.

MADDEN, T. J., ELLEN, P. S. & AJZEN, I. (1992) A comparison of the theory of planned behavior and the theory of reasoned action *Personality and Social Psychology Bulletin,* 18**,** 3-9.

MAGEE, A. (2002) Attitude-Behaviour Releationship. http://www.ciadvertising.org//SA/fall_02/adv382j/mageeac/theory.htm.

MAHAJAN, V. & PETERSON, R. A. (1985) *Models for innovation diffusion,* Newbury Park, CA, USA, Sage Publications Inc.

MALHOTRA, N. K., AGARWAL, J. & PETERSON, M. (1996a) Methodological issues in cross-cultural marketing research: a state of the art review. *International Marketing Review*.

MALHOTRA, N. K., HALL, J., SHAW, M. & CRISP, M. (1996b) *Marketing Research: An Applied Orientation*, Sydney, Prentice-Hall.

MANNING, K. (1997) Authenticity in constructivist enquiry: Methodological considerations without prescription. *Qualitative Inquiry,* 3**,** 93-116.

MARSHALL, G. (1994) *The Concise Oxford Dictionary of Sociology. ,* Oxford, UK, Oxford University Press.

MASSEY, A. P., MONTOYA-WEISS, M. M. & O'DRISCOLL, T. M. (2002) Knowledge management in pursuit of performance: Insights from Nortel networks. *MIS Quaterly*, 26**,** 269-289.

MATHIESON, K. (1991) Predicting user intentions: Comparing the Technology Acceptance Model with the Theory Of Planned Behavior. *Information Systems Research*, 2**,** 173-191.

MATHIESON, K., PEACOCK, E. & CHIN, W. W. (2001) Extending the technology acceptance model: the influence of perceived user resources. *SIGMIS Database*, 32**,** 86-112.

MAY, C., GASKA, L., ATKINSON, T., ELLIS, N., FRANCES., M. & ESMAIL, A. (2001) Resisting and promoting new technologies in clinical Practice: The case of telepsychiatry. *Social Science and Medicine,* 52**,** 1889-1901.

MAYKUT, P. & MOREHOUSE, R. (1994) Beginning Qualitative Research: A philosophical and practical guide, Washington, Falmer Press.

McALEARNEY, A. S., SCHWEIKHART, S. B. & MEDOW, M. A. (2004) Doctor's experience with handheld computers in clinical practice: qualitative study. *BMJ,* 328.

McDANIEL, J. C. & GATES, R. (1993) *Contemporary Marketing Research*, New York, West Publishing Company.

McDERMOTT, R. & O'DELL, C. (2001) Overcoming cultural barriers to sharing knowledge. *Journal of Knowledge Management,* 5**,** 76-85.

McMURRAY, J. A., PACE, R. W. & SCOTT, D. (2004) *Research: a commonsence approach,* Southbank, Victor, Thomson Learning.

MEYER, A. D. & GOES, J. B. (1988) Organizational assimilation of innovations: a multilevel contextual analysis. *Academy of Management Journal,* 31**,** 897-923.

MINGERS, J. (2001a) Combining IS research methods: Towards a pluralist methodology. *Information Systems REsearch,* 12**,** 240-259.

MINGERS, J. (2001b) Combining IS research methods: Towards a pluralist methodology. *Information Systems Research,* 21**,** 197-222.

MOEZ, L., MOHAMED, K. & WYNNE, W. C. (2004) Factors motivating software piracy: A longitudinal study. *IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT, VOL. 51, NO. 4, NOVEMBER 2004,* 51**,** 411-425.

MOOR, G. & BANBASAT, I. (1991) Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information Systems Research,* 2**,** 192-222.

MOORE, G. C. & BENBASAT, I. (1991) Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information Systems Research,* 2**,** 192-222.

MOORE, G. C. & BENBASAT, I. (1996) Integrating diffusion of innovations and theory of reasoned action models to predict utilization of information technology by end-users. In KAUTZ, K. & PRIES-HEJE, J. (Eds.) *Diffusion and adoption of information technology.* London, Chapman and Hall.

MORAN, W. R. (1986) 'The science of qualitative research'. *Journal of Advertising Research,* 26**,** 16-19.

MORGAN, D. L. & KRUEGER, R. A. (1993) When to use focus groups and why', Successful Focus Groups: Advancing the State of the Art, Thousand Oaks, CA, Sage Publication.

MORGAN, D. L. (1988) *Focus groups as Qualitative Research*, Sage Publications.

MORGAN, D. L. (1996) Focus groups. *Annual Review of Sociology,* 22**,** 129-152.

MORGAN, D. L. (1997) *Focus Groups as Qualitative Research*, Sage Publication, Thousand Oaks.

MORGAN, L. D. (1998) The Focus Group Kit: The Focus Group Guidebook, London, Sage Publications.

MORGAN, L. D. (2007) Paradigms lost and paradigms regained: Methodological implication of combining qalitative and quantitative methods. *Journal of Mixed Methods Research*, 1, 48-76.

MORSE, J. M. (2003) 'Principles of Mixed Methods an Multimethods Research Design' In Tashakkori & C Teddlie (eds), *Handbook of mixed methods: in social & behavioral research.* Thousand Oaks, California, Sage Publications.

MOSELEY, M. (2000) Innovation and rural development: Some lessons from Britain and Western Europe. *Planning Practice and Research,* 15**,** 95-115.

MUNCK, I. M. E. (1979) Model building in comparative education: Application of the LISREL method to cross-national survey data. Almqvist & Wiksell.

MYERS, D. M. (1999) Investigating information systems with ethonographic research *[Electronic Version]*. *Communication of the Association for Information Systems,* 2.

MYERS, R. (1990) Classical and Modern Regression with Applications, MA: Duxbury.

NELSON, D. E., KREPS, G. L., HESSE, B. W., CROYLE, R. T., WILLIS, G. & ARORA, N. K. (2004) The Health Information National Trends Survey (HINTS): Development, Design, and Dissemination. *Journal of Health Communication,* 9**,** 443-460.

NEUMAN, W. L. (1997) Social Research Methods: Qualitative and Quantitative Approaches, Boston, Allyn and Bacon.

NEUMAN, W. L. (2003) Social Research Methods: Qualitative and Quantitative Approach Sydney, Pearson Education Inc.

NEWBOLD, S. K. (2003) New uses for wireless technology. *Nursing Management,* 22**,** 22-32.

NEWMAN, I. & BENZ, C. R. (1998) Qualitative–Quantitative Research Methodology. *Exploring the Interactive Continuum,* Southern Illinois University Press.

NILAKANTA, S. & SCAMELL, R. W. (1990) The Effects if Information Source and Communication Channels on Diffusion of Innovation on a Database Development Environment. *Management Science,* 36**,** 24-40.

NUNNALY, J. (1978) *Psychomrtric Theory,* New York, Mc Graw-Hill.

O'DELL, C. & GRASON, C. J. (1998) If only we knew what we know: Identification and transfer of internal best practices. *California Management Review,* 40**,** 154-174.

OSTLUND, L. E. (1973) Perceived innovation attributes as predictors of innovativeness. *Journal of Consumer Research,* 1**,** 23-29.

PAGANI, M. (2004) Determinanats of adoption of third generation mobile multimedia services. *Journal of Interactive marketing* 18**,** 46-59.

PATERSON, R. A. (1994) Meta-analysis of Cronbach's Alpha. *Journal of Consumer Research,* 21**,** 381-391.

PATTON, A. Q. (1990a) *Qualitative Evaluation and Research Methods,* California, Sage, Newbury Park.

PATTON, M. (2002) *Qualitative Research and Evalustion Methods,* California, Thousand Oaks, Sage Publication.

PAVLOU, P. A. & FYGENSON, M. (2006) Understanding and prediction electronic commerce adoption: An extension of theory of planned behaviour. *MIS Quarterly,* 30**,** 115-144.

PAYNE, J. W. (1976) Task complexity and contingent processing in decision making: An information search and protocol analysis. *Organizational Behavior and Human Performance,* 16**,** 366-387.

PETERSON, R., A. (1994) Meta-analysis of Cronbach's Alpha, *Journal of Consumer Research*, 21, pp. 381-391.

PETERSON, R., A (2000) *Constructing Effective Questionnaire,* Thousand Oakes, Sage Publications.

PLOUFFE, C., R, VANDENBOSCH, M. & HULLAND, J. (2001) Intermediating technologies multi-group adoption: A comparison of consumer and merchant adoption intentions toward a new electronic payment system. *Journal of Product Innovation Management,* 18**,** 65-81.

POLI, R. (2002) Ontological Methodology. *International Journal of Human-Computer Studies,* 56**,** 639-664.

POON, S. & SWATMAN, P. M. C. (1997) Small business use of the Internet. *International Marketing Review,* 14**,** 385-402.

PRESCOTT, M. B. & CONGER, S. A. (1995) Information technology innovations: a classification by IT locus of impact and research approach. *SIGMIS Database,* 26**,** 20-41.

PRESCOTT, P. & SOEKEN, K. (1989) The Potential Uses of Pilot Work *Nursing Research,* 23**,** 60-62.

RAI, A., RAVICHANDRAN, T. & SAMADDAR, S. (1998) How to anticipate the Intenet's global diffusion. *COMMUNICATIONS OF THE ACM,* 41**,** 97-106.

RANDALL, D. M. & GIBSON, A. M. (1991) Ethical decision making in the medical profession: An application of the theory of planned behavior. *Journal of Business Ethics* 10**,** 111-122.

REDMAN, P. (2002) Wait to Invest in Next-Generation Wireless Services. Gartner Research.

REMENYI, D. S. J., WILLIAMS, B., MONEY, A. & SWARTZ, E. (1998) *Doing research in business and management: An introduction to process and method,* London, SAGE Publications.

RICHARDS, C. (2002) Distance Education, on-campus learning, and e-learning convergences: an Australian exploration. *International Journal on E-learning,* 1**,** 30-40.

RIEMENSCHNEIDER, C. K., HARRISON, D. A. & MYKYTYN JR, P. P. (2003) Understanding it adoption decisions in small business: integrating current theories. *Information & Management,* 40**,** 269-275.

RIGLER, E. (1987) Focus on focus groups. *ABA Banking Journal,* 97**,** 96-100.

ROBINSON, L. (2006) Moving beyond adoption: Exploring the determinants of student intention to use technology. *Marketing Education Review,* 16**,** 79-88.

ROETHLISBERGER, F. J. & DICKSON, W. J. (1938) *Management and the Worker,* Cambridge MA, Harvard University Press.

ROGERS, C. R. & SHOEMAKER, F. F. (1971) *Communication of Innovations: a cross-culture approach,* New York, Free Press.

ROGERS, C. R. (1942) Counseling and Psychotherapy. New York, Houghton Mifflin.

ROGERS, C. R. (1962) *Diffusion of Innovations,* New York, The Free Press.

ROGERS, E. M. (1983) *Diffusion of Innovations,* New York, Free Press.

ROGERS, E. M. (1995) *Diffusion of innovations,* New York, Free Press.

ROGERS, E. M. (2003) *Diffusion of innovations,* New York, Free Press.

ROSCOPE, T. J. (1975) *Fundamental Research Statistics for the Behavioral Sciences,* New York, Holt, Rinehart and Winston.

ROTH, D. W. & MEHTA, D. J. (2002) The Rashomon Effect. *Sociological Methods and Research,* 31**,** 131-173.

RUSSELL, D., CALVEY, D. & BANKS, M. (2003) Creating new learning communities: Towards effective e-learning production. *Journal of Workplace Learning,* 15**,** 34-44.

SAGA, V. L. & ZMUD, R. W. (1994) The nature and determinants of IT acceptance, routinization, and infusion. *IFIP Transaction,* A-45**,** 67-86.

SANDRICK, K. (2002) Surgeons pocket PDAs to end paper chase: Part II. *Bulletin of the American College of Surgeons,*, 87**,** 17-21.

SARANTAKOS, S. (2002) *Social Research,* MacMillan Publishers Australia Pty Ltd.

SARKER, S. & WELLS, D. J. (2003) Understanding mobile handheld devices use and adoption. *Communications of the ACM,* 46.

SAUSSER, G. D. (2002) Use of PDAs in health care poses risks and rewards. (Digital Perspectives). *Healthcare Financial Management.*

SAUSSER, G. D. (2003) Thin is in: web-based systems enhance security, clinical quality. *Healthcare Financial Management,* 57**,** 86-88.

SCANNEL, J. G. (1971) Optimal resources for cardiac surgery. *Circulation.***,** 221-236.

SCHAPER, K. L. & PERVAN, P. G. (2004) A model of information and communication technology acceptance and utilisation by occupational therapists. *2004 IFIP International Conference on Decision Support Systems.* Prato, Italy.

SCHAPER, K. L. & PERVAN, P. G. (2007) An Investigation of factors affecting technology acceptance and use decIsions by Australian allied health therapists. *Proceedings of the 40th Hawaii International Conference on Systems Science.* Hawaii, IEEE.

SCHUMACKER, R. E. & LOMAX, R. G. (1996) *A biginner's guide to structural equation modeling*, Mahwah, NJ: Erlbaum.

SCHUMAKER, R. E. & LOMAX, R. E. (2004) *A beginner's guide to structural equation modelling,* Mahwah, NJ, Lawrence Erlbaum Associates.

SCUPOLA, A. (2002) Adoption issues of business-to-business internet commerce in European SMEs. IN SPRAGUE, R. H. (Ed.) *35th Hawaii International Conferences on System Sciences (HICSS 35).* Hawaii, IEEE Computer Society.

SEAMAN, C. (1987) Research Methods: Principles, Practice and Theory for Nursing, Appletonand Lange, Connecticut.

SEKARAN, U. (1992) Research Methods for Business - A Skill Building Approach, John Wiley & Sons Inc.

SEKARAN, U. (2000) Research Methods for Business - A Skill Building Approach, New York, USA, John Wiley & Sons Co.

SEKARAN, U. (2002) *Research methods for business: A skill building approach,* Chichester, New York, John Wiley & Sons Incorporated.

SEKARAN, U. (2003) Research Methods for Business, A skill Building Approach, Preis, John Wiley & Son.

SHAH, M. (2001) Grassroots Computing: Palmtops in health care. *The Journal of American Medical Association,* 285**,** 1768 - 1769.

SHANKMAN, P. (1984) The Thick and the Thin: On the Interpretive Theoretical Program of Clifford Geertz. *Current Anthropology* 25**,** 261-280.

SHORT, D., FRISCHER, M. & BASHFORD, J. (2004) Barriers to the adoption of computerised decision support systems in general practice consultations: a qualitative study of GP's perspectives. *International Journal of Medical Informatics,* 73**,** 357-362.

SHROEDER, S. (1999) Wired for business. *Risk Management***,** 12-22.

SIMONIN, B. L. (1999) Ambiguity and the process of knowledge transfer in strategic alliances. *Strategic Management Journal,* 20**,** 595-623.

SIMPSON, R. L. (2003) The patient's point of view -- IT matters. *Nursing Administration Quarterly,* 27**,** 254-256.

SING, J. P. & SMITH, J. A. (2001) TQM and Innovation: An Empirical Examination of their Relationship. *Proceedings of the 5th International and 8th National Research Conference on Quality and Innovation Management.* Melbourne.

SMITH, C. M., ND, R. & CNAA, C. (2004) The new technology continues to Invade Healthcare: what are the strategic Implications/outcomes. *Nurse Admin Q, Lippincott Williams & Wilkins Inc,* 28**,** 92-98.

SMITHLINE, N. (2002) Handhelds, the holy grail of health care? *Proceedings of the Annual HIMSS Conference.*

SPARKS, K., FARAGHER, B. & COOPER, C. L. (2001) Well-Being and Occupational Health in the 21st Century Workplace. *Journal of Occupational and Organisational Psychology,* 74**,** 481-510.

SPIGEL, S. (2004) Information Technology and Medical Error reduction. An Internet reply to an enquiry. At http://www.cga.ct.gov/2004/rpt/2004-R-0125.htm.

SPIL, T. A. M. (2006a) User acceptance and diffusion of innovations summarized. In SPIL, T. A. M. & SCHURING, R. W. (Eds.) *E-health systems diffusion and use: The innovation, the user and the USE IT model.* Hershey, PA, USA, Idea Group Inc.

STANDING, C. & BENSON, S. (2000) Knowledge Mangement in a competative environment. In CARLSSON, S. A., BREZILLON, P., HUMPHREYS, P., LUNDBERG, B. G., MCCOSH, A. M. & RAJKOVIC, V. (Eds.) *Decision Support Through Knowledge Management.*

STEENKAMP, E. M. & BAUMGARTNER, H. (2000) On the use of structural equation models for marketing modeling. *International Journal of Research in Marketing,* 17**,** 195-202.

STEVENS, J. (1986) *Applied Mutlivariate Statistics for the Social Sciences. ,* Hillsdale, New Jersy, Lawrence Erlbaum Associates Publishers.

STEVENSON, S. (2001) Mobile computing places data in the palm of the hand: Devices deliver real-time access to information. *Opthalmology Times,* 26**,** 15-18.

STEWART, D. W. & SHAMDASANI, P. N. (1990) *Focus Groups: Theory and Practice,* Newbury Park, Stage Publications.

STEWART, W. D. & SHAMDASANI, N. P. (1998) Handbook of Applied Social Research Methods ... Focus Group Research: Exploration and Discovery, Sage Publication, Thousand Oaks.

STRAUB, D., W. (1989) Validating instruments in MIS Research. . *MIS Quarterly,* 13**,** 147-169.

STUART, D. & BAWANY, K. (2001) Wireless Services: United Kingdom. Gartner.

SUCCI, J. M. & WALTER, D. Z. (1999) Theory of user Acceptance of information Technologies: An Examination of Healthcare professionals. *Proceedings of the 32nd Hawaii International Conference on System Science.*

SUDMAN, S. & BLAIR, E. (1999) Sampling in the twenty-first century *Journal of the Academy of Marketing Science,* 27**,** 269-277.

SUOMI, R. (2006) Introducing electronic patient records to hospitals: Innovation adoption paths. IN SPIL, T. A. M. & W.SCHURING, R. (Eds.) *E-Health Systems Diffusion and Use: The Innovation, the User and the USE IT Model.* London, Idea Group Publishing.

SWANSON, E. B. (1974) Management Information Systems: Approach and Involment. *Management Sciences,* 21**,** 178-188.

SWENSON, J. D. & GRISWOLS, P. B. (1992) Focus Groups: Method of enquiry/intervention. *Small Group Research,* 23**,** 459-474.

SZAJNA, B. (1996) Empirical Evaluation of the Revised Technology Acceptance Model. *Management Science,* 42**,** 85-92.

SZULANSKI, G. (2003) *Sticky Knowledge,* Sage Publication.

TABACHNICK, B. C. & FIDELL, L. S. (1996) *Using Multivariate Statistics,* Northbridge, California, Harper Collins.

TAN, M. & TEO, T. S. H. (2000) Factors influencing the adoption of Internet banking. *Journal of the Association for Information Systems,* 1.

TARASEWICH, P., NICKERSON, R. & WARKENTIN, M. (2002) Issues in mobile e-commerce. *Communications of the Association for Information Systems,* 8**,** 41-64.

TASHAKKORI, A. & TEDDLIE, C. (1998b) *Mixed Methodology: Combining Qualitative and Quantitative Approaches,* 2455 Teller Road, Thousand Oaks, California, Sage Publications, Inc.

TAYLOR, S. & TODD, P. (1995a) Assessing IT usage: The role of prior experience. *MIS Quarterly,* 19**,** 561-570.

TAYLOR, S. & TODD, P. A. (1995b) Understanding information technology usage: A test of competing models. *Information Systems Research,* 6**,** 144-176.

THOMPSON, R. L., HIGGINS, C. A. & HOWELL, J. M. (1991) Personal computing: Toward a conceptual model of utilization. *MIS Quarterly,* 15**,** 125-143.

THOMPSON, W. B. (2005) The transforming effect of handheld computers on nursing practice. *Nurse Admin Q, Lippincott Williams & Wilkins Inc,* 29**,** 308-314.

TOMS, G. E. (2000) Understanding and facilitating the browsing of electronic text. *International Journal of Human-Computer Studies,* 52**,** 423-452.

TORMATZKY, L. G. & FLEISCHER, M. (1990) *The Process of Technological Innovations,* MA: Lexington Books.

TRAUTH, E. M. (1997) Achieving the research goal with qualitative methods: lessons learned along the way., London, Chapman & Hall.

TRIANDIS, H.C. (1980) *Values, attitudes, and interpersonal behavior*, Nebraska Symposium on Motivation, 27:195-259.

TSEKOURAS, G. & GRANTHAM, A. (2005) Diffusing wireless applications in a mobile world. . *Technol Soc,* 27**,** 85 - 104.

TSENG, P. T. Y. & HEUI-HUANG, C. (2007) Creating a new wireless business model of healthcare: The WiMAX Project in Hualien, Taiwan. IN HEUI-HUANG, C. (Ed.) *Mobile WiMAX Symposium, 2007. IEEE.*

TURISCO, F. (2000) Mobile computing is next technology frontier for health providers. *Healthcare Financial Management,* 54**,** 78 - 82.

VALLERAND, R., J (1997) Toward a hierarchical Model of Intrinsic and Extrinsic Motivation, in Advancees in Experimental Social Psychology. *Academic Press.* New York.

VAN DE VEN, A. H., ANGLE, H. L. & POOLE, M. S. (Eds.) (1989) *Research on the Management of Innovation: The Minnesota Studies,* New York, Ballinger Division, Harper & Rowe.

VAN DINTER, M. (2002) Personal Digital Assistants for the nurse practitioner. *Journal of Pediatric Health Care,* 16**,** 317-320.

VAUS, D. A. (2002) *Surveys in social research,* , Crows Nest, NSW., Allen & Unwin.

VENKATESH, V. & BROWN, S. A. (2001) A longitudinal investigation of personal computers in homes: Adoption determinants and emerging challenges. *MIS Quarterly,* 25**,** 71-102.

VENKATESH, V. & DAVIS, D. F. (1996) A model of antecedents of perceived ease of use: development and test. *Decision Science,* 27**,** 451-481.

VENKATESH, V. & DAVIS, D. F. (2000) A theoritical extension of the technology acceptance model: Four longitudinal field studies. *Management Science,* 2**,** 186-204.

VENKATESH, V. (1999) Creating Favorable User Perceptions: Exploring the Role of Intrinsic Motivation. *MIS Quarterly,* 23**,** 239-260.

VENKATESH, V., MORRIS, G. M., DAVIS, B. G. & DAVIS, D. F. (2003a) User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly,* 27**,** 425-478.

VICHAS, R. P. (1983) 11 ways focus groups produce profit making ideas. *Marketing Times,* 30**,** 17-18.

WALSHAM, G. (1993) Interpreting Information Systems in Organizations, England, Wiley.

WEJNERT, B. (2002) Integrating models of diffusion of innovations: A conceptual framework. *Annual Review of Sociology,* 28**,** 297-326.

WHANG, J., LEE, J., KANG, S. & LEE, S. (2004) An Empirical Study of Accepting Mobile Devices Using TAM.

WILCOX, R. A. & WHITHAM, E. M. (2003) Reduction of medical error at the point-of-care using electronic clinical information delivery. *Internal Medicine Journal,* 33**,** 537-540.

WILLIAMS, B. (2001) Handheld computers making the rounds with physicians. Devices put medical know-how – literally – in the palm of your hand. *Tenn Med*. 94(2): 30-31.

WISNICKI, H. J. (2002a) Wireless networking transforms healthcare: Physician's practices better able to handle workflow, increase productivity (The human connection). *Ophthalmology Times,* 27**,** 38 - 41.

WU, J.-H., SHEN, W.-S., LIN, L.-M., GREENES, R. A. & BATES, D. W. (2008) Testing the technology acceptance model for evaluating healthcare professionals' intention to use an adverse event reporting system. *International Journal for Quality in Health Care,* 20**,** 123-129.

WYNEKOOP, J. L., SENN, J. A. & CONGER, S. A. (1992) The implimentation of CASE Tools: An innovation diffusion approach. *Elsevier Inc.*

YACANO, F. (2002) Monitoring air quality: Handhelds and wireless tools from efficient links. *R & D,* 44**,** 42 - 46.

YAMPEL, T. & ESKENAZI, S. (2001) New GUI tools reduce time to migrate healthcare applications to wireless. *Healthcare Review,* 14**,** 15-16.

YING, A. (2003) Mobile physician order entry. *Journal of Healthcare Information Management,* 17**,** 58-63.

YU, P. & COMENSOLI, N. (2004) An exploration of the barriers to the adoption of information technology in Australian aged care industry. *Proceeding of the Health Informatics Conference 2004.*

ZELLER, R. A. (1993) Combining Quantittative and Qualitative Techniques to Develop Culturally Sensitive Measure, New York, Plenum.

ZIKMUND, W. (1984) *Business Research Methods,* New York, Dryden Press.

ZIKMUND, W. (1988) *Business Research Methods,* New York, The Dryden Press.

ZIKMUND, W. (1994) *Business Research Methods,* Orlando, FL, The Dryden Press.

ZIKMUND, W. (1997) *Business Research Methods,* Fort Worth, Dryden.

ZIKMUND, W. (2002) *Business Research Methods (with WebSurveyor Certificate and InfoTrac),* Cincinnati, Ohio, Thomson Learning/South-Western College Publication.

ZIKMUND, W. (2003) *Business Research Methods,* Australia, Thomson.

Appendices to this thesis

Appendix 1

Sample of request letter for invitation to participate in focus group sessions

Request for Focus Group Participants, Nurses/Healthcare staff

Topic

Adoption of Wireless Technology in healthcare for data management in the Australian healthcare

Hi There,

My name is Abdul Hafeez-Baig and I am PhD student at the University of Southern Queensland. I am perusing research in the area of *wireless devices and their adoptability and usability in the healthcare industry. My PhD topic is to understand the determinants for the adoption of wireless technology for data management in the Australian Healthcare industry.* In this regard I will be seeking your help to collect some first hand data. Your time and help in this regard is highly appreciated.

This research will study the drivers and inhibitors of wireless portable devices for data management in the Australian health care systems. The project is significant because it will not only help the health care provider to provide high quality of care, but it will also improve staff workload, reductions in error, better communications, high job satisfactions, reduction in coast, and better quality of services.

The research will also help to provide direction regarding the adoption of wireless technology/applications for better management and uses of patient data. The tertiary sector will benefit from a better understanding of adoption model for healthcare sector and this can be better informed to students. This research will also help vendors in development of wireless technology/applications. This study may identify a potential need for new innovative training approaches to address barriers identified for the successful adoptions of other technologies in the healthcare environment.

Your co-operation will be very helpful and information provided by you would be very relevant and valuable. If you have any questions about this project please feel free to contact either myself on 07 4631 1461 or my supervisor Associate Professor Raj Gururajan on (07) 4631 1834. We are happy to discuss with you any concerns you may have on how this study has been conducted.

PARTICIPANTS THAT CAN BE INVOLVED IN THIS STUDY:
Healthcare professionals, paramedical staff, Academic participants from the private and public healthcare facility in Australia are required for this study. Participants need to have had some exposure to PDA, to using ICT tools (Smart phones, Handheld PCs) exposure for data management, patient information, and administrative work.

We are conducting a focus group for paramedical staff (at least 5 to 8 participants) for the above research and your help is highly appreciated.

Light lunch/Refreshments will be provided

If you are interested in participating, please let me know via email on abdulhb@usq.edu.au or phone on 04 1112 1485 / 4631 1461.

Kind regards and thank you
Abdul Hafeez-Baig

Appendix 2

Focus group participants consent letter

Adoption of Wireless Technology in Healthcare for Data Management in the Australian Healthcare

Hi There,

My name is Abdul Hafeez-Baig and I am PhD student at the University of Southern Queensland. I am perusing research in the area of *wireless devices and their adoptability and usability in the healthcare industry. My PhD topic is to understand the determinants for the adoption of wireless technology for data management in the Australian Healthcare industry*. In this regard I will be seeking your help to collect some first hand data. Your time and help in this regard is highly appreciated.

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Your co-operation will be very helpful and information provided by you would be very relevant and valuable. If you have any questions about this project please feel free to contact either myself on 4631 1461/0411121485 or my supervisor Associate Professor Raj Gururajan on 4631 1834. We are happy to discuss with you any concerns you may have on how this study has been conducted.

PARTICIPANTS THAT CAN BE INVOLVED IN THIS STUDY:
Healthcare professionals, paramedical staff, Academic participants from the private and public healthcare facility in Australia are required for this study. Participants need to have had some exposure to PDA, to using ICT tools (Smart phones, Handheld PCs) exposure for data management, patient information, and administrative work.

Kind regards and thank you
Abdul Hafeez-Baig

A participant's signature indicates that they have agreed and read, or listened to, the information provided and that they have received answers to their questions. The signature also indicates that they have freely decided to participate in this research and that they can discontinue their participation at any time.

Participant Name	**Participant Signature**	**Date**

If you are interested in participating, please let me know via email on abdulhb@usq.edu.au or phone on 04 1112 1485 / 4631 1461.

Appendix 3

Sample of instrument use to collect initial demographics information about focus group participants

Adoption of Wireless Technology in Healthcare in the Australian Healthcare

Pre-Focus Group Questions (Demographic Information)

1. What type of organization is this? (Please tick ONLY one)

Private Hospital ☐ Public Hospital ☐ Nursing Home ☐ University ☐

Others (Please Specify) ....

2. Gender: Male ☐ Female ☐

3. Which of these role best describe your profession? (Please tick ONLY one)

Staff/General Duty ☐ Clinical Nurse Specialist ☐ Office Nurse ☐
Certified Registered Nurse ☐ Nurse Administrator ☐ Certified Nurse Midwife ☐
Nurse Manager/Head Nurse ☐ Certified Nurse Aide ☐ Nurse Consultant ☐
Nurse Practitioner ☐ Nurse Educator ☐ Others____________________

4. How long have you been working in the healthcare field? (Please tick ONLY one)

Less than 2 years ☐ 3-10 years ☐ More than 10 years ☐

6. What is your age group? (Please tick one)

Less Than 25 ☐ 25-29 ☐ 30-35 ☐ 36-40 ☐ More Than 40 ☐

7. Highest Education Completed (Please tick one)

Less than High School Diploma ☐ High School Diploma ☐ Associate Degree ☐

Bachelor's Degree ☐ Postgraduate Degree ☐ Others (Please Specify) ....

Primary Clinical Focus (Please tick ONLY one)

Oncology	AIDS	Critical Care	Drug/Alcohol	Health
Others	Paediatrics	Public Health	Treatment	Geriatrics
General Practice	Cardiac Care	Dialysis	Neurology	Rehabilitation
Orthopaedic	Mental Health	Neonatal	Emergency Care	Medical –
Family Health	Public	Transplants	Occupational	Surgical
	Community		Health	Other

9. I would be able to explain what a wireless technology is

Yes ☐ No ☐

10. Do you have any experience using wireless technology in a healthcare environment?

Yes ☐ No ☐

11. Do you see potential use of wireless technology in healthcare?

Yes ☐ No ☐

Appendix 4

Sample of possible focus group questions

Adoption of Wireless Technology in Healthcare for Data Management in the Australian Healthcare

WIRELESS TECHNOLOGY AND NURSES/GENERAL STAFF

1. Tasks can be performed by wireless technology **Vs** health records/patient information
2. Usage/attitude **Vs** advantages and disadvantages for using the wireless technology/applications for data management/patient records
3. Role of wireless technology/applications **Vs** time management, workflow process, demographics, and workload
4. Productivity, performance, clinical practices, demographic, and efficiency with the use of wireless technology/applications for data management
5. Features/motivators/drivers for the adoption of wireless technology/applications
6. Problems/hinderers/inhibitors for the adoption of wireless technology/applications

Concluding Question

1. Analysis of current situation

   wireless devices/application Vs status/infrastructure of health organization

For example,

Organizational readiness

Technical readiness

Clinical Practices

Compatibility

Demographics

Appendix 5

Sample of pre survey brief information about the project provided to healthcare professionals

The Determinants for the Successful Adoption of Wireless Technology in the Australian Healthcare Systems

AIM:

There is no specific or confined model for the adoption of wireless technology in the Australian healthcare environment. The study is to investigate the

- Role of wireless technology/applications, Information Communication Technologies (ICT) tools such as such as PDA, Smart telephone, Hand held PCs tools to facilitate data management in Australian healthcare facility

- To identify the determinants for the adoption of wireless technology/applications in a health care environment.

RESEARCH QUESTIONS:

Research Question-1:	What are the drivers and inhibitors of wireless technology in the Australian Healthcare Systems?
Research Question-2:	To what extent do these drivers and inhibitors affect the adoption of wireless technology for their intention to use wireless technology in the Australian Healthcare setting?

PARTICIPANTS:

Healthcare professionals, paramedical staff, Academic participants from the private and public healthcare facility in Australia are required for this study. Participants need to have had some exposure to PDA, to using ICT tools (Smart phones, Handheld PCs) exposure to wireless technology, in the context of healthcare setting.

NATURE OF THE DATA GATHERING:

The questionnaire is designed to discover aspects related to the usage of wireless technology in a healthcare environment by gathering opinions and views. Demographic information such as age, gender, qualifications and discipline are required to facilitate an understanding on how the above information has an impact on factors such as motivation and whether work discipline has any influence on the usage of wireless technology. The data collected will be analysed to identify these results. No individual or their opinion will be identified in this study. The outcome of the study will reflect the collective opinions of the participants. This questionnaire is considered as an **anonymous questionnaire. Please ensure that you do not write your name or any other comments on the questionnaire that will make you identifiable.**

DURATION:

Participants will need to spend approximately 10 minutes to fill out the questionnaire. Participants should not experience any discomfort or potential risks by participating in this study. **By completing the questionnaire you are consenting to take part in this research**.

BENEFITS OF THE STUDY

The research outcomes from this study will provide direction regarding the usage of wireless technology (ICT tools) and determinants that need to be harnessed for improved usage of wireless technology in healthcare environment. The healthcare sector will benefit from a better understanding of wireless technology in healthcare environment to improve the quality of care. This study will develop an adoption framework specific to healthcare environment for wireless technology.

Any questions concerning this study can be directed to

Abdul Hafeez-Baig, on 0411 121485 or by e-mail at abdulhb@usq.edu.au

Thank you very much for your co-operation

Appendix 6

Sample of pre survey letter provided to participants as an invitation to participate

Dear Sir/Madam

I taken the opportunity to send you these information regarding the possibility of collecting data from a survey questionnaire. Below is the brief outline of my research project, please feel free to distribute this request as you may see appropriate.

Brief outline about myself and survey:

My name is Abdul Hafeez-Baig and I am a lecturer and a PhD student at the University of Southern Queensland (USQ). I am conducting research in the area of wireless technology and their adoptability and usability in the healthcare environment. My PhD topic is to understand the determinants for the adoption of wireless technology in the Australian Healthcare system.

In this regard, I am seeking your help to collect some first hand data/information at your institution/healthcare facility. Your time and help in this regard is greatly appreciated. I would like to collect the views of the participants through a survey instrument. This study will help to provide a focus for the development of determinants for the use of wireless technology in healthcare setting. No data from the study will be published or disclosed in a way which could allow the identification of an individual/organization. Also, the maintenance of confidentiality of research data will have my highest priority. This study has already received ethics approval from the USQ ethical committee and Toowoomba Health Service District.

AIM: The aim of the study is to identify the determinants of adoption of wireless technology/applications in Australian healthcare environment.

Participants: Healthcare professionals such as doctors, nurses, technicians & administrative staff from private & public healthcare facilities in Australia are expected to participate. Participants need to have some exposure to PDA; wireless technology, and ICT tools (Pager, Smart phones, handheld PCs & other wireless handheld devices).

Duration: Approximately 5-10 minutes to fill out the questionnaire

Contribution: Results of the study will provide knowledge for adoption of wireless technology in a healthcare environment and contribute to improved efficiency and quality of care in the Australian healthcare system. Furthermore, it will provide direction for the adoption of wireless technology in a healthcare environment

The questionnaire is completely anonymous and you can discontinue your involvement at any time. By completing the questionnaire, you are consenting to take part in this research. If you have any questions about this project please feel free to contact either myself on 07 4631 1461 or my supervisor Associate Professor Raj Gururajan on (07) 4631 1834. We are happy to discuss with you any concerns you may have on how this study is being conducted.

I understand healthcare professionals are busy important individuals of our community. It would be greatly appreciated if you could help me to distribute the survey questionnaire. One suggestion I have in my mind is to distribute the survey through supervisors/manager in various hospital wards or at various forums/meetings, or you may have different strategy. **Please feel free to distribute this request as you may see appropriate.** (THANK YOU)

Thank you for your assistance and looking forward to hearing from you soon.

Kind regards

Abdul Hafeez-Baig
PhD student, USQ Toowoomba, Australia

Appendix 7

Sample of copy of instrument to check participants' views about their experiences of filling the pilot survey instrument

PILOT TEST QUESTIONNAIRE

The purpose of the questionnaire is to collect feedback on the questions that will be used in the following study:

TOPIC OF THE STUDY
Determinants of the Successful Adoption of Wireless Technology in the Australian Healthcare

Please read each statement carefully, and then tick the appropriate box	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Not Sure
1. Were 20 minutes sufficient to fill the questionnaire?	☐	☐	☐	☐	☐	☐
2. Was the survey questionnaire easy to read?	☐	☐	☐	☐	☐	☐
3. Did the questions flow naturally?	☐	☐	☐	☐	☐	☐
4. Were you able to understand the terminology used in the questionnaire?	☐	☐	☐	☐	☐	☐
5. Did you feel comfortable filling in the questionnaire?	☐	☐	☐	☐	☐	☐
6. Did completing the questionnaire make you think more deeply about the topic of the study?	☐	☐	☐	☐	☐	☐
7. Did the flow of questions in the questionnaire was acceptable?	☐	☐	☐	☐	☐	☐
8. Were you able to understand the questions?	☐	☐	☐	☐	☐	☐
9. Do you think the questionnaire will effectively measure user response?	☐	☐	☐	☐	☐	☐
10. Were there any ambiguous questions?	☐	☐	☐	☐	☐	☐
11. Did completing the questionnaire put you under any stress?	☐	☐	☐	☐	☐	☐

Other Comments and/or Suggestions for Change to the Questionnaire:

____

____

____

____

____

____

Appendix 8

Sample of copy of survey instrument used for the pilot study

SURVEY FORM FOR
Determinants of the Successful Adoption of Wireless Technology in Australian Healthcare Institutions

AIM: The aim of the study is to identify the determinants of adoption of wireless technology/applications in the Australian healthcare institutions.

PARTICIPANTS: Healthcare professionals such as physicians, nurses, technician's & administrative staff from private and public healthcare facilities in Australia are required to participate in this study. Participants need to have had some exposure to PDA; ICT tools (Smart phones, handheld PCs, & other wireless handheld devices.

DURATION: Approximately 20 minutes to fill out the questionnaire. **By completing the questionnaire you are consenting to take part in this research.**

CONTRIBUTION: Will provide knowledge for adoption of wireless technology in a healthcare environment & contribution to improve efficiency & quality of care.

We thank you for your valuable time & effort. If you would like to receive a copy of the findings or any publications from this study, please send your details to: Associate Professor. Raj Gururajan, or Abdul Hafeez-Baig, on email: gururajan@usq.edu.au, or abdulhb@usq.edu.au

SA=Strongly Agree, A=Agreed, N=Neutral, D=Disagree, SD=Strongly Agree, NS=Not Sure	SA	A	N	D	SD	NS
1. Availability of financial resources will encourage me to uses the wireless handheld devices	☐	☐	☐	☐	☐	☐
2. Knowledge & availability of resources will push me to use wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
3. Organizational non financial support is critical for wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
4. Clarity in standards and procedures will encourage me to use the wireless handheld devices	☐	☐	☐	☐	☐	☐
5. Clinical impact will effect the adoption of wireless handheld devices in my job environment	☐	☐	☐	☐	☐	☐
6. Compatibility issues have an effect on adoption of wireless handheld devices in my job environment.	☐	☐	☐	☐	☐	☐
7. Organizational support will determine my use of wireless handheld devices	☐	☐	☐	☐	☐	☐
8. Training is crucial for the adoption of wireless handheld devices in healthcare environment.	☐	☐	☐	☐	☐	☐
9. Lack of management commitment can effect introduction of wireless handheld devices in healthcare	☐	☐	☐	☐	☐	☐
10. Leadership role is crucial for the adoption of wireless handheld devices in health care environment	☐	☐	☐	☐	☐	☐
11. For the introduction of wireless handheld devices, support for appropriate culture is very important	☐	☐	☐	☐	☐	☐
12. Without strategic direction the introduction of wireless handheld devices will fail	☐	☐	☐	☐	☐	☐
13. Quality of wireless handheld devices will determine my ability to use these devices	☐	☐	☐	☐	☐	☐
14. Healthcare applications & input style will encourage me to use the wireless handheld in my job	☐	☐	☐	☐	☐	☐
15. Compatible devices with similar features will encourage use of wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
16. Feature like, size, weight, & dimensions will encourage use of wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
17. Availability of local support will help me to use the wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
18. My interest in technology will help me to use the wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
19. Individual attitude toward technology can effect introduction of wireless handheld devices at my job	☐	☐	☐	☐	☐	☐
20. My ability to input & retrieve information will effect the use the wireless devices in my job	☐	☐	☐	☐	☐	☐
21. Availability of helpful infrastructure will encourage me to use wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
22. In my job connectivity/accessibility is very critical for the use of wireless handheld devices	☐	☐	☐	☐	☐	☐
23. Availability of technical support for 24/7 will determine suitability of wireless handheld in my job	☐	☐	☐	☐	☐	☐
24. Reliability of technical infrastructure for wireless handheld devices is critical in my job	☐	☐	☐	☐	☐	☐
25. Training is important for the introduction of new wireless handheld devices in healthcare	☐	☐	☐	☐	☐	☐
26. Availability of electronic records is key in my job for the introduction of wireless handheld devices	☐	☐	☐	☐	☐	☐
27. Availability of local support is important for me to use wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
28. Support from the colleague is critical to be successful of wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
29. Healthcare environment will effect my decision to adopt the wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
30. External stakeholder can influence the decision to adopt the wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
31. Detailed planning and procedures will encourage me to use wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
32. Structure clarity for use of wireless handheld devices will help me to use these devices in my job	☐	☐	☐	☐	☐	☐
33. Integration of existing IT infrastructure is vital for adoption of wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
34. Integration of existing data base is crucial for the adoption of wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
35. Integration of existing work practices is crucial for use of wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
36. Existing rigidity in work processes will discourage me to use wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
37. Use of wireless handheld devices will improve my performance	☐	☐	☐	☐	☐	☐
38. Use of wireless handheld devices will improve my efficiency	☐	☐	☐	☐	☐	☐
39. Use of wireless handheld devices will improve my productivity	☐	☐	☐	☐	☐	☐
40. Use of wireless handheld devices will improve my routine tasks	☐	☐	☐	☐	☐	☐
41. Use of wireless handheld devices will lead to cost reduction in my job	☐	☐	☐	☐	☐	☐
42. Use of wireless handheld devices will lead to time saving in my job	☐	☐	☐	☐	☐	☐
43. Use of wireless handheld devices will save effort in my job	☐	☐	☐	☐	☐	☐
44. Use of wireless handheld devices will lead to reduced inaccuracies in my job	☐	☐	☐	☐	☐	☐
45. Use of wireless handheld devices will improve patient care in my job	☐	☐	☐	☐	☐	☐
46. Use of wireless handheld devices will help to reduce work pressure in my job	☐	☐	☐	☐	☐	☐
47. Use of wireless handheld devices will provide me real time access to information I need in my job	☐	☐	☐	☐	☐	☐
48. Use of wireless handheld devices will lead to reduction in transcription errors in my job	☐	☐	☐	☐	☐	☐
49. I will able to make an easy transaction to wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
50. Security is a not major concern for using wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
51. Perceptual constraints are major concern in my job for use of wireless handheld devices	☐	☐	☐	☐	☐	☐
52. Usage of Wireless handheld devices in my job is essential	☐	☐	☐	☐	☐	☐
53. Flexibility in wireless handheld devices will offer flexibility in my job	☐	☐	☐	☐	☐	☐
54. Ability to customize wireless handheld devices will be beneficial to my job	☐	☐	☐	☐	☐	☐
55. Physical feature of wireless handheld devices will provide benefits in my job	☐	☐	☐	☐	☐	☐
56. Wireless handheld devices features such as size, weight, and colure will impact my job environment	☐	☐	☐	☐	☐	☐
57. Mobility of wireless handheld devices is suitable for my job	☐	☐	☐	☐	☐	☐
58. Easy data entry feature of wireless handheld devices are crucial to my job	☐	☐	☐	☐	☐	☐

SA=Strongly Agree, A=Agreed, N=Neutral, D=Disagree, SD=Strongly Agree, NS=Not Sure	SA	A	N	D	SD	NS
59. Ability of wireless handheld devices to transmit information at high speed is essential in my job	☐	☐	☐	☐	☐	☐
60. I feel very comfortable with using wireless handheld devices in my job environment	☐	☐	☐	☐	☐	☐
61. I believe wireless handheld devices will help to reduce the workload in my job	☐	☐	☐	☐	☐	☐
62. I believe I will be able to save time in my job with the use of wireless handheld devices	☐	☐	☐	☐	☐	☐
63. I believe my productivity will improve with the use of wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
64. I believe I will be efficient in my job with the help of wireless handheld devices	☐	☐	☐	☐	☐	☐
65. I believe quality of care can improve with wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
66. I believe quality of information through the use wireless handheld devices will improve in my job	☐	☐	☐	☐	☐	☐
67. I believe the use of wireless handheld devices will improve the image of the healthcare facility	☐	☐	☐	☐	☐	☐
68. I believe wireless handheld devices will provide higher level of job satisfaction in my job	☐	☐	☐	☐	☐	☐
69. I am confident wireless handheld devices will improve workflow in my job	☐	☐	☐	☐	☐	☐
70. I am confident wireless handheld devices can reduce overall error in my job	☐	☐	☐	☐	☐	☐
71. I am confident wireless handheld devices will improve the communication process in my current job	☐	☐	☐	☐	☐	☐
72. I am confident use of wireless handheld devices will provide easy access to information in my job	☐	☐	☐	☐	☐	☐
73. Evidence based practices is vital for wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
74. Wireless handheld devices will help to resolve the work load issues in my job	☐	☐	☐	☐	☐	☐
75. Wireless handheld devices will help me to improve the quality of care in my job	☐	☐	☐	☐	☐	☐
76. Existing processes need to be changed in order to use wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
77. Wireless handheld devices will help to improve time management in my job	☐	☐	☐	☐	☐	☐
78. Wireless handheld devices will help to improve patient care management in my job	☐	☐	☐	☐	☐	☐
79. Wireless handheld devices will be suitable for error reduction in my job	☐	☐	☐	☐	☐	☐
80. Availability of medical records on wireless handheld devices is critical in my job	☐	☐	☐	☐	☐	☐
81. Wireless handheld devices will help to improve the report management systems in my job	☐	☐	☐	☐	☐	☐
82. Real time connectivity of wireless handheld devices is important for communication in my job	☐	☐	☐	☐	☐	☐
83. Wireless handheld devices will help for clinical communication in my job	☐	☐	☐	☐	☐	☐
84. Wireless handheld devices will enhance the general communications in my job	☐	☐	☐	☐	☐	☐
85. Wireless handheld devices will help me in better learning about my job	☐	☐	☐	☐	☐	☐
86. Values at my working environment will effect the adoption of wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
87. Local politics in my working environment will discourage the wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
88. Organizational culture will have positive effect on wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
89. Organizational politics will have positive effect on wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
90. My behavior towards technology will have positive effect on wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
91. Social values will be critical for wireless handheld devices in my job environment	☐	☐	☐	☐	☐	☐
92. Influence form our competitor will determine the social influence in my job environment	☐	☐	☐	☐	☐	☐
93. Patient expectation will influence the wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
94. Suitability of demographic characteristics are vital for wireless handheld devices in healthcare	☐	☐	☐	☐	☐	☐
95. Wireless handheld devices are only suitable for unique activity	☐	☐	☐	☐	☐	☐
96. Suitability of working environment is important for wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
97. Suitability of clinical processes is critical for wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
98. Wireless handheld devices will help me in learning in my job	☐	☐	☐	☐	☐	☐
99. It is important that wireless handheld devices improve my job performance	☐	☐	☐	☐	☐	☐
100. It is important that wireless handheld devices make my existing job easy and comfortable	☐	☐	☐	☐	☐	☐
101. Mobility provided by wireless handheld devices is relevant in my job	☐	☐	☐	☐	☐	☐
102. Flexibility offered by wireless handheld devices will provide added value to my current job	☐	☐	☐	☐	☐	☐
103. Wireless handheld devices will save time in my job	☐	☐	☐	☐	☐	☐
104. Wireless handheld devices will provide real time access to information required to do my job	☐	☐	☐	☐	☐	☐
105. The portability of wireless handheld devices will provide benefits to my job	☐	☐	☐	☐	☐	☐
106. Direct communication through wireless handheld devices will provide added benefit in my job	☐	☐	☐	☐	☐	☐
107. Wireless handheld device will help to improve patient expectation in my job	☐	☐	☐	☐	☐	☐
108. I believe peer group attitude will influence me to use wireless handheld devices in my job	☐	☐	☐	☐	☐	☐
109. Overall use of wireless handheld devices will provide added value to my job	☐	☐	☐	☐	☐	☐
110. I believe healthcare environment will benefit from the use of wireless handheld devices	☐	☐	☐	☐	☐	☐
111. Reliability of wireless handheld devices is crucial in my job	☐	☐	☐	☐	☐	☐
112. Availability of clear standards for wireless handheld devices is important in my job	☐	☐	☐	☐	☐	☐
113. Standardization of wireless handheld devices is vital in my job environment	☐	☐	☐	☐	☐	☐
114. Compatibility of existing technology with the wireless handheld device is critical in my job	☐	☐	☐	☐	☐	☐
115. Existing clinical processes need to be compatible in my job for wireless handheld devices	☐	☐	☐	☐	☐	☐
116. Access to clinical data on wireless handheld devices is vital in my job	☐	☐	☐	☐	☐	☐
117. Clinical methods need to be modify in my job for wireless handheld devices	☐	☐	☐	☐	☐	☐
118. Availability of right wireless application is critical for wireless handheld device	☐	☐	☐	☐	☐	☐
119. Integration of existing work practices is integral in my job for wireless handheld devices	☐	☐	☐	☐	☐	☐
120. Integration of existing work style need to be modified in my job for wireless handheld devices	☐	☐	☐	☐	☐	☐
121. Inter-compatibility with other working processing is critical for wireless handheld devices	☐	☐	☐	☐	☐	☐
122. Existing processes need to be changed for integration into the wireless handheld devices	☐	☐	☐	☐	☐	☐

What type of organisation is this? ☐ Public Hospital ☐ Private Hospital ☐ Others

Gender: ☐ Male ☐ Female | What is your age group? ☐ Less Than 20 ☐ 21-25 ☐ 26-30 ☐ 31-35 ☐ 35-40 ☐ 41-45 ☐ > 45

Which of these roles best describe your position? ☐ Physician ☐ Nurses ☐ Technicians ☐ Admin ☐ Others

Highest Education Completed: ☐ PhD or MBBS ☐ Master's ☐ Bachelor ☐ Diploma/Certificate ☐ Other ________________

Appendix 9

Sample of copy of survey instrument used for the wider community

INSTRUCTIONS FOR COMPLETING THE SURVEY FORM

Determinants for Successful Adoption of Wireless Technology in Australian Healthcare

Dear All

My name is Abdul Hafeez-Baig and I am a lecturer and PhD student at the University of Southern Queensland (USQ). I am conducting research in the area of wireless handheld technology (WHT) devices and their adoptability and usability in the healthcare industry. My PhD topic is to understand the determinants for the adoption of wireless technology for data management in the Australian Healthcare system. My principal supervisor is Associate Professor Raj Gururajan. I would appreciate your time and effort in completing this survey. Brief information/instructions about the study are outlined below:

> This questionnaire asks for your opinion, attitudes and perceptions about adoption of wireless handheld devices in the healthcare environment. It should take approximately 5-10 minutes to complete this questionnaire. **The questionnaire is completely anonymous and you can discontinue your involvement at any time.**

Contribution: Results of the study will provide knowledge for adoption of wireless technology in a healthcare environment and contribute to improved efficiency and quality of care in the Australian healthcare system. Furthermore, it will provide direction for the adoption of WHT in a healthcare environment.

Images obtain from google.com

Administration of the survey

Hard copy option: paper copy of the survey will be distributed by post, with reply paid self-addressed envelope and through personal visits by myself to healthcare facilities and conferences.

Online option: The survey instrument is also available through a website and can be completed online through the following website https://usqsurvey.usq.edu.au/~wireless_tech_health

We thank you for your valuable time & effort. If you would like to receive a copy of any publications that arise from this data collection exercise, please send your details to: Associate Professor Raj Gururajan, or Abdul Hafeez-Baig, School of Information Systems, University of Southern Queensland, Toowoomba, QLD 4350, or Email: gururaja@usq.edu.au & abdulhb@usq.edu.au

PLEASE COMPLETE THE SURVEY ON THE OTHER SIDE OF THE PAGE AND POST IT BACK IN THE REPLY PAID SELF ADDRESSED ENVELOPE PROVIDED, THANK YOU

SURVEY FORM FOR
Determinants of the Successful Adoption of Wireless Technology in Australian Healthcare

SA=Strongly Agree, A=Agree, N=Neutral, D=Disagree, SD=Strongly Disagree	SA	A	N	D	SD
1. Technology awareness will help in using **wireless handheld technology (WHT)**	☐	☐	☐	☐	☐
2. Availability local support will help the use of **WHT**	☐	☐	☐	☐	☐
3. Ability to access technical people will influence the use of **WHT**	☐	☐	☐	☐	☐
4. Easy interfaces will encourage the use **WHT**	☐	☐	☐	☐	☐
5. Size, weight and compactness will encourage the use of **WHT**	☐	☐	☐	☐	☐
6. Connectivity will influence the use of **WHT**	☐	☐	☐	☐	☐
7. Reliability of technical infrastructure is important for **WHT**	☐	☐	☐	☐	☐
8. Electronic records is key for introduction of **wireless handheld technology (WHT)**	☐	☐	☐	☐	☐
9. Support of colleagues is critical to the successful use of **WHT**	☐	☐	☐	☐	☐
10. The healthcare environment will influence my decision to adopt **WHT**	☐	☐	☐	☐	☐
11. Proper planning and procedures will encourage me to use **WHT**	☐	☐	☐	☐	☐
12. Existing work practices will influence the adoption of **WHT**	☐	☐	☐	☐	☐
13. Existing rigidity in the workplace will impede the use of **WHT**	☐	☐	☐	☐	☐
14. Management support is critical for **wireless handheld technology (WHT)** use	☐	☐	☐	☐	☐
15. Compatibility of wireless devices with existing systems will influence **WHT**	☐	☐	☐	☐	☐
16. Financial resources play a critical role in the use of **WHT**	☐	☐	☐	☐	☐
17. Appropriate standards and procedures will facilitate the use of **WHT**	☐	☐	☐	☐	☐
18. Clinical influences will affect the adoption of **WHT**	☐	☐	☐	☐	☐
19. Organizational support will determine the use of **WHT**	☐	☐	☐	☐	☐
20. Lack of management commitment will impact **WHT** use	☐	☐	☐	☐	☐
21. Leadership role is crucial for the adoption of **WHT**	☐	☐	☐	☐	☐
22. Strategic direction is important for the use of **WHT**	☐	☐	☐	☐	☐
23. **Wireless handheld technology (WHT)** will improve evidence based practices	☐	☐	☐	☐	☐
24. **WHT** will help to resolve workload issues	☐	☐	☐	☐	☐
25. **WHT** will help to improve quality of care	☐	☐	☐	☐	☐
26. **WHT** will help to improve time management	☐	☐	☐	☐	☐
27. **WHT** will contribute to reduction of transcription errors	☐	☐	☐	☐	☐
28. **WHT** will help to improve the reporting procedures	☐	☐	☐	☐	☐
29. **WHT** will enhance clinical communications	☐	☐	☐	☐	☐
30. **WHT** will facilitate delivery of high quality information	☐	☐	☐	☐	☐
31. Social values will influence the use of **wireless handheld technology (WHT)**	☐	☐	☐	☐	☐
32. Availability of **WHT** will attract new patients	☐	☐	☐	☐	☐
33. Organizational politics will impact the use of **WHT**	☐	☐	☐	☐	☐
34. Organizational culture will positively effect the use of **WHT**	☐	☐	☐	☐	☐
35. Suitable work environment is important for use of **WHT**	☐	☐	☐	☐	☐
36. Reliability is essential for the adoption of **wireless handheld technology (WHT)**	☐	☐	☐	☐	☐
37. Clear standards is important for use of **WHT**	☐	☐	☐	☐	☐
38. Access to clinical data using **WHT** is essential for usefulness	☐	☐	☐	☐	☐
39. Integration with other devices is essential for the effective use of **WHT**	☐	☐	☐	☐	☐
40. Integration of business process is essential for the effective use of **WHT**	☐	☐	☐	☐	☐
I will use Wireless Handheld Technology in my work provided:	☐	☐	☐	☐	☐
a) my organization in general is ready to take up the technology	☐	☐	☐	☐	☐
b) my organization is technically ready to absorb this technology	☐	☐	☐	☐	☐
c) I believe we are equipped to use the technology	☐	☐	☐	☐	☐
d) this technology can be integrated in the clinical practice	☐	☐	☐	☐	☐
e) this technology is integrated with organization culture & work practices	☐	☐	☐	☐	☐
f) this technology is compatible with existing ICT systems	☐	☐	☐	☐	☐

What type of organisation is this? ☐Public Hospital ☐Private Hospital ☐Other *(Please Specify)* ________

Gender: ☐Male ☐Female | **Your age group** ☐ <26 ☐26-30 ☐31-35 ☐36-40 ☐41-45 ☐46-50 ☐ >50

Your position ☐Physician ☐Doctor ☐Nurse ☐Technician ☐ Admin ☐Other *(Please Specify)* ________

Years of experience or length of service ☐ < 2 ☐2-5 ☐6-10 ☐11-15 ☐16-20 ☐21-25 ☐ > 25

Highest Qualification: ☐PhD or MBBS ☐Master ☐Bachelor ☐Diploma/Certificate ☐ Other ________

Appendix 10

SPSS actual outputs for descriptive analysis

Descriptive Analysis

	N	Mean	Std.	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Technology Awareness	373	1.58	.662	1.058	.126	1.679	.252
Availability of Local Support	373	1.59	.627	.915	.126	1.763	.252
Access to technical people	373	1.69	.688	.743	.126	.366	.252
Easy Interface	373	1.54	.636	.882	.126	.322	.252
Size, Weight and	373	1.62	.640	.672	.126	.053	.252
Connectivity	373	1.59	.619	.692	.126	.213	.252
Reliability of Infrastructure	373	1.51	.620	.871	.126	.082	.252
Availability Electronic	373	2.05	.833	.559	.126	.275	.252
Support from Colleagues	373	1.87	.749	.605	.126	.128	.252
Healthcare environment	373	2.18	.879	.519	.126	.006	.252
Proper Planning and	373	1.87	.749	.721	.126	.940	.252
Existing work practices	373	2.03	.793	.734	.126	.979	.252
Existing Rigidity of	373	2.13	.907	.526	.126	-.248	.252
Management Support	373	1.66	.679	.899	.126	1.355	.252
Compatibility of Devices	373	1.68	.659	.689	.126	.410	.252
Financial Resources	373	1.70	.767	1.008	.126	.935	.252
Appropriate Standards	373	1.84	.658	.347	.126	-.032	.252
Clinical Influences	373	2.03	.816	.637	.126	.260	.252
Organizational Support	373	1.82	.656	.442	.126	.243	.252
Lack of management	373	1.85	.787	.943	.126	1.241	.252
Leadership Role	373	1.91	.815	.877	.126	1.202	.252
Strategic Direction	373	1.96	.775	.587	.126	.316	.252
WHT improve evidence	373	2.26	.916	.447	.126	.005	.252
WHT resolves workload	373	2.67	1.021	.294	.126	-.278	.252
WHT improve quality of	373	2.46	.971	.420	.126	-.026	.252
WHT improve time	373	2.29	1.049	.743	.126	.178	.252
WHT error reduction	373	2.32	1.039	.541	.126	-.278	.252
WHT improve reporting	373	2.28	.931	.629	.126	.354	.252
WHT enhance clinical	373	2.24	.918	.690	.126	.374	.252
WHT high quality of	373	2.17	.913	.723	.126	.499	.252
Social values	373	2.47	.899	.374	.126	-.014	.252
Availability of WHT	373	3.20	1.062	-.233	.126	-.409	.252
Organizational Policies	373	2.25	.910	.662	.126	.470	.252
Organizational Culture	373	2.36	.859	.400	.126	.398	.252
Suitable work environment	373	2.02	.740	.694	.126	1.386	.252
Reliability of WHT	373	1.56	.668	.794	.126	-.489	.252
Clear Standards	373	1.79	.724	.606	.126	-.013	.252
Access to clinical data	373	1.79	.772	.802	.126	.709	.252
Integration with other	373	1.82	.761	.724	.126	.446	.252
Integration of business	373	2.06	.843	.365	.126	-.437	.252
I will use if organization is	373	2.09	.869	.885	.126	1.286	.252
I will use if organization is	373	2.16	.884	.565	.126	.151	.252
I will use if I believe we are	373	2.31	.938	.535	.126	.111	.252
I will use if we can integrate	373	1.99	.774	.363	.126	-.219	.252

I will use if integrated with	373	2.18	.897	.553	.126	.261	.252
I will use if WHT is	373	2.20	.904	.295	.126	-.226	.252
Valid N (listwise)	373						

Qualification * Years of Experience * Gender Crosstabulation

Gender				Years of Experience: Less than 2 years experience	Between 2-5 Years of Exp	Between 6-10 Years of Exp	Between 11-15 Years of Exp	Between 16-20 Years of Exp	Between 21-25 Years of Exp	Greater than 25 years	Total
Male	Qualification	PhD or MBBS	Count	5	9	7	21	8	8	3	61
			% within Qualification	8.2%	14.8%	11.5%	34.4%	13.1%	13.1%	4.9%	100.0%
		Master Degree	Count	2	1	6	6	1	5	0	21
			% within Qualification	9.5%	4.8%	28.6%	28.6%	4.8%	23.8%	.0%	100.0%
		Bachelor Degree	Count	4	8	2	0	1	2	6	23
			% within Qualification	17.4%	34.8%	8.7%	.0%	4.3%	8.7%	26.1%	100.0%
		Diploma or Certificate	Count	2	2	1	2	1	1	2	11
			% within Qualification	18.2%	18.2%	9.1%	18.2%	9.1%	9.1%	18.2%	100.0%
		Other Qualifications	Count	1	1	0	0	1	0	0	3
			% within Qualification	33.3%	33.3%	.0%	.0%	33.3%	.0%	.0%	100.0%
	Total		Count	14	21	16	29	12	16	11	119
			% within Qualification	11.8%	17.6%	13.4%	24.4%	10.1%	13.4%	9.2%	100.0%
Female	Qualification	PhD or MBBS	Count	2	6	2	3	9	1	10	33
			% within Qualification	6.1%	18.2%	6.1%	9.1%	27.3%	3.0%	30.3%	100.0%
		Master Degree	Count	4	4	4	5	5	4	10	36
			% within Qualification	11.1%	11.1%	11.1%	13.9%	13.9%	11.1%	27.8%	100.0%
		Bachelor Degree	Count	11	17	15	6	6	8	11	74
			% within Qualification	14.9%	23.0%	20.3%	8.1%	8.1%	10.8%	14.9%	100.0%
		Diploma or Certificate	Count	2	8	11	14	8	5	8	56
			% within Qualification	3.6%	14.3%	19.6%	25.0%	14.3%	8.9%	14.3%	100.0%
		Other Qualifications	Count	2	0	0	2	1	3	4	12
			% within Qualification	16.7%	.0%	.0%	16.7%	8.3%	25.0%	33.3%	100.0%
	Total		Count	21	35	32	30	29	21	43	211
			% within Qualification	10.0%	16.6%	15.2%	14.2%	13.7%	10.0%	20.4%	100.0%

Qualification * Current Position * Gender Crosstabulation

Gender				Current Position: Physician	Doctor	Nurse	Technician	Admin	Other Professions	Total
Male	Qualification	PhD or MBBS	Count	17	34	2	2	0	8	63
			% within Qualification	27.0%	54.0%	3.2%	3.2%	.0%	12.7%	100.0%
		Master Degree	Count	2	6	6	0	1	7	22
			% within Qualification	9.1%	27.3%	27.3%	.0%	4.5%	31.8%	100.0%
		Bachelor Degree	Count	0	1	7	2	1	13	24
			% within Qualification	.0%	4.2%	29.2%	8.3%	4.2%	54.2%	100.0%
		Diploma or Certificate	Count	0	0	7	1	1	2	11
			% within Qualification	.0%	.0%	63.6%	9.1%	9.1%	18.2%	100.0%
		Other Qualifications	Count	0	0	1	0	0	2	3
			% within Qualification	.0%	.0%	33.3%	.0%	.0%	66.7%	100.0%
	Total		Count	19	41	23	5	3	32	123
			% within Qualification	15.4%	33.3%	18.7%	4.1%	2.4%	26.0%	100.0%
Female	Qualification	PhD or MBBS	Count	5	8	5	0	0	17	35
			% within Qualification	14.3%	22.9%	14.3%	.0%	.0%	48.6%	100.0%
		Master Degree	Count	0	0	18	1	1	17	37
			% within Qualification	.0%	.0%	48.6%	2.7%	2.7%	45.9%	100.0%
		Bachelor Degree	Count	1	0	38	1	4	31	75
			% within Qualification	1.3%	.0%	50.7%	1.3%	5.3%	41.3%	100.0%
		Diploma or Certificate	Count	1	1	36	0	6	14	58
			% within Qualification	1.7%	1.7%	62.1%	.0%	10.3%	24.1%	100.0%
		Other Qualifications	Count	0	0	11	0	1	1	13
			% within Qualification	.0%	.0%	84.6%	.0%	7.7%	7.7%	100.0%
	Total		Count	7	9	108	2	12	80	218
			% within Qualification	3.2%	4.1%	49.5%	.9%	5.5%	36.7%	100.0%

Age Group * Current Position * Gender Crosstabulation

Gender				Current Position: Physician	Doctor	Nurse	Technician	Admin	Other Professions	Total
Male	Age Group	Less than 26 Years	Count	0	3	3	0	0	6	12
			% within Age Group	.0%	25.0%	25.0%	.0%	.0%	50.0%	100.0%
		Between 26-30 Years	Count	2	6	2	1	1	5	17
			% within Age Group	11.8%	35.3%	11.8%	5.9%	5.9%	29.4%	100.0%
		Between 31-33 Years	Count	2	5	3	1	0	4	15
			% within Age Group	13.3%	33.3%	20.0%	6.7%	.0%	26.7%	100.0%
		Between 36-40 Years	Count	4	11	5	0	1	1	22
			% within Age Group	18.2%	50.0%	22.7%	.0%	4.5%	4.5%	100.0%
		Between 41-45 Years	Count	4	16	5	2	1	2	30
			% within Age Group	13.3%	53.3%	16.7%	6.7%	3.3%	6.7%	100.0%
		Between 45-50 Years	Count	3	0	5	1	0	5	14
			% within Age Group	21.4%	.0%	35.7%	7.1%	.0%	35.7%	100.0%
		Greater than 50	Count	3	0	2	0	1	10	16
			% within Age Group	18.8%	.0%	12.5%	.0%	6.3%	62.5%	100.0%
	Total		Count	18	41	25	5	4	33	126
			% within Age Group	14.3%	32.5%	19.8%	4.0%	3.2%	26.2%	100.0%
Female	Age Group	Less than 26 Years	Count	0	1	11	0	1	11	24
			% within Age Group	.0%	4.2%	45.8%	.0%	4.2%	45.8%	100.0%
		Between 26-30 Years	Count	2	2	4	1	1	13	23
			% within Age Group	8.7%	8.7%	17.4%	4.3%	4.3%	56.5%	100.0%
		Between 31-33 Years	Count	0	0	15	1	0	10	26
			% within Age Group	.0%	.0%	57.7%	3.8%	.0%	38.5%	100.0%
		Between 36-40 Years	Count	3	3	14	0	1	15	36
			% within Age Group	8.3%	8.3%	38.9%	.0%	2.8%	41.7%	100.0%
		Between 41-45 Years	Count	2	1	12	0	4	10	29
			% within Age Group	6.9%	3.4%	41.4%	.0%	13.8%	34.5%	100.0%
		Between 45-50 Years	Count	0	0	23	0	1	9	33
			% within Age Group	.0%	.0%	69.7%	.0%	3.0%	27.3%	100.0%
		Greater than 50	Count	0	2	29	0	5	11	47
			% within Age Group	.0%	4.3%	61.7%	.0%	10.6%	23.4%	100.0%
	Total		Count	7	9	108	2	13	79	218
			% within Age Group	3.2%	4.1%	49.5%	.9%	6.0%	36.2%	100.0%

Age Group * Years of Experience * Gender Crosstabulation

Gender				Years of Experience: Less than 2 years experience	Between 2-5 Years of Exp	Between 6-10 Years of Exp	Between 11-15 Years of Exp	Between 16-20 Years of Exp	Between 21-25 Years of Exp	Greater than 25 years	Total
Male	Age Group	Less than 26 Years	Count	9	3	0	0	0	0	0	12
			% within Age Group	75.0%	25.0%	.0%	.0%	.0%	.0%	.0%	100.0%
		Between 26-30 Years	Count	3	9	5	0	0	0	0	17
			% within Age Group	17.6%	52.9%	29.4%	.0%	.0%	.0%	.0%	100.0%
		Between 31-33 Years	Count	1	6	2	3	1	0	0	13
			% within Age Group	7.7%	46.2%	15.4%	23.1%	7.7%	.0%	.0%	100.0%
		Between 36-40 Years	Count	0	1	7	11	0	2	0	21
			% within Age Group	.0%	4.8%	33.3%	52.4%	.0%	9.5%	.0%	100.0%
		Between 41-45 Years	Count	1	0	2	10	9	5	0	27
			% within Age Group	3.7%	.0%	7.4%	37.0%	33.3%	18.5%	.0%	100.0%
		Between 45-50 Years	Count	0	0	0	1	2	8	3	14
			% within Age Group	.0%	.0%	.0%	7.1%	14.3%	57.1%	21.4%	100.0%
		Greater than 50	Count	0	2	1	2	0	2	9	16
			% within Age Group	.0%	12.5%	6.3%	12.5%	.0%	12.5%	56.3%	100.0%
	Total		Count	14	21	17	27	12	17	12	120
			% within Age Group	11.7%	17.5%	14.2%	22.5%	10.0%	14.2%	10.0%	100.0%
Female	Age Group	Less than 26 Years	Count	16	5	2	0	0	0	0	23
			% within Age Group	69.6%	21.7%	8.7%	.0%	.0%	.0%	.0%	100.0%
		Between 26-30 Years	Count	4	12	7	0	0	0	0	23
			% within Age Group	17.4%	52.2%	30.4%	.0%	.0%	.0%	.0%	100.0%
		Between 31-33 Years	Count	1	6	11	6	2	0	0	26
			% within Age Group	3.8%	23.1%	42.3%	23.1%	7.7%	.0%	.0%	100.0%
		Between 36-40 Years	Count	1	6	8	9	9	1	1	35
			% within Age Group	2.9%	17.1%	22.9%	25.7%	25.7%	2.9%	2.9%	100.0%
		Between 41-45 Years	Count	0	1	4	7	8	6	1	27
			% within Age Group	.0%	3.7%	14.8%	25.9%	29.6%	22.2%	3.7%	100.0%
		Between 45-50 Years	Count	0	2	0	4	8	8	9	31
			% within Age Group	.0%	6.5%	.0%	12.9%	25.8%	25.8%	29.0%	100.0%
		Greater than 50	Count	0	3	1	2	2	5	33	46
			% within Age Group	.0%	6.5%	2.2%	4.3%	4.3%	10.9%	71.7%	100.0%
	Total		Count	22	35	33	28	29	20	44	211
			% within Age Group	10.4%	16.6%	15.6%	13.3%	13.7%	9.5%	20.9%	100.0%

Descriptives

	Gender			Statistic	Std. Error
Technical Readiness	Male	Mean		1.6080	.04119
		95% Confidence Interval for Mean	Lower Bound	1.5265	
			Upper Bound	1.6895	
		5% Trimmed Mean		1.5758	
		Median		1.5714	
		Variance		.219	
		Std. Deviation		.46780	
		Minimum		1.00	
		Maximum		3.71	
		Range		2.71	
		Interquartile Range		.57	
		Skewness		1.057	.213
		Kurtosis		2.882	.423
	Female	Mean		1.5484	.02871
		95% Confidence Interval for Mean	Lower Bound	1.4918	
			Upper Bound	1.6050	
		5% Trimmed Mean		1.5323	
		Median		1.5714	
		Variance		.184	
		Std. Deviation		.42881	
		Minimum		1.00	
		Maximum		2.57	
		Range		1.57	
		Interquartile Range		.86	
		Skewness		.223	.163
		Kurtosis		-1.098	.324

Descriptives

	Type of healthcare facility			Statistic	Std. Error
Technical Readiness	Public Hospital	Mean		1.5386	.03066
		95% Confidence Interval for Mean	Lower Bound	1.4782	
			Upper Bound	1.5991	
		5% Trimmed Mean		1.5145	
		Median		1.5714	
		Variance		.197	
		Std. Deviation		.44331	
		Minimum		1.00	
		Maximum		3.71	
		Range		2.71	
		Interquartile Range		.71	
		Skewness		.799	.168
		Kurtosis		1.750	.335
	Private Hospital	Mean		1.6883	.08008
		95% Confidence Interval for Mean	Lower Bound	1.5268	
			Upper Bound	1.8498	
		5% Trimmed Mean		1.6631	
		Median		1.8571	
		Variance		.282	
		Std. Deviation		.53120	
		Minimum		1.00	
		Maximum		3.14	
		Range		2.14	
		Interquartile Range		.86	
		Skewness		.232	.357
		Kurtosis		-.327	.702
	Other Healtcare Facilities	Mean		1.5700	.03936
		95% Confidence Interval for Mean	Lower Bound	1.4918	
			Upper Bound	1.6481	
		5% Trimmed Mean		1.5586	
		Median		1.5714	
		Variance		.150	
		Std. Deviation		.38768	
		Minimum		1.00	
		Maximum		2.43	
		Range		1.43	
		Interquartile Range		.57	
		Skewness		.190	.245
		Kurtosis		-.956	.485

Multiple Comparisons

Dependent Variable: Intention to Use

	(I) Profession	(J) Profession	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Tukey HSD	Doctor/physician	Nurse	-.07868	.10336	.727	-.3219	.1646
		Others (admin, technical etc.	-.22298	.10475	.086	-.4695	.0235
	Nurse	Doctor/physician	.07868	.10336	.727	-.1646	.3219
		Others (admin, technical etc.	-.14430	.08717	.224	-.3494	.0608
	Others (admin, technical etc0	Doctor/physician	.22298	.10475	.086	-.0235	.4695
		Nurse	.14430	.08717	.224	-.0608	.3494
Bonferroni	Doctor/physician	Nurse	-.07868	.10336	1.000	-.3273	.1699
		Others (admin, technical etc.	-.22298	.10475	.102	-.4749	.0290
	Nurse	Doctor/physician	.07868	.10336	1.000	-.1699	.3273
		Others (admin, technical etc0	-.14430	.08717	.296	-.3540	.0654
	Others (admin, technical etc0	Doctor/physician	.22298	.10475	.102	-.0290	.4749
		Nurse	.14430	.08717	.296	-.0654	.3540

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
ITU	374	4.00	1.00	5.00	2.1669	.74291	.552	.254	.126	.009	.252
OR	374	3.00	1.00	4.00	1.7759	.50433	.254	.327	.126	.514	.252
TR	374	2.84	1.00	3.84	1.5627	.47214	.223	.667	.126	.645	.252
MR	374	3.63	1.00	4.63	1.9280	.67162	.451	.750	.126	1.123	.252
PR	374	2.67	1.00	3.67	2.0022	.53982	.291	.169	.126	-.270	.252
CP	374	4.00	1.00	5.00	2.2756	.86420	.747	.776	.126	.784	.252
SC	374	4.00	1.00	5.00	2.3358	.67084	.450	.442	.126	1.104	.252
Comp	374	2.61	1.00	3.61	1.8144	.61414	.377	.443	.126	-.297	.252
Valid N (listwise)	374										

Appendix 11

SPSS actual outputs for principal component analysis

Principal Component Analysis

Principal Components Analysis for composite variable "Technical Readiness"

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.375	48.218	48.218	3.375	48.218	48.218
2	.963	13.753	61.971			
3	.644	9.198	71.169			
4	.623	8.896	80.065			
5	.534	7.632	87.696			
6	.457	6.531	94.228			
7	.404	5.772	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix(a)

	Component
	1
Technology Awareness	.573
Availability of Local Support	.717
Access to technical people	.700
Easy Interface	.705
Size, Weight and Compactness	.686
Connectivity	.736
Reliability of Infrastructure	.732

Extraction Method: Principal Component Analysis.

a 1 components extracted.

Principal Components Analysis for composite variable "Perceived Readiness"

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.496	41.597	41.597	2.496	41.597	41.597
2	.913	15.218	56.815			
3	.769	12.823	69.638			
4	.676	11.261	80.899			
5	.618	10.294	91.193			
6	.528	8.807	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix(a)

	Component
	1
Availability Electronic Records	.571
Support from Colleagues	.687
Healthcare environment	.729
Proper Planning and Procedures	.718
Existing work practices	.618
Existing Rigidity of workplace	.519

Extraction Method: Principal Component Analysis.

a 1 components extracted.

Principal Components Analysis for composite variable "Organizational Readiness"

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.877	43.073	43.073	3.877	43.073	43.073
2	.777	13.075	56.149			
3	.812	9.019	65.168			
4	.728	8.087	73.255			
5	.673	7.479	80.734			
6	.611	6.794	87.528			
7	.441	4.902	92.430			
8	.390	4.335	96.764			
9	.291	3.236	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix(a)

	Component	
	1	2
Management Support	.585	.409
Compatibility of Devices	.543	.582
Financial Resources	.574	.305
Appropriate Standards	.620	.310
Clinical Influences	.655	
Organizational Support	.760	
Lack of management Commitment	.694	
Leadership Role	.717	-.482
Strategic Direction	.723	-.398

Extraction Method: Principal Component Analysis.

a 2 components extracted.

Principal Components Analysis for composite variable "Clinical Practices"

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.273	65.918	65.918	5.273	65.918	65.918
2	.716	8.947	74.864			
3	.573	7.161	82.025			
4	.416	5.203	87.228			
5	.339	4.236	91.464			
6	.250	3.124	94.589			
7	.241	3.012	97.600			
8	.192	2.400	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix(a)

	Component
	1
WHT improve evidence base practice	.717
WHT resolve workload issues	.696
WHT improve quality of care	.829
WHT improve time management	.856
WHT error reduction	.832
WHT improve reporting procedures	.875
WHT enhance clinical communication	.851
WHT high quality of information	.820

Extraction Method: Principal Component Analysis.

a 1 components extracted.

Principal Components Analysis for composite variable "Social Demographics"

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.570	51.396	51.396	2.570	51.396	51.396
2	.773	15.464	66.860			
3	.683	13.664	80.525			
4	.561	11.218	91.742			
5	.413	8.258	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix(a)

	Component
	1
Social values	.649
Availability of WHT	.694
Organizational Policies	.816
Organizational Culture	.715
Suitable work environment	.700

Extraction Method: Principal Component Analysis.

a 1 components extracted.

Principal Components Analysis for composite variable "Compatibility"

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.763	55.257	55.257	2.763	55.257	55.257
2	.770	15.391	70.649			
3	.564	11.283	81.932			
4	.512	10.237	92.169			
5	.392	7.831	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix(a)

	Component
	1
Reliability of WHT	.659
Clear Standards	.756
Access to clinical data	.797
Integration with other devices	.798
Integration of business process	.698

Extraction Method: Principal Component Analysis.

a 1 components extracted.

Principal Components Analysis for composite variable “Intention to Use”

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.012	66.874	66.874	4.012	66.874	66.874
2	.687	11.458	78.332			
3	.452	7.528	85.860			
4	.378	6.307	92.166			
5	.264	4.396	96.562			
6	.206	3.438	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix(a)

	Component
	1
I will use if organization is ready	.788
I will use if organization is technically ready	.845
I will use if I believe we are ready	.833
I will use if we can integrate clinical practices	.753
I will use if integrated with organization culture	.841
I will use if WHT is compatible wit existing ICT	.841

Extraction Method: Principal Component Analysis.

a 1 components extracted.

Appendix 12

SPSS actual outputs for reliability analysis

Reliability

Reliability Statistics All 46 items

Reliability Statistics	
Cronbach's Alpha	N of Items
.936	46

Questions 1 to 7,

Reliability Statistics

Cronbach's Alpha	N of Items
.824	7

Questions 8 to 13

Reliability Statistics

Cronbach's Alpha	N of Items
.713	6

Questions 14 to 22

Reliability Statistics

Cronbach's Alpha	N of Items
.830	9

Questions 23 to 30

Reliability Statistics

Cronbach's Alpha	N of Items
.926	8

Questions 31 to 35

Reliability Statistics

Cronbach's Alpha	N of Items
.756	5

Questions 36 to 40

Reliability Statistics

Cronbach's Alpha	N of Items
.799	5

Questions 41 to 46

Reliability Statistics

Cronbach's Alpha	N of Items
.900	6

Variables , TR, OR, PR, CP, SC, C, and ITU

Reliability Statistics

Cronbach's Alpha	N of Items
.807	8

Reliability of Composite Variables

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items TR
.817	.818	6

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items PR
.685	.685	4

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items OR
.807	.807	4

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items CP
.926	.926	8

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items SD
.663	.662	3

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items Comp
.799	.799	5

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items ITU
.900	.900	6

Appendix 13

SPSS actual outputs for correlation analysis

Correlation Analysis

Table # Correlation analysis for the composite variable identified through factor analysis

		TR	OR	PR	CP	SC	C
TR	Pearson Correlation	1	.490**	.477**	.376**	.276**	.506**
	Sig. (2-tailed)		.000	.000	.000	.000	.000
OR	Pearson Correlation	.490**	1	.577**	.369**	.502**	.538**
	Sig. (2-tailed)	.000		.000	.000	.000	.000
PR	Pearson Correlation	.477**	.577**	1	.356**	.412**	.484**
	Sig. (2-tailed)	.000	.000		.000	.000	.000
CP	Pearson Correlation	.376**	.369**	.356**	1	.550**	.402**
	Sig. (2-tailed)	.000	.000	.000		.000	.000
SC	Pearson Correlation	.276**	.502**	.412**	.550**	1	.384**
	Sig. (2-tailed)	.000	.000	.000	.000		.000
C	Pearson Correlation	.506**	.538**	.484**	.402**	.384**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	

**. Correlation is significant at the 0.01 level (2-tailed).

Technical Readiness (TR), Perceived Readiness (PR), Organizational Readiness (OR), Clinical Practices (CP), Social Context (SC), and Compatibility (C)

Correlation Analysis for “Perceived Readiness”

Correlations

		Perceived Readiness	Availability Electronic Records	Support from Colleagues	Healthcare environment	Proper Planning and Procedures	Existing work practices	Existing Rigidity of workplace
PerceivedReadiness	Pearson Correlation	1	.588**	.662**	.712**	.683**	.619**	.582**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000
	N	361	361	361	361	361	361	361
Availability Electronic Records	Pearson Correlation	.588**	1	.356**	.261**	.316**	.185**	.150**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.004
	N	361	361	361	361	361	361	361
Support from Colleagues	Pearson Correlation	.662**	.356**	1	.406**	.346**	.254**	.239**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000
	N	361	361	361	361	361	361	361
Healthcare environment	Pearson Correlation	.712**	.261**	.406**	1	.435**	.349**	.258**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000
	N	361	361	361	361	361	361	361
Proper Planning and Procedures	Pearson Correlation	.683**	.316**	.346**	.435**	1	.347**	.239**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000
	N	361	361	361	361	361	361	361
Existing work practices	Pearson Correlation	.619**	.185**	.254**	.349**	.347**	1	.271**
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000
	N	361	361	361	361	361	361	361
Existing Rigidity of workplace	Pearson Correlation	.582**	.150**	.239**	.258**	.239**	.271**	1
	Sig. (2-tailed)	.000	.004	.000	.000	.000	.000	
	N	361	361	361	361	361	361	361

**. Correlation is significant at the 0.01 level (2-tailed).

Correlation Analysis for “Perceived Readiness”

Correlations

		Perceived Readiness	Availability Electronic Records	Support from Colleagues	Healthcare environment	Proper Planning and Procedures	Existing work practices	Existing Rigidity of workplace
PerceivedReadiness	Pearson Correlation	1	.588**	.662**	.712**	.683**	.619**	.582**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000
	N	361	361	361	361	361	361	361
Availability Electronic Records	Pearson Correlation	.588**	1	.356**	.261**	.316**	.185**	.150**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.004
	N	361	361	361	361	361	361	361
Support from Colleagues	Pearson Correlation	.662**	.356**	1	.406**	.346**	.254**	.239**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000
	N	361	361	361	361	361	361	361
Healthcare environment	Pearson Correlation	.712**	.261**	.406**	1	.435**	.349**	.258**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000
	N	361	361	361	361	361	361	361
Proper Planning and Procedures	Pearson Correlation	.683**	.316**	.346**	.435**	1	.347**	.239**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000
	N	361	361	361	361	361	361	361
Existing work practices	Pearson Correlation	.619**	.185**	.254**	.349**	.347**	1	.271**
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000
	N	361	361	361	361	361	361	361
Existing Rigidity of workplace	Pearson Correlation	.582**	.150**	.239**	.258**	.239**	.271**	1
	Sig. (2-tailed)	.000	.004	.000	.000	.000	.000	
	N	361	361	361	361	361	361	361

**. Correlation is significant at the 0.01 level (2-tailed).

Correlation Analysis for “Organizational Readiness”

Correlations

		Orga Readiness	Management Support	Cpmpatibility of Devices	Financial Resources	Appropriate Standards	Clinical Influences	Organizational Support	Lack of management Commitment	Leadership Role	Strategic Direction
OrgaReadiness	Pearson Correlation	1	.592**	.552**	.595**	.614**	.661**	.736**	.688**	.717**	.719**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000	.000	.000	.000
	N	361	361	361	361	361	361	361	361	361	361
Management Support	Pearson Correlation	.592**	1	.448**	.353**	.254**	.238**	.386**	.339**	.267**	.281**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000	.000	.000	.000
	N	361	361	361	361	361	361	361	361	361	361
Cpmpatibility of Devices	Pearson Correlation	.552**	.448**	1	.288**	.396**	.288**	.310**	.202**	.187**	.263**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000	.000	.000	.000
	N	361	361	361	361	361	361	361	361	361	361
Financial Resources	Pearson Correlation	.595**	.353**	.288**	1	.380**	.282**	.330**	.295**	.287**	.287**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000	.000	.000	.000
	N	361	361	361	361	361	361	361	361	361	361
Appropriate Standards	Pearson Correlation	.614**	.254**	.396**	.380**	1	.359**	.434**	.305**	.283**	.304**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000	.000	.000	.000
	N	361	361	361	361	361	361	361	361	361	361
Clinical Influences	Pearson Correlation	.661**	.238**	.288**	.282**	.359**	1	.508**	.324**	.425**	.400**
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000	.000	.000	.000
	N	361	361	361	361	361	361	361	361	361	361
Organizational Support	Pearson Correlation	.736**	.386**	.310**	.330**	.434**	.508**	1	.536**	.429**	.445**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000		.000	.000	.000
	N	361	361	361	361	361	361	361	361	361	361
Lack of management Commitment	Pearson Correlation	.688**	.339**	.202**	.295**	.305**	.324**	.536**	1	.522**	.467**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000		.000	.000
	N	361	361	361	361	361	361	361	361	361	361
Leadership Role	Pearson Correlation	.717**	.267**	.187**	.287**	.283**	.425**	.429**	.522**	1	.689**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000		.000
	N	361	361	361	361	361	361	361	361	361	361
Strategic Direction	Pearson Correlation	.719**	.281**	.263**	.287**	.304**	.400**	.445**	.467**	.689**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000	
	N	361	361	361	361	361	361	361	361	361	361

**. Correlation is significant at the 0.01 level (2-tailed).

Correlation Analysis for “Clinical Practices”

Correlations

		ClinicalPract	WHT improve evidence base practice	WHT reslolve workload issues	WHT improve quality of care	WHT improve tiemmanagement	WHT errer reduction	WHT improve reporting procedures	WHT enhance clinical communication	WHT high quality of information
ClinicalPract	Pearson Correlation	1	.722**	.715**	.832**	.859**	.831**	.868**	.842**	.809**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000	.000	.000
	N	361	361	361	361	361	361	361	361	361
WHT improve evidence base practice	Pearson Correlation	.722**	1	.447**	.574**	.496**	.545**	.568**	.502**	.576**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000	.000	.000
	N	361	361	361	361	361	361	361	361	361
WHT reslolve workload issues	Pearson Correlation	.715**	.447**	1	.611**	.622**	.470**	.521**	.514**	.404**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000	.000	.000
	N	361	361	361	361	361	361	361	361	361
WHT improve quality of care	Pearson Correlation	.832**	.574**	.611**	1	.716**	.621**	.658**	.604**	.592**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000	.000	.000
	N	361	361	361	361	361	361	361	361	361
WHT improve tiemmanagement	Pearson Correlation	.859**	.496**	.622**	.716**	1	.692**	.707**	.689**	.606**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000	.000	.000
	N	361	361	361	361	361	361	361	361	361
WHT errer reduction	Pearson Correlation	.831**	.545**	.470**	.621**	.692**	1	.740**	.657**	.638**
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000	.000	.000
	N	361	361	361	361	361	361	361	361	361
WHT improve reporting procedures	Pearson Correlation	.868**	.568**	.521**	.658**	.707**	.740**	1	.740**	.699**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000		.000	.000
	N	361	361	361	361	361	361	361	361	361
WHT enhance clinical communication	Pearson Correlation	.842**	.502**	.514**	.604**	.689**	.657**	.740**	1	.772**
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000		.000
	N	361	361	361	361	361	361	361	361	361
WHT high quality of information	Pearson Correlation	.809**	.576**	.404**	.592**	.606**	.638**	.699**	.772**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	.000	.000	
	N	361	361	361	361	361	361	361	361	361

**. Correlation is significant at the 0.01 level (2-tailed).

Correlation Analysis for "Social Demographics"

Correlations

		SocialDemo	Social values	Availability of WHT	Organizational Policies	Organizational Culture	Suitable work environment
SocialDemo	Pearson Correlation	1	.668**	.734**	.796**	.708**	.664**
	Sig. (2-tailed)		.000	.000	.000	.000	.000
	N	361	361	361	361	361	361
Social values	Pearson Correlation	.668**	1	.355**	.468**	.295**	.257**
	Sig. (2-tailed)	.000		.000	.000	.000	.000
	N	361	361	361	361	361	361
Availability of WHT	Pearson Correlation	.734**	.355**	1	.422**	.409**	.319**
	Sig. (2-tailed)	.000	.000		.000	.000	.000
	N	361	361	361	361	361	361
Organizational Policies	Pearson Correlation	.796**	.468**	.422**	1	.449**	.520**
	Sig. (2-tailed)	.000	.000	.000		.000	.000
	N	361	361	361	361	361	361
Organizational Culture	Pearson Correlation	.708**	.295**	.409**	.449**	1	.400**
	Sig. (2-tailed)	.000	.000	.000	.000		.000
	N	361	361	361	361	361	361
Suitable work environment	Pearson Correlation	.664**	.257**	.319**	.520**	.400**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	361	361	361	361	361	361

**. Correlation is significant at the 0.01 level (2-tailed).

Correlation Analysis for "Compatibility"

Correlations

		Compatibility	Reliability of WHT	Clear Standards	Access to clinical data	Intigration with other devices	Intigration of business process
Compatibility	Pearson Correlation	1	.654**	.747**	.787**	.792**	.727**
	Sig. (2-tailed)		.000	.000	.000	.000	.000
	N	361	361	361	361	361	361
Reliability of WHT	Pearson Correlation	.654**	1	.435**	.416**	.391**	.271**
	Sig. (2-tailed)	.000		.000	.000	.000	.000
	N	361	361	361	361	361	361
Clear Standards	Pearson Correlation	.747**	.435**	1	.527**	.442**	.393**
	Sig. (2-tailed)	.000	.000		.000	.000	.000
	N	361	361	361	361	361	361
Access to clinical data	Pearson Correlation	.787**	.416**	.527**	1	.555**	.414**
	Sig. (2-tailed)	.000	.000	.000		.000	.000
	N	361	361	361	361	361	361
Intigration with other devices	Pearson Correlation	.792**	.391**	.442**	.555**	1	.533**
	Sig. (2-tailed)	.000	.000	.000	.000		.000
	N	361	361	361	361	361	361
Intigration of business process	Pearson Correlation	.727**	.271**	.393**	.414**	.533**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	
	N	361	361	361	361	361	361

**. Correlation is significant at the 0.01 level (2-tailed).

Correlations

		Technical Readiness	Perceived Readiness	Organizational Readiness	Clinical Practices	Social Demographic	Compatibility	Intention to Use
Technical Readiness	Pearson Correlation	1	.453**	.495**	.340**	.264**	.512**	.265**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000
	N	373	373	373	373	373	373	373
Perceived Readiness	Pearson Correlation	.453**	1	.594**	.354**	.398**	.447**	.217**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000
	N	373	373	373	373	373	373	373
Organizational Readiness	Pearson Correlation	.495**	.594**	1	.379**	.497**	.539**	.281**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000
	N	373	373	373	373	373	373	373
Clinical Practices	Pearson Correlation	.340**	.354**	.379**	1	.532**	.384**	.405**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000
	N	373	373	373	373	373	373	373
Social Demographic	Pearson Correlation	.264**	.398**	.497**	.532**	1	.365**	.324**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000
	N	373	373	373	373	373	373	373
Compatibility	Pearson Correlation	.512**	.447**	.539**	.384**	.365**	1	.354**
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000
	N	373	373	373	373	373	373	373
Intention to Use	Pearson Correlation	.265**	.217**	.281**	.405**	.324**	.354**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	
	N	373	373	373	373	373	373	373

**. Correlation is significant at the 0.01 level (2-tailed).

Gender * Country most worked Crosstabulation

			Country most worked		
			Australia	Other	Total
Gender	Male	Count	108	23	131
		% within Gender	82.4%	17.6%	100.0%
		% of Total	29.7%	6.3%	36.0%
	Female	Count	208	25	233
		% within Gender	89.3%	10.7%	100.0%
		% of Total	57.1%	6.9%	64.0%
Total		Count	316	48	364
		% within Gender	86.8%	13.2%	100.0%
		% of Total	86.8%	13.2%	100.0%

Current position * Age group Crosstabulation

			Age group							
			Less than 26 Years	Between 26-30 Years	Between 31-33 Years	Between 36-40 Years	Between 41-45 Years	Between 45-50 Years	Greater than 50	Total
Current position	Physician	Count	0	4	2	7	6	3	3	25
		% within Current position	.0%	16.0%	8.0%	28.0%	24.0%	12.0%	12.0%	100.0%
		% of Total	.0%	1.1%	.6%	2.0%	1.7%	.8%	.8%	7.0%
	Doctor	Count	4	8	5	14	17	0	2	50
		% within Current position	8.0%	16.0%	10.0%	28.0%	34.0%	.0%	4.0%	100.0%
		% of Total	1.1%	2.2%	1.4%	3.9%	4.7%	.0%	.6%	14.0%
	Nurse	Count	16	8	20	19	19	33	31	146
		% within Current position	11.0%	5.5%	13.7%	13.0%	13.0%	22.6%	21.2%	100.0%
		% of Total	4.5%	2.2%	5.6%	5.3%	5.3%	9.2%	8.7%	40.8%
	Technician	Count	0	2	2	0	2	1	0	7
		% within Current position	.0%	28.6%	28.6%	.0%	28.6%	14.3%	.0%	100.0%
		% of Total	.0%	.6%	.6%	.0%	.6%	.3%	.0%	2.0%
	Admin	Count	1	2	0	2	5	1	6	17
		% within Current position	5.9%	11.8%	.0%	11.8%	29.4%	5.9%	35.3%	100.0%
		% of Total	.3%	.6%	.0%	.6%	1.4%	.3%	1.7%	4.7%
	Other Professions	Count	17	18	14	17	12	14	21	113
		% within Current position	15.0%	15.9%	12.4%	15.0%	10.6%	12.4%	18.6%	100.0%
		% of Total	4.7%	5.0%	3.9%	4.7%	3.4%	3.9%	5.9%	31.6%
Total		Count	38	42	43	59	61	52	63	358
		% within Current position	10.6%	11.7%	12.0%	16.5%	17.0%	14.5%	17.6%	100.0%
		% of Total	10.6%	11.7%	12.0%	16.5%	17.0%	14.5%	17.6%	100.0%

Age group * Qualification Crosstabulation

			Qualification					
			PhD or MBBS	Master Degree	Bachelor Degree	Diploma or Certificate	Other Qualifications	Total
Age group	Less than 26 Years	Count	4	2	23	4	4	37
		% within Age group	10.8%	5.4%	62.2%	10.8%	10.8%	100.0%
		% of Total	1.1%	.6%	6.6%	1.1%	1.1%	10.6%
	Between 26-30 Years	Count	14	4	20	2	1	41
		% within Age group	34.1%	9.8%	48.8%	4.9%	2.4%	100.0%
		% of Total	4.0%	1.1%	5.7%	.6%	.3%	11.7%
	Between 31-33 Years	Count	5	11	14	11	1	42
		% within Age group	11.9%	26.2%	33.3%	26.2%	2.4%	100.0%
		% of Total	1.4%	3.2%	4.0%	3.2%	.3%	12.0%
	Between 36-40 Years	Count	25	11	10	12	1	59
		% within Age group	42.4%	18.6%	16.9%	20.3%	1.7%	100.0%
		% of Total	7.2%	3.2%	2.9%	3.4%	.3%	16.9%
	Between 41-45 Years	Count	20	13	9	16	0	58
		% within Age group	34.5%	22.4%	15.5%	27.6%	.0%	100.0%
		% of Total	5.7%	3.7%	2.6%	4.6%	.0%	16.6%
	Between 45-50 Years	Count	11	9	16	12	4	52
		% within Age group	21.2%	17.3%	30.8%	23.1%	7.7%	100.0%
		% of Total	3.2%	2.6%	4.6%	3.4%	1.1%	14.9%
	Greater than 50	Count	17	9	16	14	4	60
		% within Age group	28.3%	15.0%	26.7%	23.3%	6.7%	100.0%
		% of Total	4.9%	2.6%	4.6%	4.0%	1.1%	17.2%
Total		Count	96	59	108	71	15	349
		% within Age group	27.5%	16.9%	30.9%	20.3%	4.3%	100.0%
		% of Total	27.5%	16.9%	30.9%	20.3%	4.3%	100.0%

Age group * Years of experience Crosstabulation

			Years of experience							
			Less than 2 years experence	Between 2-5 Years of Exp	Between 6-10 Years of Exp	Between 11-15 Years of Exp	Between 16-20 Years of Exp	Between 21-25 Years of Exp	Greater than 25 years	Total
Age group	Less than 26 Years	Count	27	8	2	0	0	0	0	37
		% within Age group	73.0%	21.6%	5.4%	.0%	.0%	.0%	.0%	100.0%
		% of Total	7.8%	2.3%	.6%	.0%	.0%	.0%	.0%	10.7%
	Between 26-30 Years	Count	7	23	12	0	0	0	0	42
		% within Age group	16.7%	54.8%	28.6%	.0%	.0%	.0%	.0%	100.0%
		% of Total	2.0%	6.6%	3.5%	.0%	.0%	.0%	.0%	12.1%
	Between 31-33 Years	Count	2	12	14	10	3	0	0	41
		% within Age group	4.9%	29.3%	34.1%	24.4%	7.3%	.0%	.0%	100.0%
		% of Total	.6%	3.5%	4.0%	2.9%	.9%	.0%	.0%	11.8%
	Between 36-40 Years	Count	1	8	15	20	10	3	1	58
		% within Age group	1.7%	13.8%	25.9%	34.5%	17.2%	5.2%	1.7%	100.0%
		% of Total	.3%	2.3%	4.3%	5.8%	2.9%	.9%	.3%	16.8%
	Between 41-45 Years	Count	1	2	6	18	17	11	1	56
		% within Age group	1.8%	3.6%	10.7%	32.1%	30.4%	19.6%	1.8%	100.0%
		% of Total	.3%	.6%	1.7%	5.2%	4.9%	3.2%	.3%	16.2%
	Between 45-50 Years	Count	0	2	0	7	11	16	14	50
		% within Age group	.0%	4.0%	.0%	14.0%	22.0%	32.0%	28.0%	100.0%
		% of Total	.0%	.6%	.0%	2.0%	3.2%	4.6%	4.0%	14.5%
	Greater than 50	Count	0	5	2	4	2	7	42	62
		% within Age group	.0%	8.1%	3.2%	6.5%	3.2%	11.3%	67.7%	100.0%
		% of Total	.0%	1.4%	.6%	1.2%	.6%	2.0%	12.1%	17.9%
Total		Count	38	60	51	59	43	37	58	346
		% within Age group	11.0%	17.3%	14.7%	17.1%	12.4%	10.7%	16.8%	100.0%
		% of Total	11.0%	17.3%	14.7%	17.1%	12.4%	10.7%	16.8%	100.0%

Age group * Type of healthcare facility Crosstabulation

			Type of healthcare facility			
			Public Hospital	Private Hospital	Other Healtcare Facilities	Total
Age group	Less than 26 Years	Count	26	6	5	37
		% within Age group	70.3%	16.2%	13.5%	100.0%
		% of Total	7.4%	1.7%	1.4%	10.5%
	Between 26-30 Years	Count	33	3	6	42
		% within Age group	78.6%	7.1%	14.3%	100.0%
		% of Total	9.3%	.8%	1.7%	11.9%
	Between 31-33 Years	Count	27	4	12	43
		% within Age group	62.8%	9.3%	27.9%	100.0%
		% of Total	7.6%	1.1%	3.4%	12.2%
	Between 36-40 Years	Count	35	10	14	59
		% within Age group	59.3%	16.9%	23.7%	100.0%
		% of Total	9.9%	2.8%	4.0%	16.7%
	Between 41-45 Years	Count	27	9	24	60
		% within Age group	45.0%	15.0%	40.0%	100.0%
		% of Total	7.6%	2.5%	6.8%	17.0%
	Between 45-50 Years	Count	33	4	14	51
		% within Age group	64.7%	7.8%	27.5%	100.0%
		% of Total	9.3%	1.1%	4.0%	14.4%
	Greater than 50	Count	34	6	21	61
		% within Age group	55.7%	9.8%	34.4%	100.0%
		% of Total	9.6%	1.7%	5.9%	17.3%
Total		Count	215	42	96	353
		% within Age group	60.9%	11.9%	27.2%	100.0%
		% of Total	60.9%	11.9%	27.2%	100.0%

Appendix 14

SPSS actual outputs for contingency analysis

Contingency Analysis for Demographic variables

Gender * Current position Crosstabulation

			Current position						
			Physician	Doctor	Nurse	Technician	Admin	Other Professions	Total
Gender	Male	Count	20	41	28	5	4	33	131
		Expected Count	9.7	18.0	53.6	2.5	6.5	40.7	131.0
		% within Gender	15.3%	31.3%	21.4%	3.8%	3.1%	25.2%	100.0%
	Female	Count	7	9	121	2	14	80	233
		Expected Count	17.3	32.0	95.4	4.5	11.5	72.3	233.0
		% within Gender	3.0%	3.9%	51.9%	.9%	6.0%	34.3%	100.0%
Total		Count	27	50	149	7	18	113	364
		Expected Count	27.0	50.0	149.0	7.0	18.0	113.0	364.0
		% within Gender	7.4%	13.7%	40.9%	1.9%	4.9%	31.0%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	89.632(a)	5	.000
Likelihood Ratio	89.668	5	.000
Linear-by-Linear Association	19.814	1	.000
N of Valid Cases	364		

a 2 cells (16.7%) have expected count less than 5. The minimum expected count is 2.52.

Gender * Qualification Crosstabulation

			Qualification					
			PhD or MBBS	Master Degree	Bachelor Degree	Diploma or Certificate	Other Qualifications	Total
Gender	Male	Count	63	22	26	11	3	125
		Expected Count	34.7	20.9	37.9	25.8	5.7	125.0
		% within Gender	50.4%	17.6%	20.8%	8.8%	2.4%	100.0%
	Female	Count	35	37	81	62	13	228
		Expected Count	63.3	38.1	69.1	47.2	10.3	228.0
		% within Gender	15.4%	16.2%	35.5%	27.2%	5.7%	100.0%
Total		Count	98	59	107	73	16	353
		Expected Count	98.0	59.0	107.0	73.0	16.0	353.0
		% within Gender	27.8%	16.7%	30.3%	20.7%	4.5%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	56.742[a]	4	.000
Likelihood Ratio	57.192	4	.000
Linear-by-Linear Association	50.445	1	.000
N of Valid Cases	353		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.67.

Gender * Age group Crosstabulation

			Age group							
			Less than 26 Years	Between 26-30 Years	Between 31-33 Years	Between 36-40 Years	Between 41-45 Years	Between 45-50 Years	Greater than 50	Total
Gender	Male	Count	12	17	15	22	31	15	16	128
		Expected Count	13.7	15.1	15.5	20.9	21.9	18.3	22.7	128.0
		% within Gender	9.4%	13.3%	11.7%	17.2%	24.2%	11.7%	12.5%	100.0%
	Female	Count	26	25	28	36	30	36	47	228
		Expected Count	24.3	26.9	27.5	37.1	39.1	32.7	40.3	228.0
		% within Gender	11.4%	11.0%	12.3%	15.8%	13.2%	15.8%	20.6%	100.0%
Total		Count	38	42	43	58	61	51	63	356
		Expected Count	38.0	42.0	43.0	58.0	61.0	51.0	63.0	356.0
		% within Gender	10.7%	11.8%	12.1%	16.3%	17.1%	14.3%	17.7%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.660(a)	6	.099
Likelihood Ratio	10.613	6	.101
Linear-by-Linear Association	.812	1	.368
N of Valid Cases	356		

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 13.66.

Gender * Years of experience Crosstabulation

			Years of experience							
			Less than 2 years experence	Between 2-5 Years of Exp	Between 6-10 Years of Exp	Between 11-15 Years of Exp	Between 16-20 Years of Exp	Between 21-25 Years of Exp	Greater than 25 years	Total
Gender	Male	Count	14	22	18	30	12	17	12	125
		Expected Count	13.6	21.1	18.6	22.1	15.0	13.6	21.1	125.0
		% within Gender	11.2%	17.6%	14.4%	24.0%	9.6%	13.6%	9.6%	100.0%
	Female	Count	24	37	34	32	30	21	47	225
		Expected Count	24.4	37.9	33.4	39.9	27.0	24.4	37.9	225.0
		% within Gender	10.7%	16.4%	15.1%	14.2%	13.3%	9.3%	20.9%	100.0%
Total		Count	38	59	52	62	42	38	59	350
		Expected Count	38.0	59.0	52.0	62.0	42.0	38.0	59.0	350.0
		% within Gender	10.9%	16.9%	14.9%	17.7%	12.0%	10.9%	16.9%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.805[a]	6	.046
Likelihood Ratio	13.199	6	.040
Linear-by-Linear Association	2.155	1	.142
N of Valid Cases	350		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 13.57.

Gender * Type of healthcare facility Crosstabulation

			Type of healthcare facility			
			Public Hospital	Private Hospital	Other Healtcare Facilities	Total
Gender	Male	Count	78	4	47	129
		Expected Count	78.9	15.5	34.6	129.0
		% within Gender	60.5%	3.1%	36.4%	100.0%
	Female	Count	141	39	49	229
		Expected Count	140.1	27.5	61.4	229.0
		% within Gender	61.6%	17.0%	21.4%	100.0%
Total		Count	219	43	96	358
		Expected Count	219.0	43.0	96.0	358.0
		% within Gender	61.2%	12.0%	26.8%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	20.305[a]	2	.000
Likelihood Ratio	23.111	2	.000
Linear-by-Linear Association	2.815	1	.093
N of Valid Cases	358		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 15.49.

Appendix 15

SPSS actual outputs for regression analysis

Linear Regression Analysis

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.373[a]	.139	.136	.668

a. Predictors: (Constant), COMP

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.296	.116		11.171	.000
	COMP	.476	.061	.373	7.743	.000

a. Dependent Variable: Intention

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.331[a]	.109	.107	.679

a. Predictors: (Constant), SC

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.243	.139		8.939	.000
	SC	.370	.055	.331	6.761	.000

a. Dependent Variable: Intention

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.408[a]	.166	.164	.657

a. Predictors: (Constant), CP

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.286	.106		12.101	.000
	CP	.372	.043	.408	8.614	.000

a. Dependent Variable: Intention

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.286[a]	.082	.079	.690

a. Predictors: (Constant), ORR

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.372	.140		9.789	.000
	ORR	.428	.074	.286	5.756	.000

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.372	.140		9.789	.000
	ORR	.428	.074	.286	5.756	.000

a. Dependent Variable: Intention

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.249[a]	.062	.059	.697

a. Predictors: (Constant), PR

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.471	.142		10.341	.000
	PR	.343	.069	.249	4.953	.000

a. Dependent Variable: Intention

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.277[a]	.077	.074	.692

a. Predictors: (Constant), TR

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.448	.132		10.991	.000
	TR	.444	.080	.277	5.554	.000

a. Dependent Variable: Intention

Multiple Regression Analysis (OR, TR and PR)

Variables Entered/Removed

Model	Variables Entered	Variables Removed	Method
1	TR, OR[a]	.	Enter

a. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.618[a]	.382	.379	.41027

a. Predictors: (Constant), TR, OR

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	38.670	2	19.335	114.873	.000[a]
	Residual	62.446	371	.168		
	Total	101.116	373			

a. Predictors: (Constant), TR, OR

b. Dependent Variable: PR

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.621	.093		6.684	.000
	OR	.489	.051	.452	9.655	.000
	TR	.297	.054	.255	5.455	.000

a. Dependent Variable: PR

Multiple Regression Analysis (PR and ITU)

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	PR[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Intention

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.249[a]	.062	.059	.697

a. Predictors: (Constant), PR

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.924	1	11.924	24.531	.000[a]
	Residual	180.811	372	.486		
	Total	192.734	373			

a. Predictors: (Constant), PR

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.924	1	11.924	24.531	.000[a]
	Residual	180.811	372	.486		
	Total	192.734	373			

a. Predictors: (Constant), PR

b. Dependent Variable: Intention

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.471	.142		10.341	.000
	PR	.343	.069	.249	4.953	.000

a. Dependent Variable: Intention

Muliple Regression Analysis (TR, OR, CP, SC, C and ITU)

Variables Entered/Removed

Model	Variables Entered	Variables Removed	Method
1	C, SC, TR, CP, ORR[a]	.	Enter

a. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.466[a]	.217	.206	.66194

a. Predictors: (Constant), C, SC, TR, CP, ORR

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	44.616	5	8.923	20.365	.000[a]
	Residual	161.246	368	.438		
	Total	205.863	373			

a. Predictors: (Constant), C, SC, TR, CP, ORR

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	44.616	5	8.923	20.365	.000[a]
	Residual	161.246	368	.438		
	Total	205.863	373			

a. Predictors: (Constant), C, SC, TR, CP, ORR

b. Dependent Variable: ITU

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.717	.168		4.271	.000
	ORR	-.008	.095	-.005	-.084	.933
	TR	.088	.095	.053	.923	.357
	CP	.212	.055	.225	3.873	.000
	SC	.139	.070	.120	1.999	.046
	C	.271	.078	.205	3.464	.001

a. Dependent Variable: ITU

Variables Entered/Removed

Model	Variables Entered	Variables Removed	Method
1	C, SC, TR, CP, OR[a]	.	Enter

a. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.476[a]	.227	.216	.636

a. Predictors: (Constant), COMP, SC, TR, CP, OR

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	43.663	5	8.733	21.558	.000[a]
	Residual	149.071	368	.405		
	Total	192.734	373			

a. Predictors: (Constant), C, SC, TR, CP, OR

b. Dependent Variable: Intention

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.734	.161		4.549	.000
	OR	.019	.092	.013	.204	.838
	TR	.074	.091	.046	.812	.417
	CP	.229	.053	.251	4.344	.000
	SC	.106	.067	.095	1.585	.114
	C	.262	.075	.205	3.483	.001

a. Dependent Variable: Intention

Multiple Regression Analysis (PR, CP, SC, C and ITU)

Variables Entered/Removed

Model	Variables Entered	Variables Removed	Method
1	C, SC, PR, CP[a]	.	Enter

a. All requested variables entered.

odel Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.464[a]	.215	.206	.66178

a. Predictors: (Constant), C, SC, PR, CP

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	44.257	4	11.064	25.263	.000[a]
	Residual	161.606	369	.438		
	Total	205.863	373			

a. Predictors: (Constant), C, SC, PR, CP

b. Dependent Variable: ITU

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.791	.164		4.827	.000
	PR	-.020	.079	-.014	-.255	.799
	CP	.224	.054	.237	4.147	.000
	SC	.141	.067	.122	2.105	.036
	C	.305	.073	.231	4.171	.000

a. Dependent Variable: ITU

Multiple Regression Analysis (CP, SC, C and ITU)

Variables Entered/Removed

Model	Variables Entered	Variables Removed	Method
1	Standardized Predicted Value, CP, SC, C[a]	.	Enter

a. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.475[a]	.226	.218	.636

a. Predictors: (Constant), Standardized Predicted Value, CP, SC, C

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	43.552	4	10.888	26.931	.000[a]
	Residual	149.182	369	.404		
	Total	192.734	373			

a. Predictors: (Constant), Standardized Predicted Value, CP, SC, C

b. Dependent Variable: Intention

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.890	.189		4.712	.000
	CP	.233	.052	.256	4.495	.000
	SC	.098	.065	.087	1.506	.133
	C	.265	.075	.208	3.540	.000
	Standardized Predicted Value	.034	.044	.047	.769	.442

a. Dependent Variable: Intention

Multiple Regression Analysis (OR, TR, PR, CP, SC, C and ITU)

Variables Entered/Removed

Model	Variables Entered	Variables Removed	Method
1	C, SC, TR, PR, CP, ORR[a]	.	Enter

a. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.466[a]	.217	.205	.66258

a. Predictors: (Constant), C, SC, TR, PR, CP, ORR

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	44.745	6	7.457	16.987	.000[a]
	Residual	161.118	367	.439		
	Total	205.863	373			

a. Predictors: (Constant), C, SC, TR, PR, CP, ORR

b. Dependent Variable: ITU

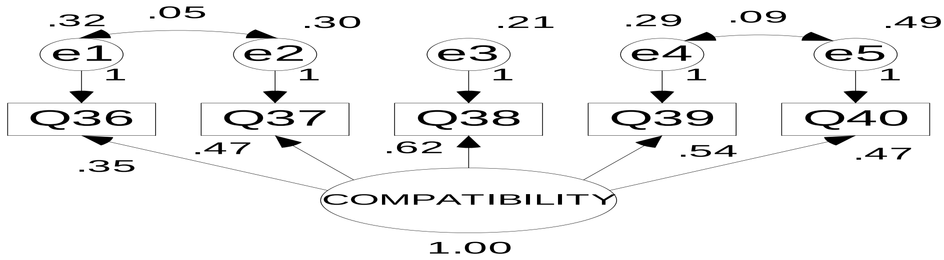
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.738	.172		4.282	.000
	ORR	.009	.100	.006	.087	.931
	TR	.098	.097	.059	1.011	.312
	PR	-.047	.086	-.033	-.541	.589
	CP	.213	.055	.227	3.888	.000
	SC	.144	.070	.124	2.046	.041
	C	.277	.079	.210	3.503	.001

a. Dependent Variable: ITU

Appendix 16

AMOS actual outputs for structural equations modelling for composite variables



Compatibility Construct
Chi-square = 5.429
df = 3
p = .143
GFI = .994
RMSEA = .047
RMR = .009
CFI = .995
TLI = .985

Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Q36 <--- COPMATIBILITY	.354	.037	9.635	***	
Q37 <--- COPMATIBILITY	.467	.038	12.245	***	
Q38 <--- COPMATIBILITY	.619	.040	15.654	***	
Q39 <--- COPMATIBILITY	.539	.040	13.610	***	
Q40 <--- COPMATIBILITY	.467	.047	9.982	***	

Standardized Regression Weights: (Group number 1 - Default model)

	Estimate
Q36 <--- COPMATIBILITY	.531
Q37 <--- COPMATIBILITY	.646
Q38 <--- COPMATIBILITY	.803
Q39 <--- COPMATIBILITY	.709
Q40 <--- COPMATIBILITY	.554

Covariances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
e1 <--> e2	.046	.020	2.251	.024	
e4 <--> e5	.094	.028	3.402	***	

Correlations: (Group number 1 - Default model)

			Estimate
e1	<-->	e2	.147
e4	<-->	e5	.250

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
COPMATIBILITY	1.000				
e1	.319	.027	11.969	***	
e2	.304	.028	10.759	***	
e3	.211	.031	6.743	***	
e4	.287	.030	9.480	***	
e5	.492	.042	11.609	***	

Squared Multiple Correlations: (Group number 1 - Default model)

	Estimate
Q40	.307
Q39	.503
Q38	.645
Q37	.418
Q36	.282

Matrices (Group number 1 - Default model)

Implied (for all variables) Covariances (Group number 1 - Default model)

	COPMATIBILITY	Q40	Q39	Q38	Q37	Q36
COPMATIBILITY	1.000					
Q40	.467	.710				
Q39	.539	.346	.578			
Q38	.619	.289	.334	.594		
Q37	.467	.218	.252	.289	.523	
Q36	.354	.165	.191	.219	.211	.445

Implied (for all variables) Correlations (Group number 1 - Default model)

	COPMATIBILITY	Q40	Q39	Q38	Q37	Q36
COPMATIBILITY	1.000					
Q40	.554	1.000				
Q39	.709	.539	1.000			
Q38	.803	.445	.569	1.000		
Q37	.646	.358	.458	.519	1.000	
Q36	.531	.294	.377	.427	.438	1.000

Implied Covariances (Group number 1 - Default model)

	Q40	Q39	Q38	Q37	Q36
Q40	.710				
Q39	.346	.578			
Q38	.289	.334	.594		
Q37	.218	.252	.289	.523	
Q36	.165	.191	.219	.211	.445

Implied Correlations (Group number 1 - Default model)

	Q40	Q39	Q38	Q37	Q36
Q40	1.000				
Q39	.539	1.000			
Q38	.445	.569	1.000		
Q37	.358	.458	.519	1.000	
Q36	.294	.377	.427	.438	1.000

Residual Covariances (Group number 1 - Default model)

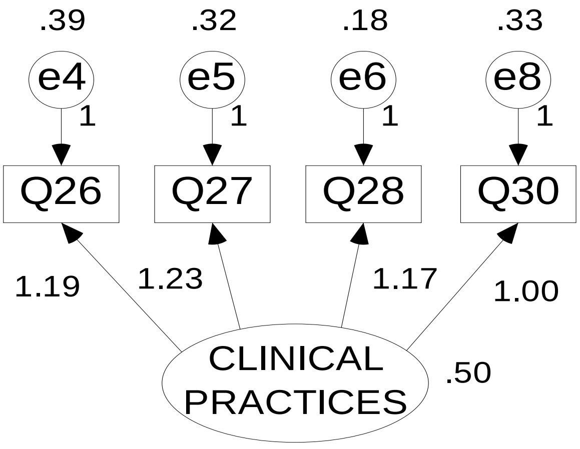
	Q40	Q39	Q38	Q37	Q36
Q40	.000				
Q39	.000	.000			
Q38	-.011	.004	.000		
Q37	.028	-.014	.002	.000	
Q36	-.007	.008	-.003	.000	.000

Standardized Residual Covariances (Group number 1 - Default model)

	Q40	Q39	Q38	Q37	Q36
Q40	.000				
Q39	.000	.000			
Q38	-.303	.120	.000		
Q37	.834	-.443	.059	.000	
Q36	-.231	.277	-.101	.000	.000

Factor Score Weights (Group number 1 - Default model)

	Q40	Q39	Q38	Q37	Q36
COPMATIBILITY	.126	.335	.588	.281	.182



CLINICAL PRACTICES CONSTRUCT
Chi-square = 2.018
df = 2
p = .365
GFI = .997
RMSEA = .005
RMR = .008
CFI = 1.000
TLI = 1.000

Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
Q26	<---	CLINICAL_PRACTICES	1.186	.073	16.302	***	par_1
Q27	<---	CLINICAL_PRACTICES	1.227	.072	17.143	***	par_2
Q28	<---	CLINICAL_PRACTICES	1.167	.064	18.191	***	par_3
Q30	<---	CLINICAL_PRACTICES	1.000				

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
Q26	<---	CLINICAL_PRACTICES	.803
Q27	<---	CLINICAL_PRACTICES	.838
Q28	<---	CLINICAL_PRACTICES	.889
Q30	<---	CLINICAL_PRACTICES	.777

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
CLINICAL_PRACTICES	.503	.058	8.630	***	par_4
e4	.390	.036	10.893	***	par_5
e5	.320	.032	9.983	***	par_6
e6	.181	.023	7.881	***	par_7
e8	.330	.029	11.356	***	par_8

Squared Multiple Correlations: (Group number 1 - Default model)

	Estimate
Q30	.604
Q28	.791
Q27	.703
Q26	.645

Matrices (Group number 1 - Default model)

Implied (for all variables) Covariances (Group number 1 - Default model)

	CLINICAL_PRACTICES	Q30	Q28	Q27	Q26
CLINICAL_PRACTICES	.503				
Q30	.503	.833			
Q28	.587	.587	.867		
Q27	.617	.617	.721	1.078	
Q26	.597	.597	.697	.732	1.098

Implied (for all variables) Correlations (Group number 1 - Default model)

	CLINICAL_PRACTICES	Q30	Q28	Q27	Q26
CLINICAL_PRACTICES	1.000				
Q30	.777	1.000			
Q28	.889	.691	1.000		
Q27	.838	.651	.745	1.000	
Q26	.803	.624	.714	.673	1.000

Residual Covariances (Group number 1 - Default model)

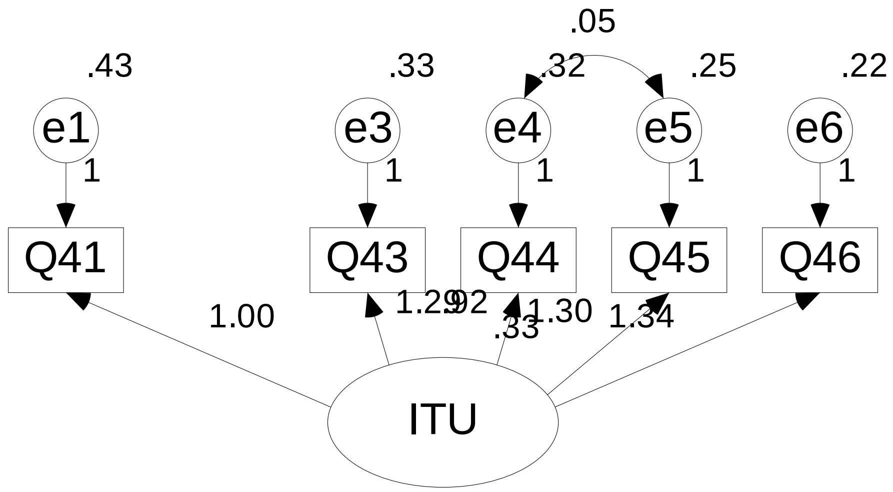
	Q30	Q28	Q27	Q26
Q30	.000			
Q28	.009	.000		
Q27	-.004	-.005	.000	
Q26	-.014	-.003	.015	.000

Standardized Residual Covariances (Group number 1 - Default model)

	Q30	Q28	Q27	Q26
Q30	.000			
Q28	.171	.000		
Q27	-.076	-.083	.000	
Q26	-.237	-.042	.226	.000

Factor Score Weights (Group number 1 - Default model)

	Q30	Q28	Q27	Q26
CLINICAL_PRACTICES	.145	.309	.184	.146



Compatibility Construct
Chi-square = 7.312
df = 4
p = .120
GFI = .992
RMSEA = .047
RMR = .010
CFI = .996
TLI = .991

Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Q41 <--- Intention_To Use	1.000				
Q43 <--- Intention_To Use	1.291	.100	12.888	***	par_1
Q44 <--- Intention_To Use	.922	.082	11.269	***	par_2
Q45 <--- Intention_To Use	1.296	.098	13.268	***	par_3
Q46 <--- Intention_To Use	1.344	.099	13.593	***	par_4

Standardized Regression Weights: (Group number 1 - Default model)

	Estimate
Q41 <--- Intention_To Use	.660
Q43 <--- Intention_To Use	.789
Q44 <--- Intention_To Use	.683
Q45 <--- Intention_To Use	.828
Q46 <--- Intention_To Use	.852

Covariances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
e4 <--> e5	.045	.021	2.178	.029	par_5

Correlations: (Group number 1 - Default model)

	Estimate
e4 <--> e5	.159

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Intention_To Use	.328	.048	6.832	***	par_6
e1	.426	.035	12.265	***	par_7
e3	.332	.031	10.580	***	par_8
e4	.319	.028	11.549	***	par_9
e5	.253	.027	9.226	***	par_10
e6	.223	.026	8.580	***	par_11

Squared Multiple Correlations: (Group number 1 - Default model)

	Estimate
Q46	.726
Q45	.685
Q44	.467
Q43	.623
Q41	.435

Matrices (Group number 1 - Default model)

Implied (for all variables) Covariances (Group number 1 - Default model)

	Intention_To Use	Q46	Q45	Q44	Q43	Q41
Intention_To Use	.328					
Q46	.441	.816				
Q45	.426	.572	.805			
Q44	.303	.407	.438	.599		
Q43	.424	.570	.550	.391	.879	
Q41	.328	.441	.426	.303	.424	.754

Implied (for all variables) Correlations (Group number 1 - Default model)

	Intention_To Use	Q46	Q45	Q44	Q43	Q41
Intention_To Use	1.000					
Q46	.852	1.000				
Q45	.828	.706	1.000			
Q44	.683	.582	.631	1.000		
Q43	.789	.673	.653	.539	1.000	
Q41	.660	.562	.546	.451	.521	1.000

Implied Covariances (Group number 1 - Default model)

	Q46	Q45	Q44	Q43	Q41
Q46	.816				
Q45	.572	.805			
Q44	.407	.438	.599		
Q43	.570	.550	.391	.879	
Q41	.441	.426	.303	.424	.754

Implied Correlations (Group number 1 - Default model)

	Q46	Q45	Q44	Q43	Q41
Q46	1.000				
Q45	.706	1.000			
Q44	.582	.631	1.000		
Q43	.673	.653	.539	1.000	
Q41	.562	.546	.451	.521	1.000

Residual Covariances (Group number 1 - Default model)

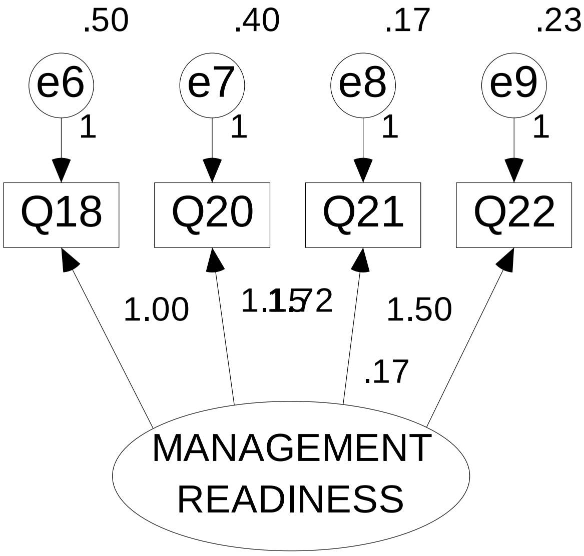
	Q46	Q45	Q44	Q43	Q41
Q46	.000				
Q45	.013	.000			
Q44	-.012	.000	.000		
Q43	-.001	-.018	.018	.000	
Q41	-.012	-.003	.000	.023	.000

Standardized Residual Covariances (Group number 1 - Default model)

	Q46	Q45	Q44	Q43	Q41
Q46	.000				
Q45	.251	.000			
Q44	-.286	.000	.000		
Q43	-.026	-.349	.432	.000	
Q41	-.264	-.064	.003	.474	.000

Factor Score Weights (Group number 1 - Default model)

	Q46	Q45	Q44	Q43	Q41
Intention_To Use	.226	.177	.083	.146	.088



MANAGEMENT READINESS CONSTRUCT
Chi-square = 1.536
df = 2
p = .464
GFI = .998
RMSEA = .000
RMR = .008
CFI = 1.000
TLI = 1.003

Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Q18 <--- MANAGEMENT_READINESS	1.000				
Q20 <--- MANAGEMENT_READINESS	1.149	.143	8.024	***	par_1
Q21 <--- MANAGEMENT_READINESS	1.717	.187	9.174	***	par_2
Q22 <--- MANAGEMENT_READINESS	1.496	.164	9.126	***	par_3

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
Q18	<---	MANAGEMENT_READINESS	.502
Q20	<---	MANAGEMENT_READINESS	.598
Q21	<---	MANAGEMENT_READINESS	.863
Q22	<---	MANAGEMENT_READINESS	.790

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
MANAGEMENT_READINESS	.168	.035	4.772	***	par_4
e6	.498	.039	12.781	***	par_5
e7	.397	.033	12.162	***	par_6
e8	.169	.031	5.478	***	par_7
e9	.225	.027	8.241	***	par_8

Squared Multiple Correlations: (Group number 1 - Default model)

	Estimate
Q22	.625
Q21	.745
Q20	.358
Q18	.252

Matrices (Group number 1 - Default model)

Implied (for all variables) Covariances (Group number 1 - Default model)

	MANAGEMENT_READINESS	Q22	Q21	Q20	Q18
MANAGEMENT_READINESS	.168				
Q22	.251	.600			
Q21	.288	.430	.663		
Q20	.192	.288	.330	.618	
Q18	.168	.251	.288	.192	.665

Implied (for all variables) Correlations (Group number 1 - Default model)

	MANAGEMENT_READINESS	Q22	Q21	Q20	Q1
MANAGEMENT_READINESS	1.000				
Q22	.790	1.000			
Q21	.863	.682	1.000		
Q20	.598	.473	.516	1.000	
Q18	.502	.397	.433	.300	1.00

Residual Covariances (Group number 1 - Default model)

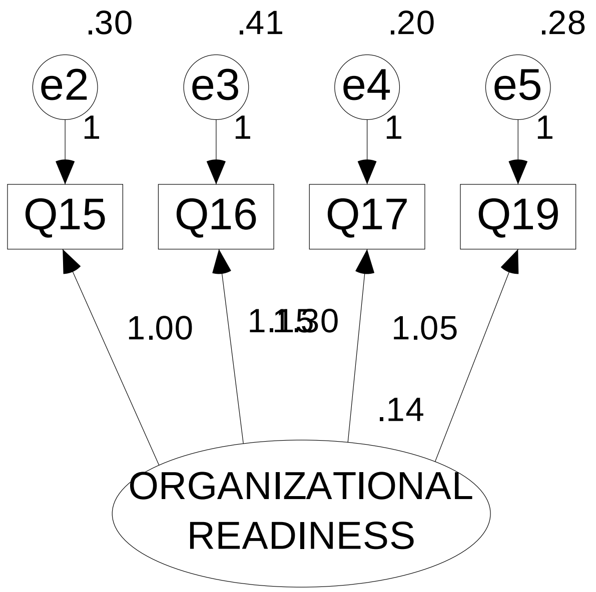
	Q22	Q21	Q20	Q18
Q22	.000			
Q21	.002	.000		
Q20	-.008	.001	.000	
Q18	.002	-.008	.023	.000

Standardized Residual Covariances (Group number 1 - Default model)

	Q22	Q21	Q20	Q18
Q22	.000			
Q21	.049	.000		
Q20	-.229	.021	.000	
Q18	.048	-.201	.649	.000

Factor Score Weights (Group number 1 - Default model)

	Q22	Q21	Q20	Q18
MANAGEMENT_READINESS	.172	.262	.075	.052



ORGANIZATIONAL READINESS CONSTRUCT
Chi-square = .173
df = 2
p = .917
GFI = 1.000
RMSEA = .000
RMR = .002
CFI = 1.000
TLI = 1.022

Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
Q17	<---	ORGANIZATION_REAINESS	1.303	.164	7.967	***	par_1
Q19	<---	ORGANIZATION_REAINESS	1.052	.139	7.594	***	par_2
Q15	<---	ORGANIZATION_REAINESS	1.000				
Q16	<---	ORGANIZATION_REAINESS	1.145	.157	7.302	***	par_3

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
Q17	<---	ORGANIZATION_REAINESS	.734
Q19	<---	ORGANIZATION_REAINESS	.594
Q15	<---	ORGANIZATION_REAINESS	.563
Q16	<---	ORGANIZATION_REAINESS	.554

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
ORGANIZATION_REAINESS	.137	.028	4.904	***	par_4
e2	.296	.027	11.071	***	par_5
e3	.406	.036	11.190	***	par_6
e4	.199	.028	7.209	***	par_7
e5	.278	.026	10.564	***	par_8

Squared Multiple Correlations: (Group number 1 - Default model)

	Estimate
Q19	.353
Q17	.539
Q16	.307
Q15	.316

Matrices (Group number 1 - Default model)

Implied (for all variables) Covariances (Group number 1 - Default model)

	ORGANIZATION_REAINESS	Q19	Q17	Q16	Q15
ORGANIZATION_REAINESS	.137				
Q19	.144	.430			
Q17	.179	.188	.432		
Q16	.157	.165	.205	.586	
Q15	.137	.144	.179	.157	.434

Implied (for all variables) Correlations (Group number 1 - Default model)

	ORGANIZATION_REAINESS	Q19	Q17	Q16	Q15
ORGANIZATION_REAINESS	1.000				
Q19	.594	1.000			
Q17	.734	.436	1.000		
Q16	.554	.329	.407	1.000	
Q15	.563	.334	.413	.312	1.000

Residual Covariances (Group number 1 - Default model)

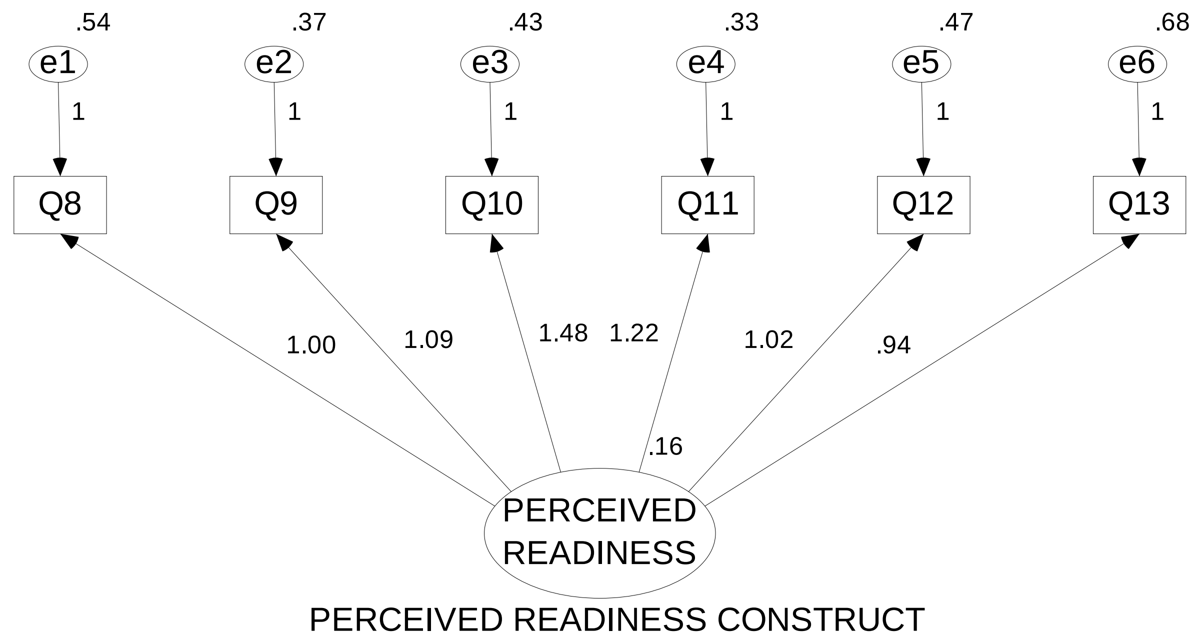
	Q19	Q17	Q16	Q15
Q19	.000			
Q17	-.001	.000		
Q16	.005	-.002	.000	
Q15	-.002	.002	-.003	.000

Standardized Residual Covariances (Group number 1 - Default model)

	Q19	Q17	Q16	Q15
Q19	.000			
Q17	-.041	.000		
Q16	.180	-.054	.000	
Q15	-.092	.098	-.094	.000

Factor Score Weights (Group number 1 - Default model)

	Q19	Q17	Q16	Q15
ORGANIZATION_REAINESS	.143	.248	.107	.128



PERCEIVED READINESS CONSTRUCT
Chi-square = 14.251
df = 9
p = .114
GFI = .987
RMSEA = .040
RMR = .020
CFI = .985
TLI = .974

Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Q8 <--- PERCEIVED_READINESS	1.000				
Q9 <--- PERCEIVED_READINESS	1.090	.160	6.798	***	par_1
Q10 <--- PERCEIVED_READINESS	1.479	.205	7.203	***	par_2
Q11 <--- PERCEIVED_READINESS	1.217	.171	7.122	***	par_3
Q12 <--- PERCEIVED_READINESS	1.019	.160	6.375	***	par_4
Q13 <--- PERCEIVED_READINESS	.944	.168	5.602	***	par_5

Standardized Regression Weights: (Group number 1 - Default model)

	Estimate
Q8 <--- PERCEIVED_READINESS	.475
Q9 <--- PERCEIVED_READINESS	.576
Q10 <--- PERCEIVED_READINESS	.665
Q11 <--- PERCEIVED_READINESS	.643
Q12 <--- PERCEIVED_READINESS	.508
Q13 <--- PERCEIVED_READINESS	.412

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
PERCEIVED_READINESS	.156	.038	4.158	***	par_6
e1	.537	.044	12.235	***	par_7
e2	.374	.033	11.205	***	par_8
e3	.431	.044	9.712	***	par_9
e4	.328	.032	10.144	***	par_10
e5	.466	.039	11.948	***	par_11
e6	.682	.054	12.664	***	par_12

Squared Multiple Correlations: (Group number 1 - Default model)

	Estimate
Q13	.169
Q12	.258
Q11	.414
Q10	.442
Q9	.332
Q8	.225

Matrices (Group number 1 - Default model)

Implied (for all variables) Covariances (Group number 1 - Default model)

	PERCEIVED_READINESS	Q13	Q12	Q11	Q10	Q9	Q8
PERCEIVED_READINESS	.156						
Q13	.147	.821					
Q12	.159	.150	.628				
Q11	.190	.179	.194	.560			
Q10	.231	.218	.235	.281	.773		
Q9	.170	.161	.173	.207	.252	.560	
Q8	.156	.147	.159	.190	.231	.170	.693

Implied (for all variables) Correlations (Group number 1 - Default model)

	PERCEIVED_READINESS	Q13	Q12	Q11	Q10	Q9	Q8
PERCEIVED_READINESS	1.000						
Q13	.412	1.000					
Q12	.508	.209	1.000				
Q11	.643	.265	.327	1.000			
Q10	.665	.274	.338	.428	1.000		
Q9	.576	.237	.293	.370	.383	1.000	
Q8	.475	.195	.241	.305	.316	.273	1.000

Residual Covariances (Group number 1 - Default model)

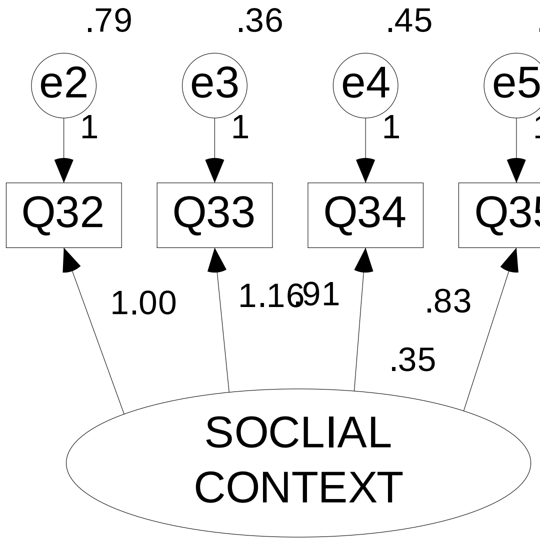
	Q13	Q12	Q11	Q10	Q9	Q8
Q13	.000					
Q12	.045	.000				
Q11	-.013	.010	.000			
Q10	-.011	.014	.005	.000		
Q9	.006	-.034	-.014	.007	.000	
Q8	-.016	-.026	.011	-.030	.049	.000

Standardized Residual Covariances (Group number 1 - Default model)

	Q13	Q12	Q11	Q10	Q9	Q8
Q13	.000					
Q12	1.175	.000				
Q11	-.356	.310	.000			
Q10	-.248	.376	.129	.000		
Q9	.163	-1.060	-.449	.204	.000	
Q8	-.412	-.753	.320	-.757	1.477	.000

Factor Score Weights (Group number 1 - Default model)

	Q13	Q12	Q11	Q10	Q9	Q8
PERCEIVED_READINESS	.056	.089	.151	.140	.119	.076



SOCIAL DEMOGRAPHICS CONSTRUCT
Chi-square = 5.928
df = 2
p = .052
GFI = .992
RMSEA = .073
RMR = .021
CFI = .988
TLI = .963

Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Q32 <--- SOCIAL_CONTEXT	1.000				
Q33 <--- SOCIAL_CONTEXT	1.163	.133	8.724	***	par_1
Q34 <--- SOCIAL_CONTEXT	.913	.111	8.201	***	par_2
Q35 <--- SOCIAL_CONTEXT	.826	.098	8.406	***	par_3

Standardized Regression Weights: (Group number 1 - Default model)

	Estimate
Q32 <--- SOCIAL_CONTEXT	.555
Q33 <--- SOCIAL_CONTEXT	.756
Q34 <--- SOCIAL_CONTEXT	.629
Q35 <--- SOCIAL_CONTEXT	.660

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
SOCIAL_CONTEXT	.350	.069	5.040	***	par_4
e2	.786	.067	11.674	***	par_5
e3	.355	.047	7.619	***	par_6
e4	.447	.042	10.677	***	par_7
e5	.309	.031	10.083	***	par_8

Squared Multiple Correlations: (Group number 1 - Default model)

	Estimate
Q35	.436
Q34	.395
Q33	.571
Q32	.308

Matrices (Group number 1 - Default model)

Implied (for all variables) Covariances (Group number 1 - Default model)

	SOCIAL_CONTEXT	Q35	Q34	Q33	Q32
SOCIAL_CONTEXT	.350				
Q35	.289	.548			
Q34	.320	.264	.739		
Q33	.407	.336	.372	.829	
Q32	.350	.289	.320	.407	1.136

Implied (for all variables) Correlations (Group number 1 - Default model)

	SOCIAL_CONTEXT	Q35	Q34	Q33	Q32
SOCIAL_CONTEXT	1.000				
Q35	.660	1.000			
Q34	.629	.415	1.000		
Q33	.756	.499	.475	1.000	
Q32	.555	.367	.349	.420	1.000

Implied Covariances (Group number 1 - Default model)

	Q35	Q34	Q33	Q32
Q35	.548			
Q34	.264	.739		
Q33	.336	.372	.829	
Q32	.289	.320	.407	1.136

Implied Correlations (Group number 1 - Default model)

	Q35	Q34	Q33	Q32
Q35	1.000			
Q34	.415	1.000		
Q33	.499	.475	1.000	
Q32	.367	.349	.420	1.000

Residual Covariances (Group number 1 - Default model)

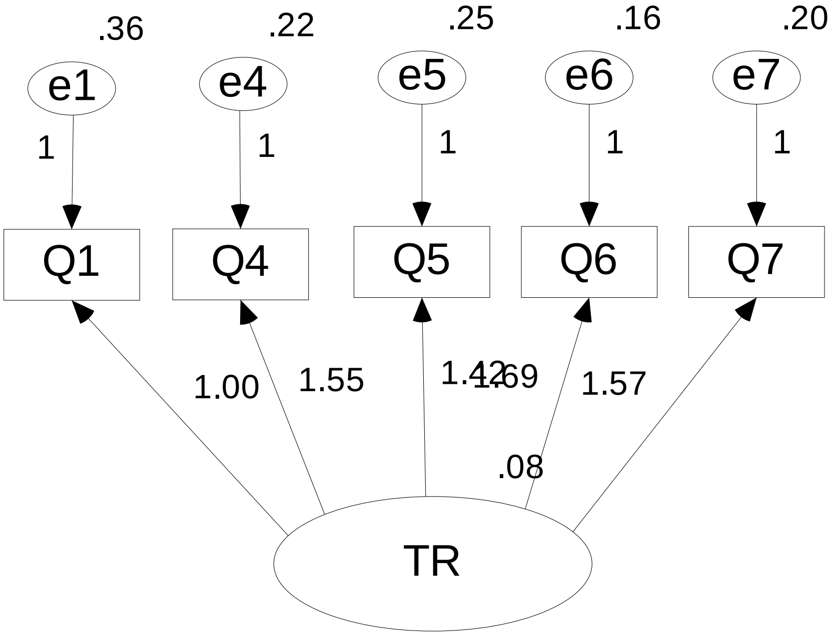
	Q35	Q34	Q33	Q32
Q35	.000			
Q34	-.007	.000		
Q33	.016	-.015	.000	
Q32	-.030	.054	-.009	.000

Standardized Residual Covariances (Group number 1 - Default model)

	Q35	Q34	Q33	Q32
Q35	.000			
Q34	-.196	.000		
Q33	.409	-.337	.000	
Q32	-.685	1.067	-.168	.000

Factor Score Weights (Group number 1 - Default model)

	Q35	Q34	Q33	Q32
SOCIAL_CONTEXT	.222	.170	.273	.106



Compatibility Construct
Chi-square = 7.805
df = 5
p = .167
GFI = .991
RMSEA = .039
RMR = .008
CFI = .994
TLI = .987

Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Q1 <--- Technical_Readiness	1.000				
Q4 <--- Technical_Readiness	1.549	.225	6.901	***	par_1
Q5 <--- Technical_Readiness	1.421	.213	6.679	***	par_2
Q6 <--- Technical_Readiness	1.688	.237	7.114	***	par_3
Q7 <--- Technical_Readiness	1.574	.225	6.988	***	par_4

Standardized Regression Weights: (Group number 1 - Default model)

	Estimate
Q1 <--- Technical_Readiness	.417
Q4 <--- Technical_Readiness	.673
Q5 <--- Technical_Readiness	.614
Q6 <--- Technical_Readiness	.754
Q7 <--- Technical_Readiness	.701

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Technical_Readiness	.076	.020	3.767	***	par_5
e1	.361	.028	12.915	***	par_6
e4	.221	.021	10.650	***	par_7
e5	.254	.022	11.487	***	par_8
e6	.165	.019	8.856	***	par_9
e7	.195	.019	10.119	***	par_10

Squared Multiple Correlations: (Group number 1 - Default model)

	Estimate
Q7	.491
Q6	.568
Q5	.376
Q4	.453
Q1	.174

Matrices (Group number 1 - Default model)

Implied (for all variables) Covariances (Group number 1 - Default model)

	Technical_Readiness	Q7	Q6	Q5	Q4	Q1
Technical_Readiness	.076					
Q7	.120	.384				
Q6	.128	.202	.382			
Q5	.108	.170	.182	.408		
Q4	.118	.186	.199	.167	.403	
Q1	.076	.120	.128	.108	.118	.437

Implied (for all variables) Correlations (Group number 1 - Default model)

	Technical_Readiness	Q7	Q6	Q5	Q4	Q1
Technical_Readiness	1.000					
Q7	.701	1.000				
Q6	.754	.528	1.000			
Q5	.614	.430	.462	1.000		
Q4	.673	.472	.507	.413	1.000	
Q1	.417	.293	.315	.256	.281	1.000

Residual Covariances (Group number 1 - Default model)

	Q7	Q6	Q5	Q4	Q1
Q7	.000				
Q6	.012	.000			
Q5	-.014	-.005	.000		
Q4	-.004	-.010	.022	.000	
Q1	-.007	.000	.004	.005	.000

Standardized Residual Covariances (Group number 1 - Default model)

	Q7	Q6	Q5	Q4	Q1
Q7	.000				
Q6	.542	.000			
Q5	-.611	-.230	.000		
Q4	-.184	-.435	.958	.000	
Q1	-.313	.008	.161	.213	.000

Factor Score Weights (Group number 1 - Default model)

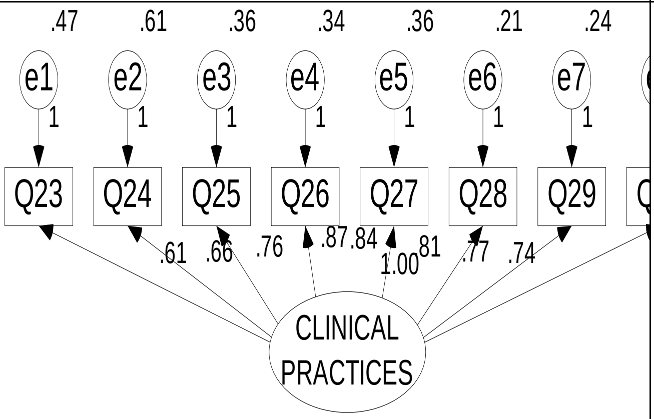
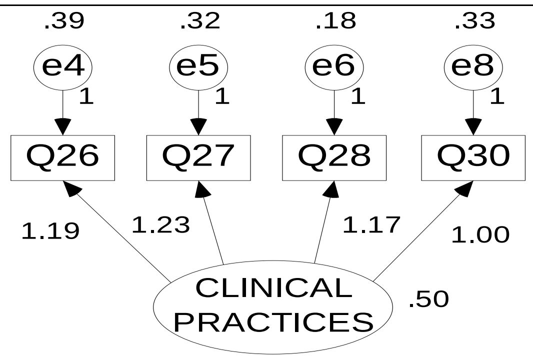
	Q7	Q6	Q5	Q4	Q1
Technical_Readiness	.125	.158	.086	.108	.043

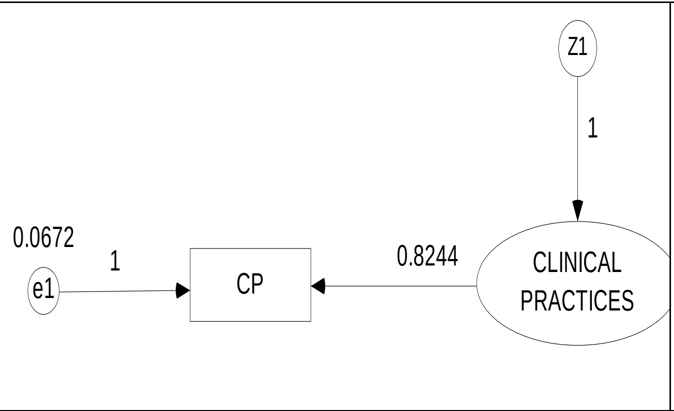
Appendix 17

AMOS actual outputs for structural equations modelling for development of one congeneric models

Development of one factor congeneric model

One Congeneric model for Compatibility

Stage 1	Initial Measurement Model
	CLINICAL PRACTICES CONSTRU Chi-square = 165.738 df = 20 p = .000 GFI = .897 RMSEA = .140 RMR = .042 CFI = .931 TLI = .903 Does not adequately fit the initial model
Stage 2	**Improved Measurement Model**
	CLINICAL PRACTICES CONSTRUCT Chi-square = 2.018 df = 2 p = .365 GFI = .997 RMSEA = .005 RMR = .008 CFI = 1.000 TLI = 1.000 Data fit the improved model
Stage 3	**Composite Measurement Model**



Composite Reliability = 0.90

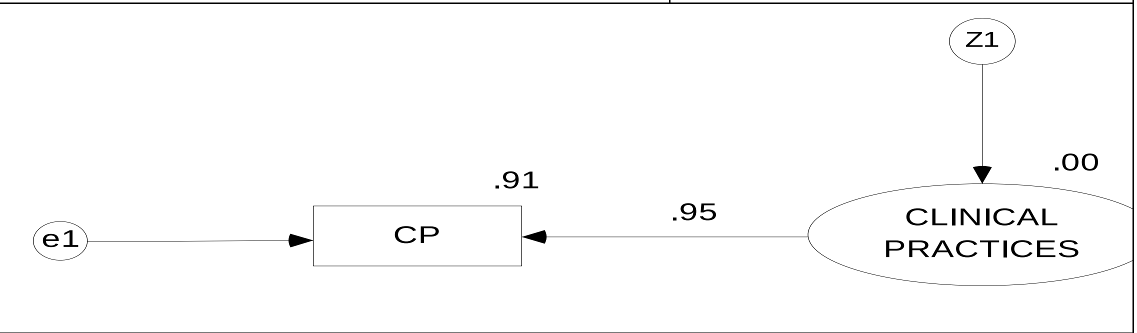
Lambda = .8244

Error = 0.0672

Mean of composite measure = 2.28

Variance = 0.7468

Standard Deviation = 0.8642



Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Q26 <--- CLINICAL_PRACTICES	1.186	.073	16.302	***	par_1
Q27 <--- CLINICAL_PRACTICES	1.227	.072	17.143	***	par_2
Q28 <--- CLINICAL_PRACTICES	1.167	.064	18.191	***	par_3
Q30 <--- CLINICAL_PRACTICES	1.000				

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
Q26	<---	CLINICAL_PRACTICES	.803
Q27	<---	CLINICAL_PRACTICES	.838
Q28	<---	CLINICAL_PRACTICES	.889

	Estimate
Q30 <--- CLINICAL_PRACTICES	.777

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
CLINICAL_PRACTICES	.503	.058	8.630	***	par_4
e4	.390	.036	10.893	***	par_5
e5	.320	.032	9.983	***	par_6
e6	.181	.023	7.881	***	par_7
e8	.330	.029	11.356	***	par_8

Squared Multiple Correlations: (Group number 1 - Default model)

	Estimate
Q30	.604
Q28	.791
Q27	.703
Q26	.645

Matrices (Group number 1 - Default model)

Implied (for all variables) Covariances (Group number 1 - Default model)

	CLINICAL_PRACTICES	Q30	Q28	Q27	Q26
CLINICAL_PRACTICES	.503				
Q30	.503	.833			
Q28	.587	.587	.867		
Q27	.617	.617	.721	1.078	
Q26	.597	.597	.697	.732	1.098

Implied (for all variables) Correlations (Group number 1 - Default model)

	CLINICAL_PRACTICES	Q30	Q28	Q27	Q26
CLINICAL_PRACTICES	1.000				
Q30	.777	1.000			
Q28	.889	.691	1.000		
Q27	.838	.651	.745	1.000	
Q26	.803	.624	.714	.673	1.000

Residual Covariances (Group number 1 - Default model)

	Q30	Q28	Q27	Q26
Q30	.000			
Q28	.009	.000		
Q27	-.004	-.005	.000	
Q26	-.014	-.003	.015	.000

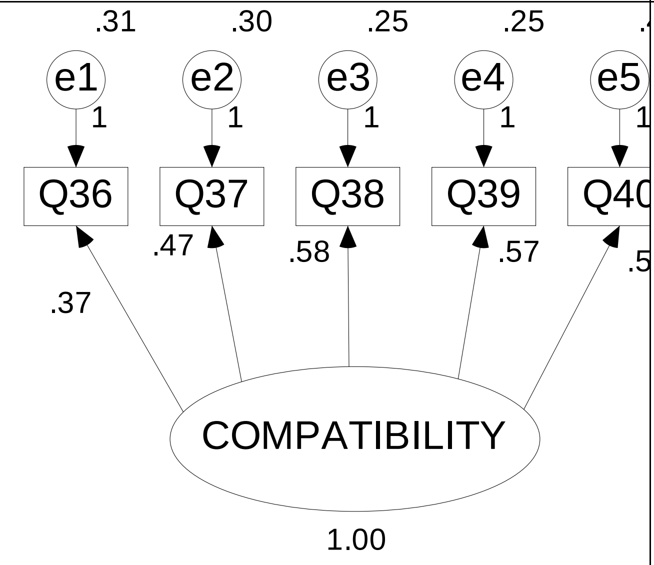
Standardized Residual Covariances (Group number 1 - Default model)

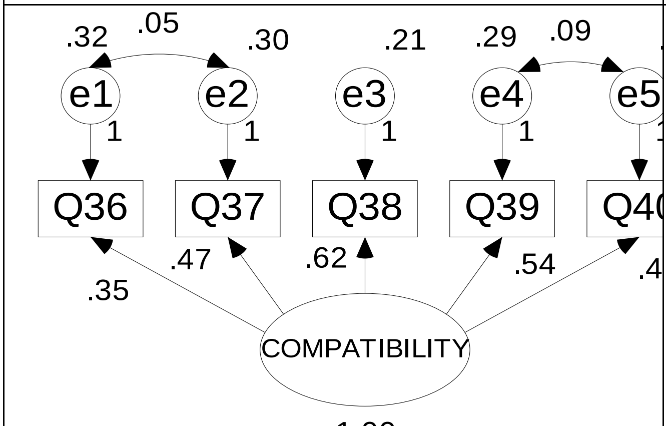
	Q30	Q28	Q27	Q26
Q30	.000			
Q28	.171	.000		
Q27	-.076	-.083	.000	
Q26	-.237	-.042	.226	.000

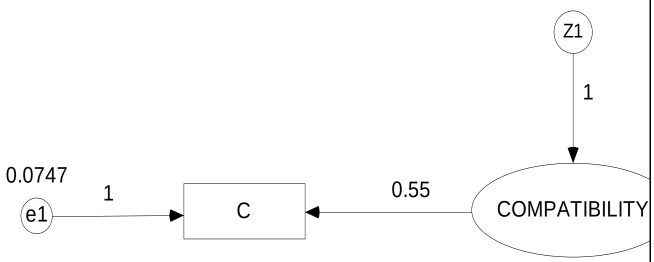
Factor Score Weights (Group number 1 - Default model)

	Q30	Q28	Q27	Q26
CLINICAL_PRACTICES	.145	.309	.184	.146

One Congeneric model for Compatibility

<table>
<tr><th>Stage 1</th><th>Initial Measurement Model</th></tr>
<tr><td>
</td><td>Compatibility Constru
Chi-square = 25.874
df = 5
p = .000
GFI = .973
RMSEA = .106
RMR = .021
CFI = .961
TLI = .922

Does not adequately fit the initial model</td></tr>
<tr><th>Stage 2</th><th>Improved Measurement Model</th></tr>
<tr><td>
</td><td>Compatibility Construc
Chi-square = 5.429
df = 3
p = .143
GFI = .994
RMSEA = .047
RMR = .009
CFI = .995
TLI = .985

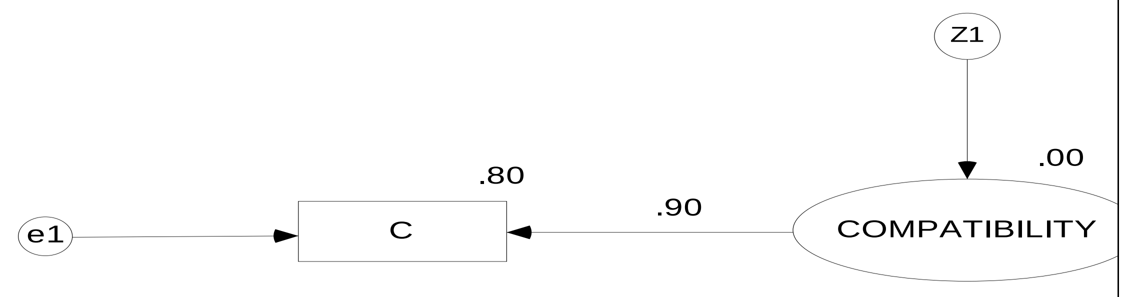
Data fit the improved model</td></tr>
<tr><th>Stage 3</th><th>Composite Measurement Model</th></tr>
<tr><td>
</td><td>Composite Reliability = 0.802

Lambda = .5500

Error = 0.0747

Mean of composite measure = 1.814</td></tr>
</table>

	Variance = 0.3772 Standard Deviation = 0.61414



Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Q36 <--- COPMATIBILITY	.354	.037	9.635	***	
Q37 <--- COPMATIBILITY	.467	.038	12.245	***	
Q38 <--- COPMATIBILITY	.619	.040	15.654	***	
Q39 <--- COPMATIBILITY	.539	.040	13.610	***	
Q40 <--- COPMATIBILITY	.467	.047	9.982	***	

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
Q36	<---	COPMATIBILITY	.531
Q37	<---	COPMATIBILITY	.646
Q38	<---	COPMATIBILITY	.803
Q39	<---	COPMATIBILITY	.709
Q40	<---	COPMATIBILITY	.554

Covariances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
e1 <--> e2	.046	.020	2.251	.024	
e4 <--> e5	.094	.028	3.402	***	

Correlations: (Group number 1 - Default model)

	Estimate
e1 <--> e2	.147
e4 <--> e5	.250

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
COPMATIBILITY	1.000				
e1	.319	.027	11.969	***	
e2	.304	.028	10.759	***	
e3	.211	.031	6.743	***	
e4	.287	.030	9.480	***	
e5	.492	.042	11.609	***	

Squared Multiple Correlations: (Group number 1 - Default model)

	Estimate
Q40	.307
Q39	.503
Q38	.645
Q37	.418
Q36	.282

Matrices (Group number 1 - Default model)

Implied (for all variables) Covariances (Group number 1 - Default model)

	COPMATIBILITY	Q40	Q39	Q38	Q37	Q36
COPMATIBILITY	1.000					

	COPMATIBILITY	Q40	Q39	Q38	Q37	Q36
Q40	.467	.710				
Q39	.539	.346	.578			
Q38	.619	.289	.334	.594		
Q37	.467	.218	.252	.289	.523	
Q36	.354	.165	.191	.219	.211	.445

Implied (for all variables) Correlations (Group number 1 - Default model)

	COPMATIBILITY	Q40	Q39	Q38	Q37	Q36
COPMATIBILITY	1.000					
Q40	.554	1.000				
Q39	.709	.539	1.000			
Q38	.803	.445	.569	1.000		
Q37	.646	.358	.458	.519	1.000	
Q36	.531	.294	.377	.427	.438	1.000

Implied Covariances (Group number 1 - Default model)

	Q40	Q39	Q38	Q37	Q36
Q40	.710				
Q39	.346	.578			
Q38	.289	.334	.594		
Q37	.218	.252	.289	.523	
Q36	.165	.191	.219	.211	.445

Implied Correlations (Group number 1 - Default model)

	Q40	Q39	Q38	Q37	Q36
Q40	1.000				

	Q40	Q39	Q38	Q37	Q36
Q39	.539	1.000			
Q38	.445	.569	1.000		
Q37	.358	.458	.519	1.000	
Q36	.294	.377	.427	.438	1.000

Residual Covariances (Group number 1 - Default model)

	Q40	Q39	Q38	Q37	Q36
Q40	.000				
Q39	.000	.000			
Q38	-.011	.004	.000		
Q37	.028	-.014	.002	.000	
Q36	-.007	.008	-.003	.000	.000

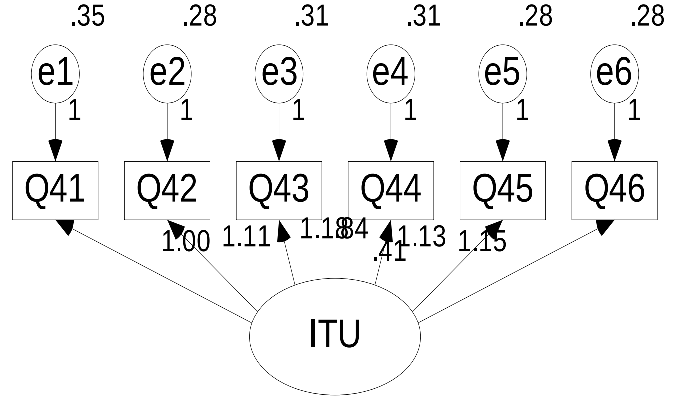
Standardized Residual Covariances (Group number 1 - Default model)

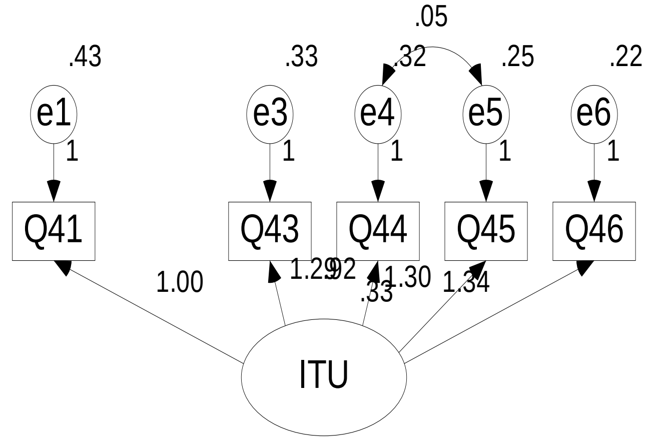
	Q40	Q39	Q38	Q37	Q36
Q40	.000				
Q39	.000	.000			
Q38	-.303	.120	.000		
Q37	.834	-.443	.059	.000	
Q36	-.231	.277	-.101	.000	.000

Factor Score Weights (Group number 1 - Default model)

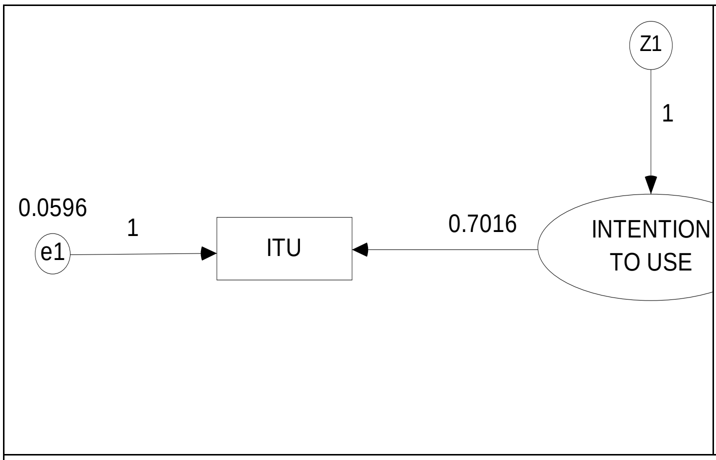
	Q40	Q39	Q38	Q37	Q36
COPMATIBILITY	.126	.335	.588	.281	.182

One Congeneric model for ITU

<table>
<tr><td>Stage 1</td><td>Initial Measurement Model</td></tr>
<tr><td>
</td><td>Chi-square = 143.531
df = 9
p = .000
GFI = .884
RMSEA = .200
RMR = .042
CFI = .900
TLI = .834

Does not adequately fit the initial model</td></tr>
<tr><td>Stage 2</td><td>Improved Measurement Model</td></tr>
<tr><td>
</td><td>Chi-square = 7.31
df = 4
p = .120
GFI = .992
RMSEA = .047
RMR = .010
CFI = .996
TLI = .991

Data fit the improved model</td></tr>
<tr><td>Stage 3</td><td>Composite Measurement Model</td></tr>
</table>



Composite Reliability = 0.892

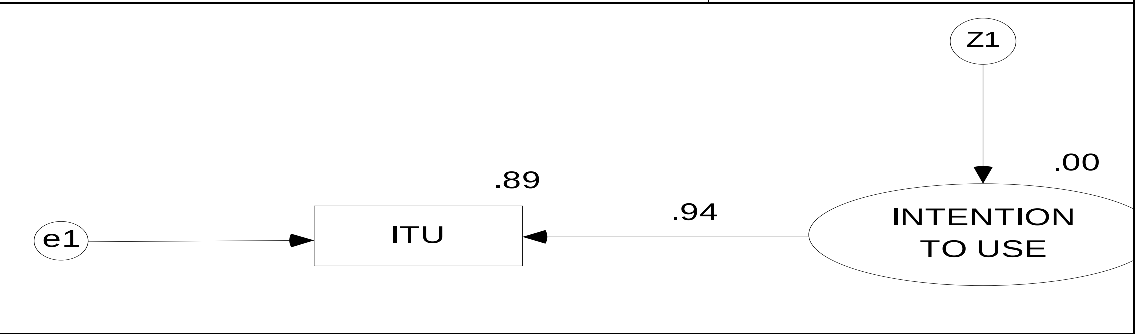
Lambda = .7016

Error = 0.0596

Mean of composite measure = 2.177

Variance = 0.5519

Standard Deviation = 0.74291



Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Q41 <--- Intention_To Use	1.000				
Q43 <--- Intention_To Use	1.291	.100	12.888	***	par_1
Q44 <--- Intention_To Use	.922	.082	11.269	***	par_2
Q45 <--- Intention_To Use	1.296	.098	13.268	***	par_3
Q46 <--- Intention_To Use	1.344	.099	13.593	***	par_4

Standardized Regression Weights: (Group number 1 - Default model)

	Estimate
Q41 <--- Intention_To Use	.660
Q43 <--- Intention_To Use	.789
Q44 <--- Intention_To Use	.683
Q45 <--- Intention_To Use	.828
Q46 <--- Intention_To Use	.852

Covariances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
e4 <--> e5	.045	.021	2.178	.029	par_5

Correlations: (Group number 1 - Default model)

	Estimate
e4 <--> e5	.159

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Intention_To Use	.328	.048	6.832	***	par_6
e1	.426	.035	12.265	***	par_7
e3	.332	.031	10.580	***	par_8
e4	.319	.028	11.549	***	par_9
e5	.253	.027	9.226	***	par_10
e6	.223	.026	8.580	***	par_11

Squared Multiple Correlations: (Group number 1 - Default model)

	Estimate
Q46	.726
Q45	.685
Q44	.467
Q43	.623
Q41	.435

Matrices (Group number 1 - Default model)

Implied (for all variables) Covariances (Group number 1 - Default model)

	Intention_To Use	Q46	Q45	Q44	Q43	Q41
Intention_To Use	.328					
Q46	.441	.816				
Q45	.426	.572	.805			
Q44	.303	.407	.438	.599		
Q43	.424	.570	.550	.391	.879	
Q41	.328	.441	.426	.303	.424	.754

Implied (for all variables) Correlations (Group number 1 - Default model)

	Intention_To Use	Q46	Q45	Q44	Q43	Q41
Intention_To Use	1.000					
Q46	.852	1.000				
Q45	.828	.706	1.000			
Q44	.683	.582	.631	1.000		
Q43	.789	.673	.653	.539	1.000	
Q41	.660	.562	.546	.451	.521	1.000

Implied Covariances (Group number 1 - Default model)

	Q46	Q45	Q44	Q43	Q41
Q46	.816				
Q45	.572	.805			
Q44	.407	.438	.599		
Q43	.570	.550	.391	.879	
Q41	.441	.426	.303	.424	.754

Implied Correlations (Group number 1 - Default model)

	Q46	Q45	Q44	Q43	Q41
Q46	1.000				
Q45	.706	1.000			
Q44	.582	.631	1.000		
Q43	.673	.653	.539	1.000	
Q41	.562	.546	.451	.521	1.000

Residual Covariances (Group number 1 - Default model)

	Q46	Q45	Q44	Q43	Q41
Q46	.000				
Q45	.013	.000			
Q44	-.012	.000	.000		
Q43	-.001	-.018	.018	.000	
Q41	-.012	-.003	.000	.023	.000

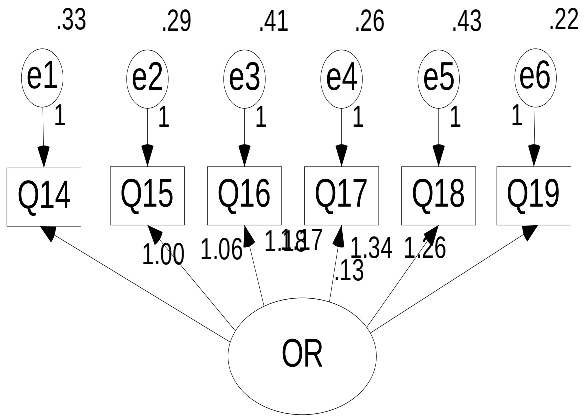
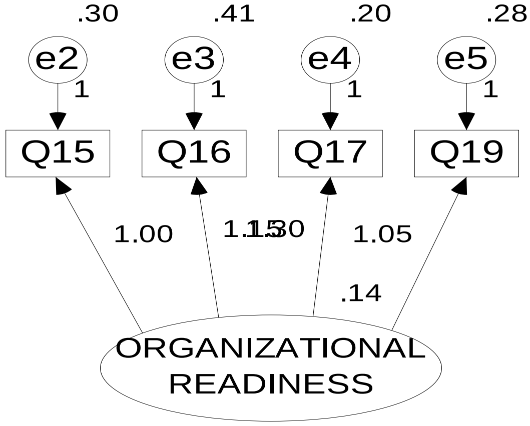
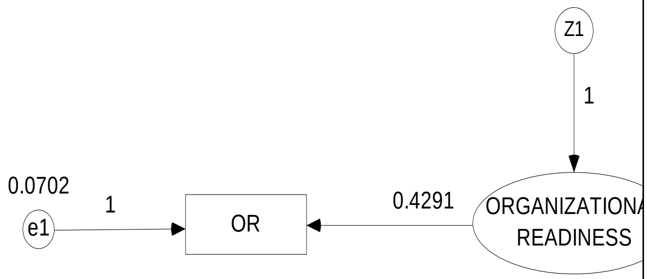
Standardized Residual Covariances (Group number 1 - Default model)

	Q46	Q45	Q44	Q43	Q41
Q46	.000				
Q45	.251	.000			
Q44	-.286	.000	.000		
Q43	-.026	-.349	.432	.000	
Q41	-.264	-.064	.003	.474	.000

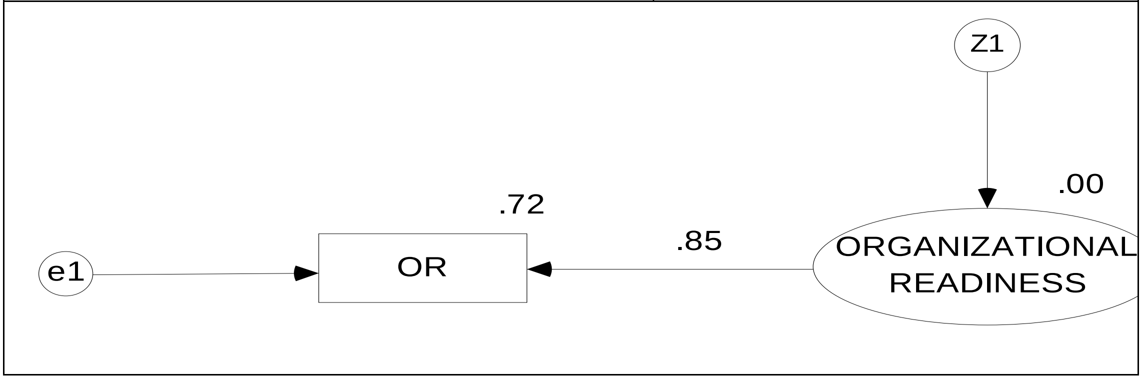
Factor Score Weights (Group number 1 - Default model)

	Q46	Q45	Q44	Q43	Q41
Intention_To Use	.226	.177	.083	.146	.088

One Congeneric model for Organizational Readiness

Stage 1	Initial Measurement Model
	ORGANIZATIONAL READINES Chi-square = 57.588 df = 9 p = .000 GFI = .953 RMSEA = .120 RMR = .026 CFI = .901 TLI = .836 Does not adequately fit the initial model
Stage 2	**Improved Measurement Model**
	ORGANIZATIONAL READINESS CONSTRUCT Chi-square = .173 df = 2 p = .917 GFI = 1.000 RMSEA = .000 RMR = .002 CFI = 1.000 TLI = 1.022 Data fit the improved model
Stage 3	**Composite Measurement Model**
	Composite Reliability = 0.724 Lambda = .4291 Error = 0.0702 Mean of composite measure = 1.776 Variance = 0.2544

	Standard Deviation = 0.50433



Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Q17 <--- ORGANIZATION_REAINESS	1.303	.164	7.967	***	par_1
Q19 <--- ORGANIZATION_REAINESS	1.052	.139	7.594	***	par_2
Q15 <--- ORGANIZATION_REAINESS	1.000				
Q16 <--- ORGANIZATION_REAINESS	1.145	.157	7.302	***	par_3

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
Q17	<---	ORGANIZATION_REAINESS	.734
Q19	<---	ORGANIZATION_REAINESS	.594
Q15	<---	ORGANIZATION_REAINESS	.563
Q16	<---	ORGANIZATION_REAINESS	.554

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
ORGANIZATION_REAINESS	.137	.028	4.904	***	par_4
e2	.296	.027	11.071	***	par_5
e3	.406	.036	11.190	***	par_6
e4	.199	.028	7.209	***	par_7
e5	.278	.026	10.564	***	par_8

Squared Multiple Correlations: (Group number 1 - Default model)

	Estimate
Q19	.353
Q17	.539
Q16	.307
Q15	.316

Matrices (Group number 1 - Default model)

Implied (for all variables) Covariances (Group number 1 - Default model)

	ORGANIZATION_REAINESS	Q19	Q17	Q16	Q15
ORGANIZATION_REAINESS	.137				
Q19	.144	.430			
Q17	.179	.188	.432		
Q16	.157	.165	.205	.586	
Q15	.137	.144	.179	.157	.434

Implied (for all variables) Correlations (Group number 1 - Default model)

	ORGANIZATION_REAINESS	Q19	Q17	Q16	Q15
ORGANIZATION_REAINESS	1.000				
Q19	.594	1.000			
Q17	.734	.436	1.000		
Q16	.554	.329	.407	1.000	
Q15	.563	.334	.413	.312	1.000

Residual Covariances (Group number 1 - Default model)

	Q19	Q17	Q16	Q15
Q19	.000			
Q17	-.001	.000		
Q16	.005	-.002	.000	
Q15	-.002	.002	-.003	.000

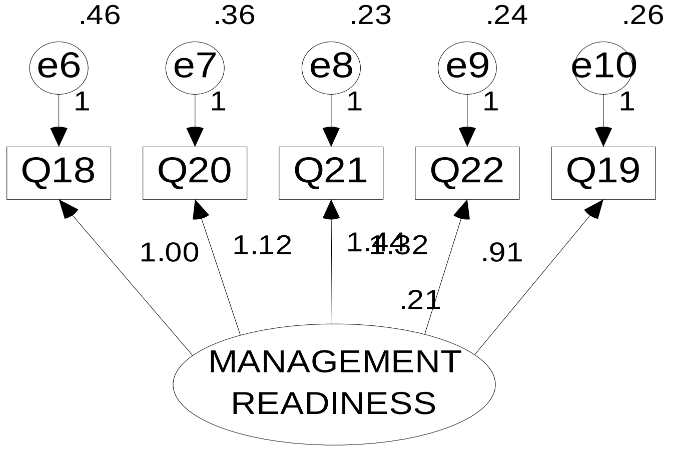
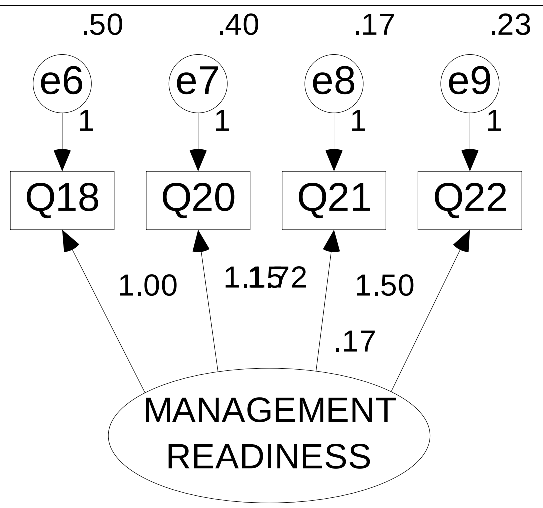
Standardized Residual Covariances (Group number 1 - Default model)

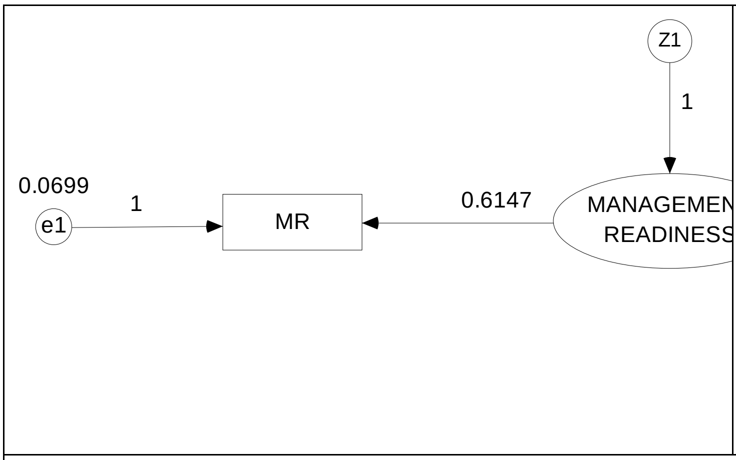
	Q19	Q17	Q16	Q15
Q19	.000			
Q17	-.041	.000		
Q16	.180	-.054	.000	
Q15	-.092	.098	-.094	.000

Factor Score Weights (Group number 1 - Default model)

	Q19	Q17	Q16	Q15
ORGANIZATION_REAINESS	.143	.248	.107	.128

<u>**One Congeneric model for Management Readiness**</u>

Stage 1	Initial Measurement Model
	MANAGEMENT READINESS CONSTRU Chi-square = 72.991 df = 5 p = .000 GFI = .928 RMSEA = .191 RMR = .034 CFI = .896 TLI = .792 Does not adequately fit the initial model
Stage 2	**Improved Measurement Model**
	MANAGEMENT READINESS CONSTRUCT Chi-square = 1.536 df = 2 p = .464 GFI = .998 RMSEA = .000 RMR = .008 CFI = 1.000 TLI = 1.003 Data fit the improved model
Stage 3	**Composite Measurement Model**



Composite Reliability = 0.845

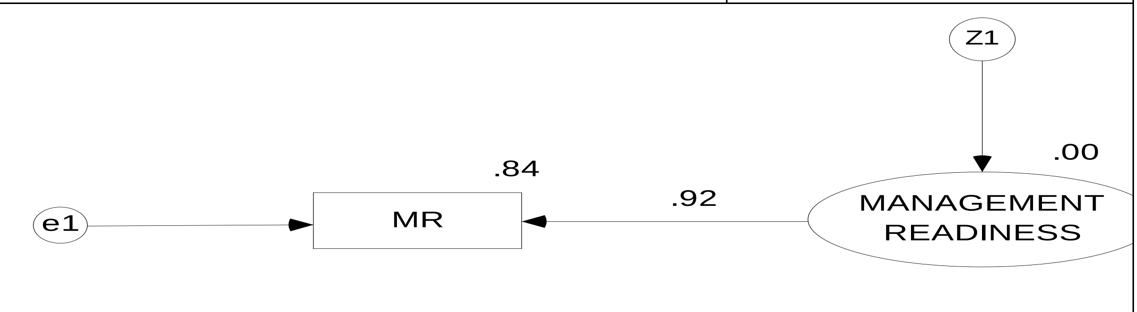
Lambda = .6174

Error = 0.0699

Mean of composite measure = 1.928

Variance = 0.4511

Standard Deviation = 0.67162



Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Q18 <--- MANAGEMENT_READINESS	1.000				
Q20 <--- MANAGEMENT_READINESS	1.149	.143	8.024	***	par_1
Q21 <--- MANAGEMENT_READINESS	1.717	.187	9.174	***	par_2
Q22 <--- MANAGEMENT_READINESS	1.496	.164	9.126	***	par_3

Standardized Regression Weights: (Group number 1 - Default model)

	Estimate
Q18 <--- MANAGEMENT_READINESS	.502
Q20 <--- MANAGEMENT_READINESS	.598
Q21 <--- MANAGEMENT_READINESS	.863
Q22 <--- MANAGEMENT_READINESS	.790

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
MANAGEMENT_READINESS	.168	.035	4.772	***	par_4
e6	.498	.039	12.781	***	par_5
e7	.397	.033	12.162	***	par_6
e8	.169	.031	5.478	***	par_7
e9	.225	.027	8.241	***	par_8

Squared Multiple Correlations: (Group number 1 - Default model)

	Estimate
Q22	.625
Q21	.745
Q20	.358
Q18	.252

Matrices (Group number 1 - Default model)

Implied (for all variables) Covariances (Group number 1 - Default model)

	MANAGEMENT_READINESS	Q22	Q21	Q20	Q18
MANAGEMENT_READINESS	.168				
Q22	.251	.600			
Q21	.288	.430	.663		
Q20	.192	.288	.330	.618	
Q18	.168	.251	.288	.192	.665

Implied (for all variables) Correlations (Group number 1 - Default model)

	MANAGEMENT_READINESS	Q22	Q21	Q20	Q18
MANAGEMENT_READINESS	1.000				
Q22	.790	1.000			
Q21	.863	.682	1.000		
Q20	.598	.473	.516	1.000	
Q18	.502	.397	.433	.300	1.000

Residual Covariances (Group number 1 - Default model)

	Q22	Q21	Q20	Q18
Q22	.000			
Q21	.002	.000		
Q20	-.008	.001	.000	
Q18	.002	-.008	.023	.000

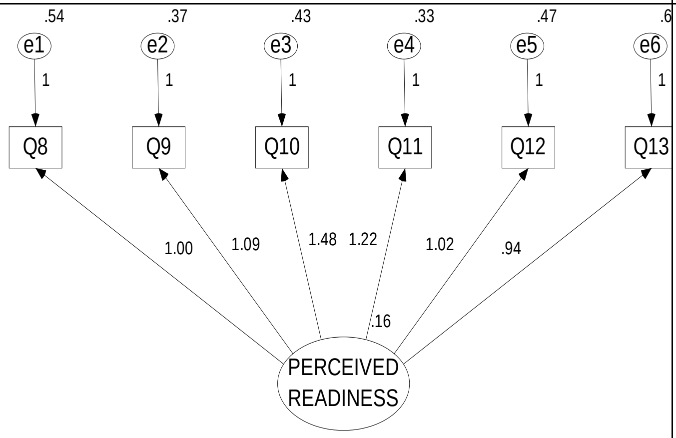
Standardized Residual Covariances (Group number 1 - Default model)

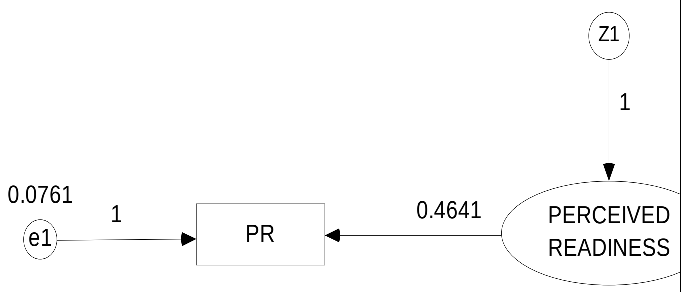
	Q22	Q21	Q20	Q18
Q22	.000			
Q21	.049	.000		
Q20	-.229	.021	.000	
Q18	.048	-.201	.649	.000

Factor Score Weights (Group number 1 - Default model)

	Q22	Q21	Q20	Q18
MANAGEMENT_READINESS	.172	.262	.075	.052

<u>**One Congeneric model for Perceived Readiness**</u>

<table>
<tr><th>Stage 1</th><th>Initial Measurement Model</th></tr>
<tr><td>
</td><td>PERCEIVED READINESS CONSTRU
Chi-square = 14.251
df = 9
p = .114
GFI = .987
RMSEA = .040
RMR = .020
CFI = .985
TLI = .974

Data fit the improved model</td></tr>
<tr><th>Stage 2</th><th>Improved Measurement Model</th></tr>
<tr><td></td><td>Data fit the improved model</td></tr>
<tr><th>Stage 3</th><th>Composite Measurement Model</th></tr>
<tr><td>
</td><td>Composite Reliability = 0.739

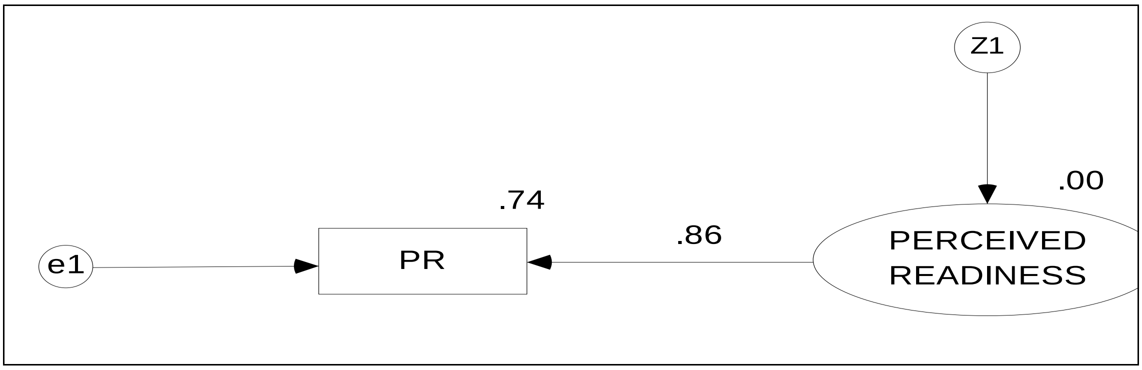
Lambda = .4641

Error = 0.0761

Mean of composite measure = 2.002

Variance = 0.2914

Standard Deviation = 0.53982</td></tr>
</table>


Z1
.00
.74
.86
e1
PR
PERCEIVED
READINESS

Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Q8 <--- PERCEIVED_READINESS	1.000				
Q9 <--- PERCEIVED_READINESS	1.090	.160	6.798	***	par_1
Q10 <--- PERCEIVED_READINESS	1.479	.205	7.203	***	par_2
Q11 <--- PERCEIVED_READINESS	1.217	.171	7.122	***	par_3
Q12 <--- PERCEIVED_READINESS	1.019	.160	6.375	***	par_4
Q13 <--- PERCEIVED_READINESS	.944	.168	5.602	***	par_5

Standardized Regression Weights: (Group number 1 - Default model)

	Estimate
Q8 <--- PERCEIVED_READINESS	.475
Q9 <--- PERCEIVED_READINESS	.576
Q10 <--- PERCEIVED_READINESS	.665
Q11 <--- PERCEIVED_READINESS	.643
Q12 <--- PERCEIVED_READINESS	.508
Q13 <--- PERCEIVED_READINESS	.412

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
PERCEIVED_READINESS	.156	.038	4.158	***	par_6
e1	.537	.044	12.235	***	par_7
e2	.374	.033	11.205	***	par_8
e3	.431	.044	9.712	***	par_9
e4	.328	.032	10.144	***	par_10
e5	.466	.039	11.948	***	par_11
e6	.682	.054	12.664	***	par_12

Squared Multiple Correlations: (Group number 1 - Default model)

	Estimate
Q13	.169
Q12	.258
Q11	.414
Q10	.442
Q9	.332
Q8	.225

Matrices (Group number 1 - Default model)

Implied (for all variables) Covariances (Group number 1 - Default model)

	PERCEIVED_READINES	Q13	Q12	Q11	Q10	Q9	Q8
PERCEIVED_READINES	.156						
Q13	.147	.82					
Q12	.159	.15	.62				
Q11	.190	.17	.19	.56			
Q10	.231	.21	.23	.28	.77		
Q9	.170	.16	.17	.20	.25	.56	
Q8	.156	.14	.15	.19	.23	.17	.69

Implied (for all variables) Correlations (Group number 1 - Default model)

	PERCEIVED_READIN	Q13	Q12	Q11	Q10	Q9	Q8
PERCEIVED_READIN	1.000						
Q13	.412	1.00					
Q12	.508	.209	1.00				
Q11	.643	.265	.327	1.00			
Q10	.665	.274	.338	.428	1.00		
Q9	.576	.237	.293	.370	.383	1.00	
Q8	.475	.195	.241	.305	.316	.273	1.00

Residual Covariances (Group number 1 - Default model)

	Q13	Q12	Q11	Q10	Q9	Q8
Q13	.000					
Q12	.045	.000				
Q11	-.013	.010	.000			
Q10	-.011	.014	.005	.000		
Q9	.006	-.034	-.014	.007	.000	
Q8	-.016	-.026	.011	-.030	.049	.000

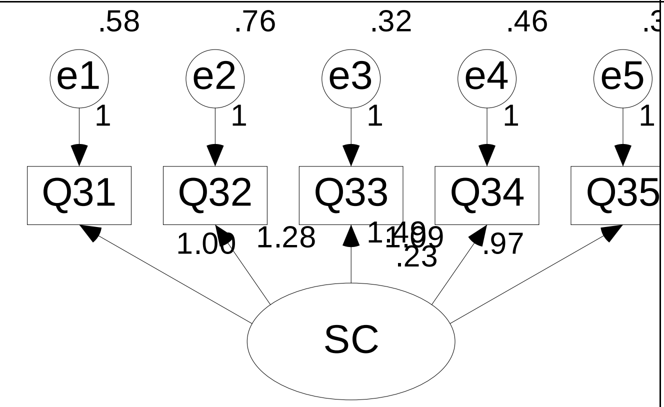
Standardized Residual Covariances (Group number 1 - Default model)

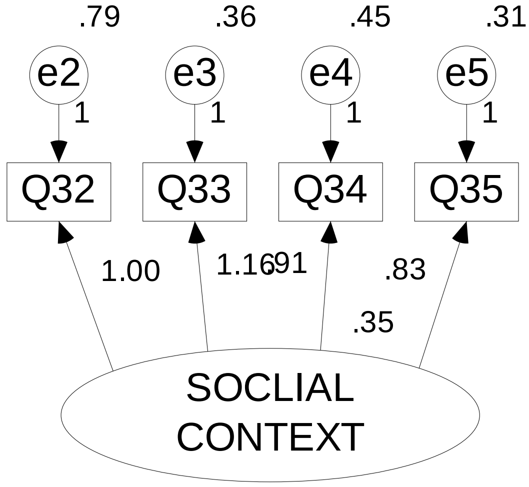
	Q13	Q12	Q11	Q10	Q9	Q8
Q13	.000					
Q12	1.175	.000				
Q11	-.356	.310	.000			
Q10	-.248	.376	.129	.000		
Q9	.163	-1.060	-.449	.204	.000	
Q8	-.412	-.753	.320	-.757	1.477	.000

Factor Score Weights (Group number 1 - Default model)

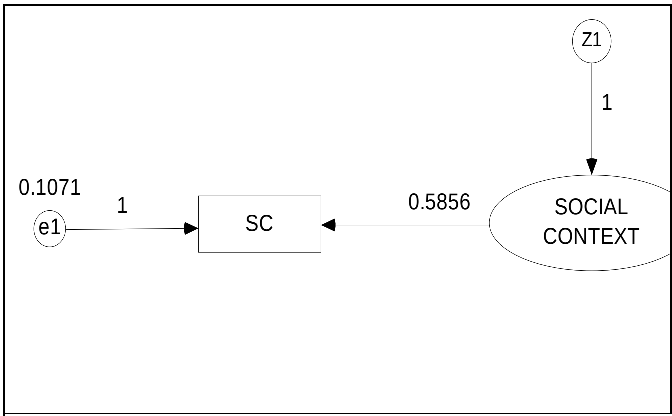
	Q13	Q12	Q11	Q10	Q9	Q8
PERCEIVED_READINESS	.056	.089	.151	.140	.119	.076

One Congeneric model for Social Context

<table>
<tr><th>Stage 1</th><th>Initial Measurement Model</th></tr>
<tr><td>
</td><td>Social Context
Chi-square = 20.90
df = 5
p = .001
GFI = .979
RMSEA = .092
RMR = .031
CFI = .962
TLI = .924

Does not adequately fit the initial model</td></tr>
<tr><th>Stage 2</th><th>Improved Measurement Model</th></tr>
<tr><td>
</td><td>SOCIAL CONTEXT
Chi-square = 5.928
df = 2
p = .052
GFI = .992
RMSEA = .073
RMR = .021
CFI = .988
TLI = .963

Data fit the improved model</td></tr>
<tr><th>Stage 3</th><th>Composite Measurement Model</th></tr>
</table>



Composite Reliability = 0.762

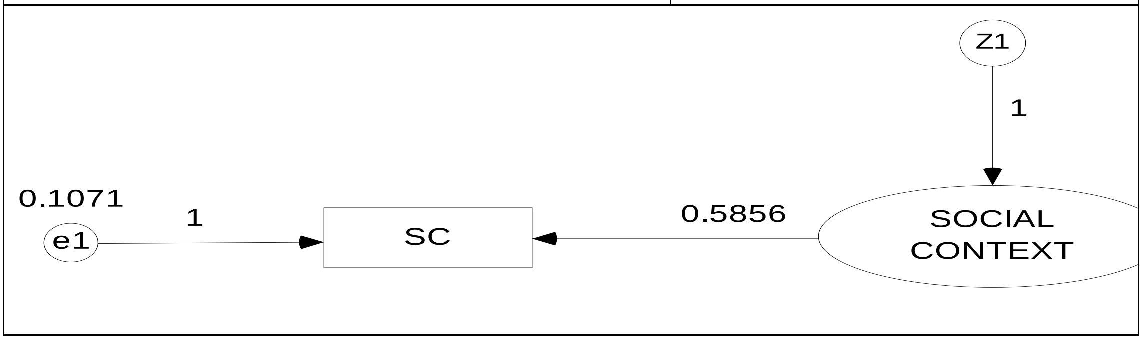
Lambda = .5856

Error = 0.1071

Mean of composite measure = 2.336

Variance = 0.4500

Standard Deviation = 0.67084



Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Q32 <--- SOCIAL_CONTEXT	1.000				
Q33 <--- SOCIAL_CONTEXT	1.163	.133	8.724	***	par_1
Q34 <--- SOCIAL_CONTEXT	.913	.111	8.201	***	par_2
Q35 <--- SOCIAL_CONTEXT	.826	.098	8.406	***	par_3

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
Q32	<---	SOCIAL_CONTEXT	.555
Q33	<---	SOCIAL_CONTEXT	.756
Q34	<---	SOCIAL_CONTEXT	.629
Q35	<---	SOCIAL_CONTEXT	.660

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
SOCIAL_CONTEXT	.350	.069	5.040	***	par_4
e2	.786	.067	11.674	***	par_5
e3	.355	.047	7.619	***	par_6
e4	.447	.042	10.677	***	par_7
e5	.309	.031	10.083	***	par_8

Squared Multiple Correlations: (Group number 1 - Default model)

	Estimate
Q35	.436
Q34	.395
Q33	.571
Q32	.308

Matrices (Group number 1 - Default model)

Implied (for all variables) Covariances (Group number 1 - Default model)

	SOCIAL_CONTEXT	Q35	Q34	Q33	Q32
SOCIAL_CONTEXT	.350				
Q35	.289	.548			
Q34	.320	.264	.739		
Q33	.407	.336	.372	.829	
Q32	.350	.289	.320	.407	1.136

Implied (for all variables) Correlations (Group number 1 - Default model)

	SOCIAL_CONTEXT	Q35	Q34	Q33	Q32
SOCIAL_CONTEXT	1.000				
Q35	.660	1.000			
Q34	.629	.415	1.000		
Q33	.756	.499	.475	1.000	
Q32	.555	.367	.349	.420	1.000

Implied Covariances (Group number 1 - Default model)

	Q35	Q34	Q33	Q32
Q35	.548			
Q34	.264	.739		
Q33	.336	.372	.829	
Q32	.289	.320	.407	1.136

Implied Correlations (Group number 1 - Default model)

	Q35	Q34	Q33	Q32
Q35	1.000			
Q34	.415	1.000		
Q33	.499	.475	1.000	
Q32	.367	.349	.420	1.000

Residual Covariances (Group number 1 - Default model)

	Q35	Q34	Q33	Q32
Q35	.000			
Q34	-.007	.000		
Q33	.016	-.015	.000	
Q32	-.030	.054	-.009	.000

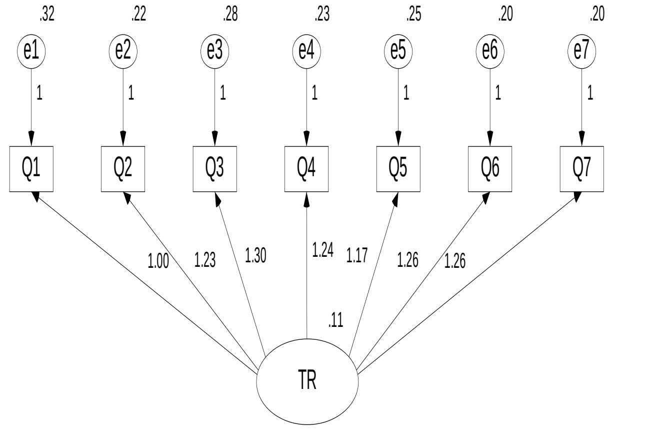
Standardized Residual Covariances (Group number 1 - Default model)

	Q35	Q34	Q33	Q32
Q35	.000			
Q34	-.196	.000		
Q33	.409	-.337	.000	
Q32	-.685	1.067	-.168	.000

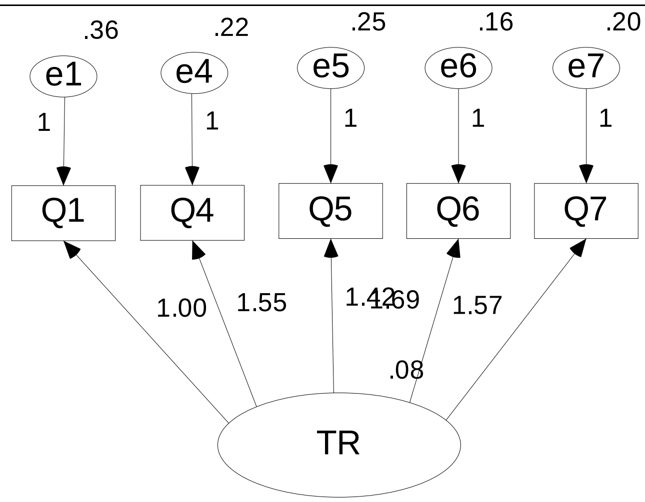
Factor Score Weights (Group number 1 - Default model)

	Q35	Q34	Q33	Q32
SOCIAL_CONTEXT	.222	.170	.273	.106

One Congeneric model for Technical Readiness

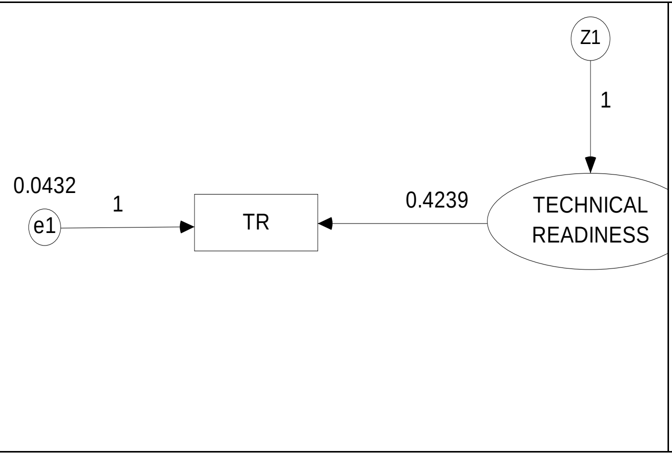
<table>
<tr><td>Stage 1</td><td>Initial Measurement Model</td></tr>
<tr><td>


</td><td>TECHNOLOGICAL READINESS
Chi-square = 75.040
df = 14
p = .000
GFI = .939
RMSEA = .108
RMR = .022
CFI = .920
TLI = .880

Does not adequately fit the initial model</td></tr>
<tr><td>Stage 2</td><td>Improved Measurement Model</td></tr>
<tr><td>


</td><td>TECHNOLOGICAL READINES
Chi-square = 7.805
df = 5
p = .167
GFI = .991
RMSEA = .039
RMR = .008
CFI = .994
TLI = .987

Data fit the improved model</td></tr>
<tr><td>Stage 3</td><td>Composite Measurement Model</td></tr>
</table>



Composite Reliability = 0.806

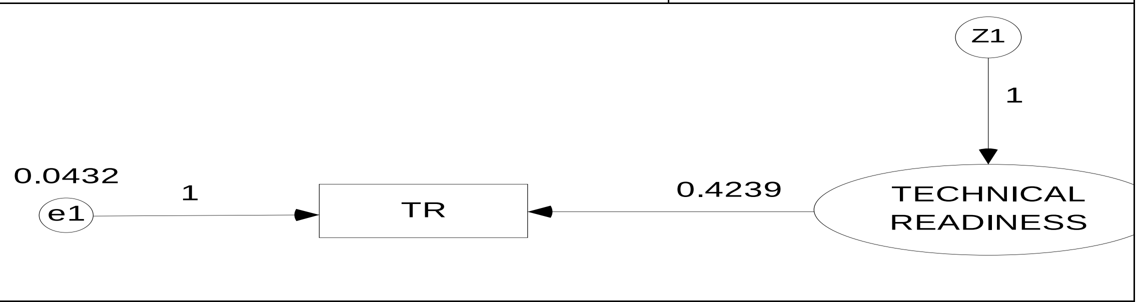
Lambda = .4239

Error = 0.0432

Mean of composite measure = 1.563

Variance = 0.2229

Standard Deviation = 0.47214



Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Q1 <--- Technical_Readiness	1.000				
Q4 <--- Technical_Readiness	1.549	.225	6.901	***	par_1
Q5 <--- Technical_Readiness	1.421	.213	6.679	***	par_2
Q6 <--- Technical_Readiness	1.688	.237	7.114	***	par_3
Q7 <--- Technical_Readiness	1.574	.225	6.988	***	par_4

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
Q1	<---	Technical_Readiness	.417
Q4	<---	Technical_Readiness	.673
Q5	<---	Technical_Readiness	.614
Q6	<---	Technical_Readiness	.754
Q7	<---	Technical_Readiness	.701

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Technical_Readiness	.076	.020	3.767	***	par_5
e1	.361	.028	12.915	***	par_6
e4	.221	.021	10.650	***	par_7
e5	.254	.022	11.487	***	par_8
e6	.165	.019	8.856	***	par_9
e7	.195	.019	10.119	***	par_10

Squared Multiple Correlations: (Group number 1 - Default model)

	Estimate
Q7	.491
Q6	.568
Q5	.376
Q4	.453
Q1	.174

Matrices (Group number 1 - Default model)

Implied (for all variables) Covariances (Group number 1 - Default model)

	Technical_Readiness	Q7	Q6	Q5	Q4	Q1
Technical_Readiness	.076					
Q7	.120	.384				
Q6	.128	.202	.382			
Q5	.108	.170	.182	.408		
Q4	.118	.186	.199	.167	.403	
Q1	.076	.120	.128	.108	.118	.437

Implied (for all variables) Correlations (Group number 1 - Default model)

	Technical_Readiness	Q7	Q6	Q5	Q4	Q1
Technical_Readiness	1.000					
Q7	.701	1.000				
Q6	.754	.528	1.000			
Q5	.614	.430	.462	1.000		
Q4	.673	.472	.507	.413	1.000	
Q1	.417	.293	.315	.256	.281	1.000

Residual Covariances (Group number 1 - Default model)

	Q7	Q6	Q5	Q4	Q1
Q7	.000				
Q6	.012	.000			
Q5	-.014	-.005	.000		
Q4	-.004	-.010	.022	.000	
Q1	-.007	.000	.004	.005	.000

Standardized Residual Covariances (Group number 1 - Default model)

	Q7	Q6	Q5	Q4	Q1
Q7	.000				
Q6	.542	.000			
Q5	-.611	-.230	.000		
Q4	-.184	-.435	.958	.000	
Q1	-.313	.008	.161	.213	.000

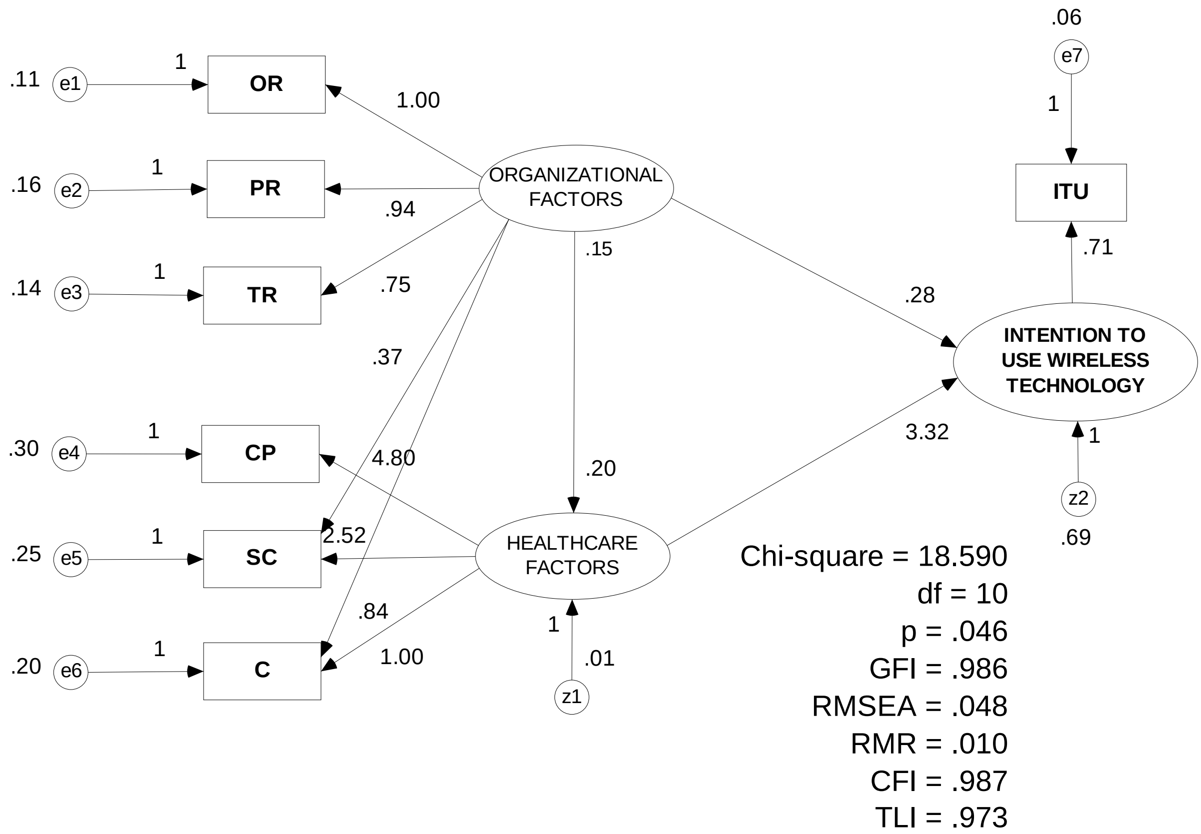
Factor Score Weights (Group number 1 - Default model)

	Q7	Q6	Q5	Q4	Q1
Technical_Readiness	.125	.158	.086	.108	.043

Appendix 18

AMOS actual outputs for structural equations modelling for development of the SEM final models

<u>**Stage 1 SEM model for the wireless technology in healthcare setting**</u>



Notes for Model (Default model)

Computation of degrees of freedom (Default model)

Number of distinct sample moments:	28
Number of distinct parameters to be estimated:	18
Degrees of freedom (28 - 18):	10

Result (Default model)

Minimum was achieved
Chi-square = 18.590
Degrees of freedom = 10
Probability level = .046

Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
HEALTHCARE_FACTORS	<---	ORGANIZATIONAL_FACTORS	.205	.075	2.731	.006	
INTENTION TO_USE WIRELESS_TECHNOLOGY	<---	ORGANIZATIONAL_FACTORS	.278	.260	1.070	.284	
INTENTION TO_USE WIRELESS_TECHNOLOGY	<---	HEALTHCARE_FACTORS	3.318	1.161	2.857	.004	
ITU_FL	<---	INTENTION TO_USE WIRELESS_TECHNOLOGY	.708				
OR_FL	<---	ORGANIZATIONAL_FACTORS	1.000				
SC_FL	<---	HEALTHCARE_FACTORS	2.523	.828	3.048	.002	
TR_FL	<---	ORGANIZATIONAL_FACTORS	.749	.074	10.182	***	
CP_FL	<---	HEALTHCARE_FACTORS	4.797	1.731	2.772	.006	
C_FL	<---	HEALTHCARE_FACTORS	1.000				
C_FL	<---	ORGANIZATIONAL_FACTORS	.840	.128	6.562	***	
PR_FL	<---	ORGANIZATIONAL_FACTORS	.936	.085	10.951	***	
SC_FL	<---	ORGANIZATIONAL_FACTORS	.367	.174	2.112	.035	

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
HEALTHCARE_FACTORS	<---	ORGANIZATIONAL_FACTORS	.565
INTENTION TO_USE WIRELESS_TECHNOLOGY	<---	ORGANIZATIONAL_FACTORS	.108
INTENTION TO_USE WIRELESS_TECHNOLOGY	<---	HEALTHCARE_FACTORS	.468
ITU_FL	<---	INTENTION TO_USE WIRELESS_TECHNOLOGY	.942
OR_FL	<---	ORGANIZATIONAL_FACTORS	.764
SC_FL	<---	HEALTHCARE_FACTORS	.524
TR_FL	<---	ORGANIZATIONAL_FACTORS	.612
CP_FL	<---	HEALTHCARE_FACTORS	.774
C_FL	<---	HEALTHCARE_FACTORS	.227
C_FL	<---	ORGANIZATIONAL_FACTORS	.527
PR_FL	<---	ORGANIZATIONAL_FACTORS	.668
SC_FL	<---	ORGANIZATIONAL_FACTORS	.211

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
ORGANIZATIONAL_FACTORS	.148	.020	7.560	***	
z1	.013	.009	1.530	.126	
z2	.694	.069	9.989	***	
e7	.062				
e4	.299	.074	4.021	***	
e5	.249	.027	9.402	***	
e6	.201	.018	11.243	***	
e1	.106	.013	8.389	***	
e3	.139	.012	11.460	***	
e2	.161	.015	10.650	***	

Squared Multiple Correlations: (Group number 1 - Default model)

	Estimate
HEALTHCARE_FACTORS	.320
INTENTION TO_USE WIRELESS_TECHNOLOGY	.288
PR_FL	.446
TR_FL	.374
C_FL	.464
CP_FL	.599
SC_FL	.444
OR_FL	.584
ITU_FL	.888

Matrices (Group number 1 - Default model)

Implied (for all variables) Covariances (Group number 1 - Default model)

	ORGANIZATIONAL_FACTORS	HEALTHCARE_FACTORS	INTENTION TO_USE WIRELESS_TECHNOLOGY	PR_FL	TR_FL	C_FL	CP_FL	SC_FL	OR_FL	ITU_FL
ORGANIZATIONAL_FACTORS	.148									
HEALTHCARE_FACTORS	.030	.019								
INTENTION TO_USE WIRELESS_TECHNOLOGY	.142	.073	.975							
PR_FL	.139	.028	.133	.291						
TR_FL	.111	.023	.106	.104	.222					
C_FL	.155	.045	.192	.145	.116	.376				
CP_FL	.145	.093	.349	.136	.109	.215	.745			
SC_FL	.131	.060	.235	.122	.098	.170	.288	.449		
OR_FL	.148	.030	.142	.139	.111	.155	.145	.131	.254	
ITU_FL	.100	.051	.690	.094	.075	.136	.247	.167	.100	.550

Implied (for all variables) Correlations (Group number 1 - Default model)

	ORGANIZATIONAL_FACTORS	HEALTHCARE_FACTORS	INTENTION TO_USE WIRELESS_TECHNOLOGY	PR_FL	TR_FL	C_FL	CP_FL	SC_FL	OR_FL	ITU_FL
ORGANIZATIONAL_FACTORS	1.000									
HEALTHCARE_FACTORS	.565	1.000								
INTENTION TO_USE WIRELESS_TECHNOLOGY	.373	.529	1.000							
PR_FL	.668	.378	.249	1.000						
TR_FL	.612	.346	.228	.409	1.000					
C_FL	.655	.525	.317	.438	.401	1.000				
CP_FL	.438	.774	.409	.292	.268	.406	1.000			
SC_FL	.507	.644	.356	.339	.310	.413	.498	1.000		
OR_FL	.764	.432	.285	.511	.467	.501	.334	.388	1.000	
ITU_FL	.351	.498	.942	.235	.215	.298	.386	.335	.268	1.000

Implied Covariances (Group number 1 - Default model)

	PR_FL	TR_FL	C_FL	CP_FL	SC_FL	OR_FL	ITU_FL
PR_FL	.291						
TR_FL	.104	.222					
C_FL	.145	.116	.376				
CP_FL	.136	.109	.215	.745			
SC_FL	.122	.098	.170	.288	.449		
OR_FL	.139	.111	.155	.145	.131	.254	
ITU_FL	.094	.075	.136	.247	.167	.100	.550

Implied Correlations (Group number 1 - Default model)

	PR_FL	TR_FL	C_FL	CP_FL	SC_FL	OR_FL	ITU_FL
PR_FL	1.000						
TR_FL	.409	1.000					
C_FL	.438	.401	1.000				
CP_FL	.292	.268	.406	1.000			
SC_FL	.339	.310	.413	.498	1.000		
OR_FL	.511	.467	.501	.334	.388	1.000	
ITU_FL	.235	.215	.298	.386	.335	.268	1.000

Residual Covariances (Group number 1 - Default model)

	PR_FL	TR_FL	C_FL	CP_FL	SC_FL	OR_FL	ITU_FL
PR_FL	.000						
TR_FL	-.007	.000					
C_FL	-.009	.012	.000				
CP_FL	.001	.028	-.007	.000			
SC_FL	.015	-.008	-.006	.005	.000		
OR_FL	.006	-.002	-.002	-.014	-.001	.000	
ITU_FL	-.012	.008	.031	-.003	-.010	-.009	.000

Standardized Residual Covariances (Group number 1 - Default model)

	PR_FL	TR_FL	C_FL	CP_FL	SC_FL	OR_FL	ITU_FL
PR_FL	.000						
TR_FL	-.467	.000					
C_FL	-.465	.715	.000				
CP_FL	.030	1.299	-.234	.000			
SC_FL	.749	-.471	-.276	.160	.000		
OR_FL	.364	-.135	-.100	-.597	-.065	.000	
ITU_FL	-.578	.450	1.244	-.098	-.350	-.458	.000

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	18	18.590	10	.046	1.859
Saturated model	28	.000	0		
Independence model	7	698.494	21	.000	33.262

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.010	.986	.959	.352
Saturated model	.000	1.000		
Independence model	.132	.537	.383	.403

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.973	.944	.988	.973	.987
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.476	.464	.470
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	8.590	.155	24.790
Saturated model	.000	.000	.000
Independence model	677.494	594.872	767.525

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	.050	.023	.000	.066
Saturated model	.000	.000	.000	.000
Independence model	1.873	1.816	1.595	2.058

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.048	.006	.082	.492
Independence model	.294	.276	.313	.000

AIC

Model	AIC	BCC	BIC	CAIC
Default model	54.590	55.379	125.226	143.226
Saturated model	56.000	57.227	165.879	193.879
Independence model	712.494	712.801	739.964	746.964

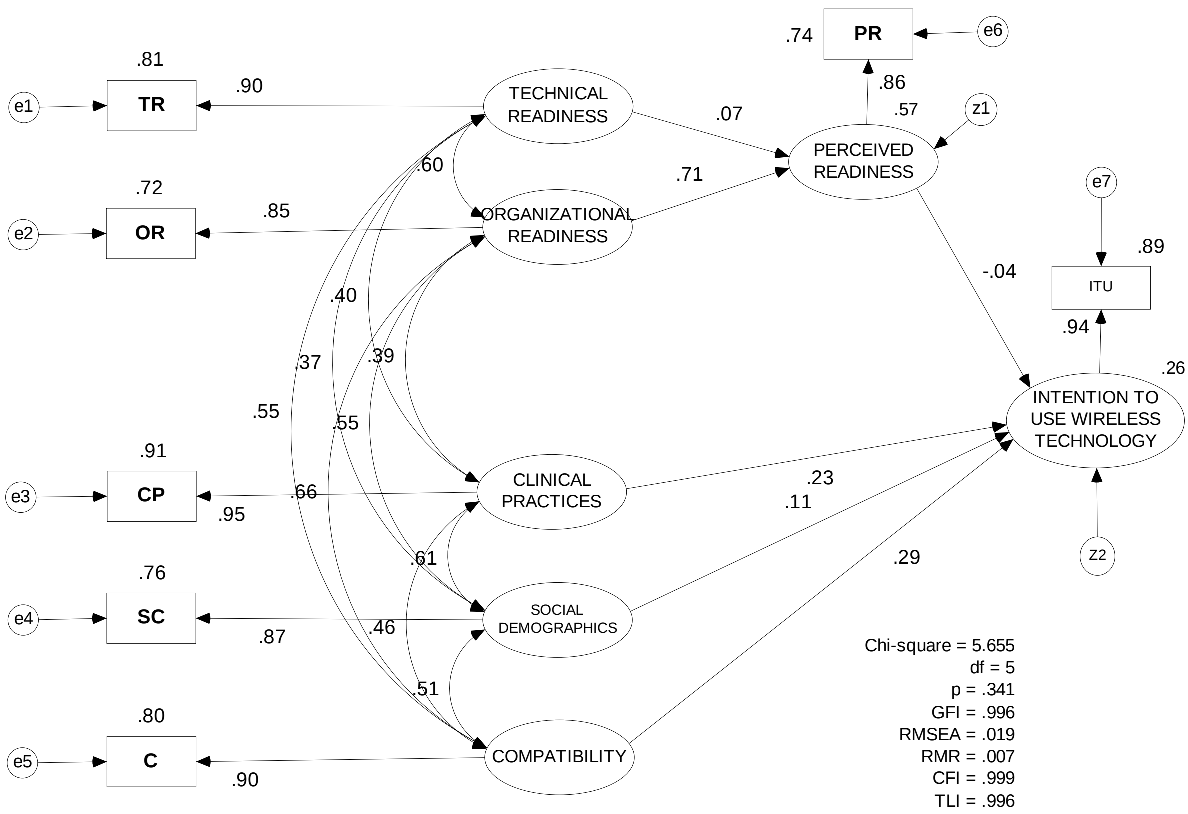
ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	.146	.124	.190	.148
Saturated model	.150	.150	.150	.153
Independence model	1.910	1.689	2.152	1.911

HOELTER

Model	HOELTER .05	HOELTER .01
Default model	368	466
Independence model	18	21

Stage 2 SEM model for the wireless technology in healthcare setting



Notes for Model (Default model)

Computation of degrees of freedom (Default model)

Number of distinct sample moments:	28
Number of distinct parameters to be estimated:	23
Degrees of freedom (28 - 23):	5

Result (Default model)

Minimum was achieved
Chi-square = 5.655
Degrees of freedom = 5
Probability level = .341

Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
PERCEIVED_READINESS	<---	ORGANIZATIONAL_READINESS	.718	.086	8.380	***	
PERCEIVED_READINESS	<---	TECHNICAL_READINESS	.068	.082	.830	.407	
INTENTION TO_USE WIRELESS_TECHNOLOGY	<---	CLINICAL_PRACTICES	.234	.073	3.230	.001	
INTENTION TO_USE WIRELESS_TECHNOLOGY	<---	COMPATIBILITY	.289	.077	3.726	***	
INTENTION TO_USE WIRELESS_TECHNOLOGY	<---	SOCIAL_CONTEXT	.112	.086	1.308	.191	
INTENTION TO_USE WIRELESS_TECHNOLOGY	<---	PERCEIVED_READINESS	-.039	.072	-.540	.589	
CP_FL	<---	CLINICAL_PRACTICES	.824				
C_FL	<---	COMPATIBILITY	.550				
SC_FL	<---	SOCIAL_CONTEXT	.586				
OR_FL	<---	ORGANIZATIONAL_READINESS	.429				
TR_FL	<---	TECHNICAL_READINESS	.424				
ITU_FL	<---	INTENTION TO_USE WIRELESS_TECHNOLOGY	.702				
PR_FL	<---	PERCEIVED_READINESS	.464				

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
PERCEIVED_READINESS	<---	ORGANIZATIONAL_READINESS	.713
PERCEIVED_READINESS	<---	TECHNICAL_READINESS	.068
INTENTION TO_USE WIRELESS_TECHNOLOGY	<---	CLINICAL_PRACTICES	.234
INTENTION TO_USE WIRELESS_TECHNOLOGY	<---	COMPATIBILITY	.288
INTENTION TO_USE WIRELESS_TECHNOLOGY	<---	SOCIAL_CONTEXT	.112
INTENTION TO_USE WIRELESS_TECHNOLOGY	<---	PERCEIVED_READINESS	-.039
CP_FL	<---	CLINICAL_PRACTICES	.954
C_FL	<---	COMPATIBILITY	.895
SC_FL	<---	SOCIAL_CONTEXT	.873
OR_FL	<---	ORGANIZATIONAL_READINESS	.849
TR_FL	<---	TECHNICAL_READINESS	.898
ITU_FL	<---	INTENTION TO_USE WIRELESS_TECHNOLOGY	.944
PR_FL	<---	PERCEIVED_READINESS	.859

Covariances: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
COMPATIBILITY	<-->	TECHNICAL_READINESS	.548	.070	7.814	***	
SOCIAL_CONTEXT	<-->	TECHNICAL_READINESS	.365	.069	5.321	***	
CLINICAL_PRACTICES	<-->	TECHNICAL_READINESS	.394	.064	6.192	***	
CLINICAL_PRACTICES	<-->	COMPATIBILITY	.459	.065	7.065	***	
COMPATIBILITY	<-->	ORGANIZATIONAL_READINESS	.656	.075	8.804	***	
SOCIAL_CONTEXT	<-->	ORGANIZATIONAL_READINESS	.546	.073	7.438	***	
CLINICAL_PRACTICES	<-->	ORGANIZATIONAL_READINESS	.389	.065	5.976	***	
CLINICAL_PRACTICES	<-->	SOCIAL_CONTEXT	.607	.070	8.736	***	
COMPATIBILITY	<-->	SOCIAL_CONTEXT	.508	.071	7.141	***	
ORGANIZATIONAL_READINESS	<-->	TECHNICAL_READINESS	.599	.074	8.085	***	

Correlations: (Group number 1 - Default model)

			Estimate
COMPATIBILITY	<-->	TECHNICAL_READINESS	.550
SOCIAL_CONTEXT	<-->	TECHNICAL_READINESS	.366
CLINICAL_PRACTICES	<-->	TECHNICAL_READINESS	.395
CLINICAL_PRACTICES	<-->	COMPATIBILITY	.460
COMPATIBILITY	<-->	ORGANIZATIONAL_READINESS	.664
SOCIAL_CONTEXT	<-->	ORGANIZATIONAL_READINESS	.552
CLINICAL_PRACTICES	<-->	ORGANIZATIONAL_READINESS	.393
CLINICAL_PRACTICES	<-->	SOCIAL_CONTEXT	.609
COMPATIBILITY	<-->	SOCIAL_CONTEXT	.509
ORGANIZATIONAL_READINESS	<-->	TECHNICAL_READINESS	.605

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
CLINICAL_PRACTICES	.997	.080	12.424	***	
COMPATIBILITY	.996	.091	10.945	***	
SOCIAL_CONTEXT	.997	.096	10.398	***	
ORGANIZATIONAL_READINESS	.982	.100	9.863	***	
TECHNICAL_READINESS	.997	.091	11.003	***	
z1	.427	.069	6.188	***	
Z2	.740	.065	11.348	***	
e3	.067				
e2	.070				
e6	.076				
e1	.043				
e5	.075				
e7	.060				
e4	.107				

Squared Multiple Correlations: (Group number 1 - Default model)

	Estimate
PERCEIVED_READINESS	.571
INTENTION TO_USE WIRELESS_TECHNOLOGY	.258
ITU_FL	.892
TR_FL	.806
OR_FL	.720
SC_FL	.761
C_FL	.801
PR_FL	.738
CP_FL	.910

Matrices (Group number 1 - Default model)

Implied (for all variables) Covariances (Group number 1 - Default model)

	TECHNICAL_READINESS	ORGANIZATIONAL_READINESS	SOCIAL_CONTEXT	COMPATIBILITY	CLINICAL_PRACTICES	PERCEIVED_READINESS	INTENTION TO_USE WIRELESS_TECHNOLOGY	ITU_FL	TR_FL	OR_FL	SC_FL	C_FL	PR_FL	CP_FL
TECHNICAL_READINESS	.997													
ORGANIZATIONAL_READINESS	.599	.982												
SOCIAL_CONTEXT	.365	.546	.997											
COMPATIBILITY	.548	.656	.508	.996										
CLINICAL_PRACTICES	.394	.389	.607	.459	.997									
PERCEIVED_READINESS	.497	.745	.417	.508	.306	.996								
INTENTION TO_USE WIRELESS_TECHNOLOGY	.272	.313	.384	.432	.422	.226	.998							
ITU_FL	.191	.219	.270	.303	.296	.159	.700	.551						
TR_FL	.422	.254	.155	.232	.167	.211	.115	.081	.222					
OR_FL	.257	.421	.234	.282	.167	.320	.134	.094	.109	.251				
SC_FL	.213	.320	.584	.297	.356	.244	.225	.158	.090	.137	.449			
C_FL	.301	.361	.279	.548	.252	.279	.238	.167	.128	.155	.164	.376		
PR_FL	.231	.346	.193	.236	.142	.462	.105	.074	.098	.148	.113	.130	.291	
CP_FL	.325	.321	.501	.378	.822	.252	.348	.244	.138	.138	.293	.208	.117	.745

Implied (for all variables) Correlations (Group number 1 - Default model)

	TECHNICAL_ READINESS	ORGANIZATION AL_READINESS	SOCIAL_ CONTEXT	COMPA TIBILITY	CLINICAL_ PRACTICES	PERCEIVED_ READINESS	INTENTION TO_USE WIRELESS_T ECHNOLOGY	ITU _FL	TR _F L	OR _FL	SC _F L	C _F L	PR _F L	CP _F L
TECHNICAL_REA DINESS	1.000													
ORGANIZATION AL_READINESS	.605	1.000												
SOCIAL_CONTE XT	.366	.552	1.000											
COMPATIBILITY	.550	.664	.509	1.000										
CLINICAL_PRAC TICES	.395	.393	.609	.460	1.000									
PERCEIVED_REA DINESS	.499	.754	.418	.510	.307	1.000								
INTENTION TO_USE WIRELESS_TECH NOLOGY	.273	.316	.385	.433	.423	.227	1.000							
ITU_FL	.257	.298	.364	.409	.400	.214	.944	1.000						
TR_FL	.898	.543	.328	.493	.355	.448	.245	.231	1.000					
OR_FL	.513	.849	.469	.563	.333	.640	.268	.253	.461	1.000				
SC_FL	.319	.482	.873	.445	.532	.365	.336	.317	.286	.409	1.000			
C_FL	.492	.594	.456	.895	.412	.457	.388	.366	.442	.504	.398	1.00		
PR_FL	.429	.647	.359	.438	.264	.859	.195	.184	.385	.550	.314	.392	1.000	
CP_FL	.377	.375	.581	.439	.954	.293	.404	.381	.338	.318	.507	.393	.251	1.000

Implied Covariances (Group number 1 - Default model)

	ITU_FL	TR_FL	OR_FL	SC_FL	C_FL	PR_FL	CP_FL
ITU_FL	.551						
TR_FL	.081	.222					
OR_FL	.094	.109	.251				
SC_FL	.158	.090	.137	.449			
C_FL	.167	.128	.155	.164	.376		
PR_FL	.074	.098	.148	.113	.130	.291	
CP_FL	.244	.138	.138	.293	.208	.117	.745

Implied Correlations (Group number 1 - Default model)

	ITU_FL	TR_FL	OR_FL	SC_FL	C_FL	PR_FL	CP_FL
ITU_FL	1.000						
TR_FL	.231	1.000					
OR_FL	.253	.461	1.000				
SC_FL	.317	.286	.409	1.000			
C_FL	.366	.442	.504	.398	1.000		
PR_FL	.184	.385	.550	.314	.392	1.000	
CP_FL	.381	.338	.318	.507	.393	.251	1.000

Residual Covariances (Group number 1 - Default model)

	ITU_FL	TR_FL	OR_FL	SC_FL	C_FL	PR_FL	CP_FL
ITU_FL	-.001						
TR_FL	.003	.000					
OR_FL	-.003	.000	.003				
SC_FL	-.001	-.001	-.008	.000			
C_FL	.000	.000	-.002	.000	.000		
PR_FL	.008	-.001	-.004	.024	.006	.000	
CP_FL	-.001	.000	-.006	.000	.000	.020	.000

Standardized Residual Covariances (Group number 1 - Default model)

	ITU_FL	TR_FL	OR_FL	SC_FL	C_FL	PR_FL	CP_FL
ITU_FL	-.013						
TR_FL	.142	.001					
OR_FL	-.150	.020	.143				
SC_FL	-.023	-.032	-.412	.000			
C_FL	-.018	-.018	-.114	.000	.001		
PR_FL	.379	-.040	-.255	1.220	.346	.000	
CP_FL	-.021	-.021	-.272	.000	.001	.796	.000

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	23	5.655	5	.341	1.131
Saturated model	28	.000	0		
Independence model	7	698.494	21	.000	33.262

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.007	.996	.975	.178
Saturated model	.000	1.000		
Independence model	.132	.537	.383	.403

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.992	.966	.999	.996	.999
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.238	.236	.238
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	.655	.000	10.856
Saturated model	.000	.000	.000
Independence model	677.494	594.872	767.525

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	.015	.002	.000	.029
Saturated model	.000	.000	.000	.000
Independence model	1.873	1.816	1.595	2.058

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.019	.000	.076	.754
Independence model	.294	.276	.313	.000

AIC

Model	AIC	BCC	BIC	CAIC
Default model	51.655	52.663	141.912	164.912
Saturated model	56.000	57.227	165.879	193.879
Independence model	712.494	712.801	739.964	746.964

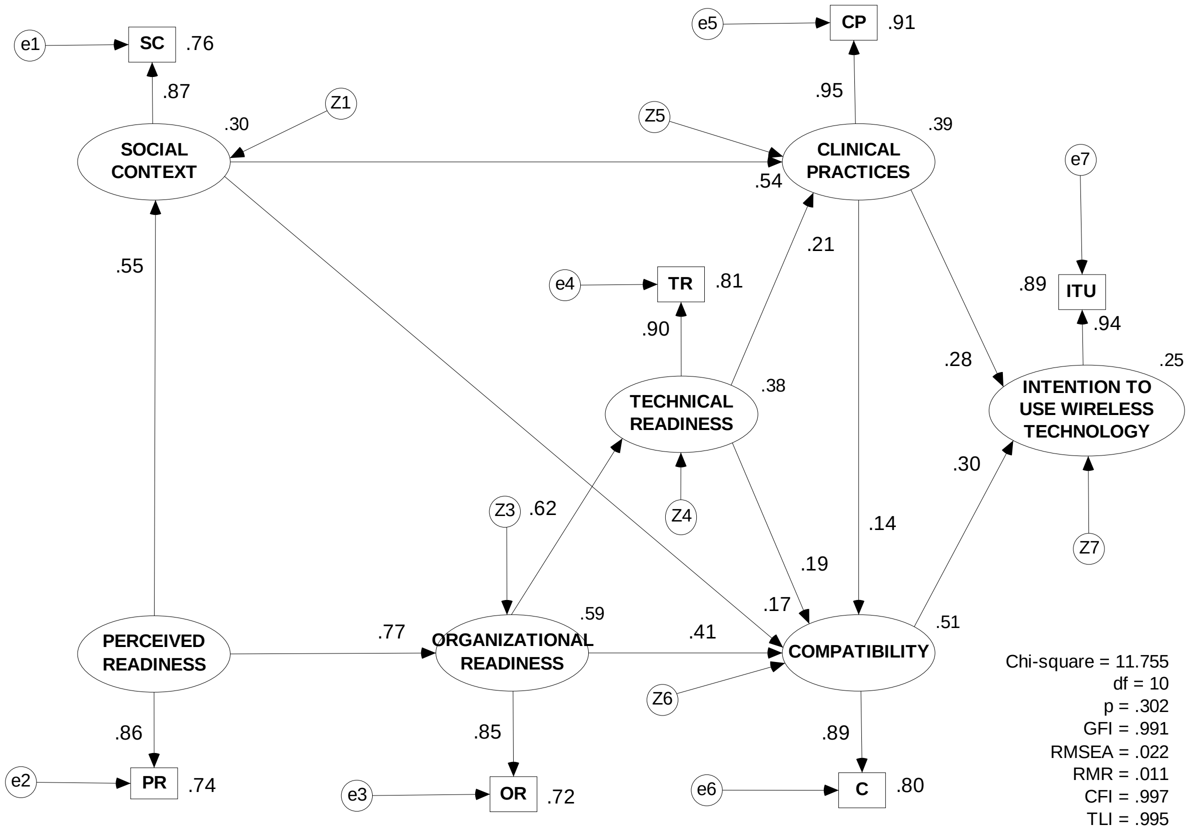
ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	.138	.137	.166	.141
Saturated model	.150	.150	.150	.153
Independence model	1.910	1.689	2.152	1.911

HOELTER

Model	HOELTER .05	HOELTER .01
Default model	731	996
Independence model	18	21

Stage 3 SEM model for the wireless technology in healthcare setting



Notes for Model (Default model)

Computation of degrees of freedom (Default model)

Number of distinct sample moments:	28
Number of distinct parameters to be estimated:	18
Degrees of freedom (28 - 18):	10

Result (Default model)

Minimum was achieved
Chi-square = 11.755
Degrees of freedom = 10
Probability level = .302

Estimates (Group number 1 - Default model)

Scalar Estimates (Group number 1 - Default model)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
ORGANIZATIONAL_READINESS	<---	PERCEIVED_READINESS	.770	.061	12.718	***	
SOCIAL_CONTEXT	<---	PERCEIVED_READINESS	.551	.063	8.794	***	
TECHNICAL_READINESS	<---	ORGANIZATIONAL_READINESS	.622	.060	10.361	***	
CLINICAL_PRACTICES	<---	SOCIAL_CONTEXT	.534	.056	9.566	***	
CLINICAL_PRACTICES	<---	TECHNICAL_READINESS	.212	.053	3.975	***	
COMPATIBILITY	<---	ORGANIZATIONAL_READINESS	.409	.085	4.834	***	
COMPATIBILITY	<---	CLINICAL_PRACTICES	.138	.069	2.001	.045	
COMPATIBILITY	<---	TECHNICAL_READINESS	.185	.077	2.417	.016	
COMPATIBILITY	<---	SOCIAL_CONTEXT	.170	.077	2.217	.027	
INTENTION TO_USE WIRELESS_TECHNOLOGY	<---	CLINICAL_PRACTICES	.285	.060	4.730	***	
INTENTION TO_USE WIRELESS_TECHNOLOGY	<---	COMPATIBILITY	.304	.063	4.784	***	
ITU_FL	<---	INTENTION TO_USE WIRELESS_TECHNOLOGY	.702				
CP_FL	<---	CLINICAL_PRACTICES	.824				
C_FL	<---	COMPATIBILITY	.550				
OR_FL	<---	ORGANIZATIONAL_READINESS	.429				
SC_FL	<---	SOCIAL_CONTEXT	.586				
PR_FL	<---	PERCEIVED_READINESS	.464				
TR_FL	<---	TECHNICAL_READINESS	.424				

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
ORGANIZATIONAL_READINESS	<---	PERCEIVED_READINESS	.768
SOCIAL_CONTEXT	<---	PERCEIVED_READINESS	.546
TECHNICAL_READINESS	<---	ORGANIZATIONAL_READINESS	.619
CLINICAL_PRACTICES	<---	SOCIAL_CONTEXT	.538
CLINICAL_PRACTICES	<---	TECHNICAL_READINESS	.213
COMPATIBILITY	<---	ORGANIZATIONAL_READINESS	.410
COMPATIBILITY	<---	CLINICAL_PRACTICES	.138
COMPATIBILITY	<---	TECHNICAL_READINESS	.186
COMPATIBILITY	<---	SOCIAL_CONTEXT	.171
INTENTION TO_USE WIRELESS_TECHNOLOGY	<---	CLINICAL_PRACTICES	.284
INTENTION TO_USE WIRELESS_TECHNOLOGY	<---	COMPATIBILITY	.302
ITU_FL	<---	INTENTION TO_USE WIRELESS_TECHNOLOGY	.944
CP_FL	<---	CLINICAL_PRACTICES	.953
C_FL	<---	COMPATIBILITY	.894
OR_FL	<---	ORGANIZATIONAL_READINESS	.849
SC_FL	<---	SOCIAL_CONTEXT	.873
PR_FL	<---	PERCEIVED_READINESS	.857
TR_FL	<---	TECHNICAL_READINESS	.898

Variances: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
PERCEIVED_READINESS	.981	.098	10.055	***	
Z3	.405	.067	6.023	***	
Z4	.615	.071	8.678	***	
Z1	.701	.079	8.815	***	

	Estimate	S.E.	C.R.	P	Label
Z5	.595	.057	10.369	***	
Z6	.484	.058	8.308	***	
Z7	.745	.065	11.392	***	
e5	.067				
e3	.070				
e2	.076				
e4	.043				
e6	.075				
e7	.060				
e1	.107				

Squared Multiple Correlations: (Group number 1 - Default model)

	Estimate
ORGANIZATIONAL_READINESS	.589
TECHNICAL_READINESS	.384
SOCIAL_CONTEXT	.298
CLINICAL_PRACTICES	.395
COMPATIBILITY	.507
INTENTION TO_USE WIRELESS_TECHNOLOGY	.249
TR_FL	.806
PR_FL	.735
SC_FL	.762
OR_FL	.721
C_FL	.799
CP_FL	.909
ITU_FL	.891

Matrices (Group number 1 - Default model)

Implied (for all variables) Covariances (Group number 1 - Default model)

	PERCEIVED_READINESS	ORGANIZATIONAL_READINESS	TECHNICAL_READINESS	SOCIAL_CONTEXT	CLINICAL_PRACTICES	COMPATIBILITY	INTENTION TO_USE WIRELESS_TECHNOLOGY	TR_FL	PR_FL	SC_FL	OR_FL	C_FL	CP_FL	ITU_FL
PERCEIVED_READINESS	.981													
ORGANIZATIONAL_READINESS	.756	.988												
TECHNICAL_READINESS	.470	.615	.997											
SOCIAL_CONTEXT	.540	.416	.259	.998										
CLINICAL_PRACTICES	.388	.352	.350	.588	.983									
COMPATIBILITY	.541	.636	.528	.469	.444	.983								
INTENTION TO_USE WIRELESS_TECHNOLOGY	.275	.294	.260	.310	.415	.425	.992							
TR_FL	.199	.261	.423	.110	.148	.224	.110	.222						
PR_FL	.455	.351	.218	.251	.180	.251	.128	.092	.287					
SC_FL	.316	.244	.152	.584	.344	.274	.182	.064	.147	.449				
OR_FL	.324	.424	.264	.179	.151	.273	.126	.112	.150	.105	.252			
C_FL	.298	.350	.290	.258	.244	.540	.234	.123	.138	.151	.150	.372		
CP_FL	.320	.291	.288	.485	.810	.366	.342	.122	.148	.284	.125	.201	.735	
ITU_FL	.193	.206	.182	.217	.291	.298	.696	.077	.090	.127	.088	.164	.240	.548

Implied (for all variables) Correlations (Group number 1 - Default model)

	PERCEIVED_READINESS	ORGANIZATIONAL_READINESS	TECHNICAL_READINESS	SOCIAL_CONTEXT	CLINICAL_PRACTICES	COMPATIBILITY	INTENTION TO_USE WIRELESS_TECHNOLOGY	TR_FL	PR_FL	SC_FL	OR_FL	C_FL	CP_FL	ITU_FL
PERCEIVED_READINESS	1.000													
ORGANIZATIONAL_READINESS	.768	1.000												
TECHNICAL_READINESS	.475	.619	1.000											
SOCIAL_CONTEXT	.546	.419	.260	1.000										
CLINICAL_PRACTICES	.395	.358	.353	.594	1.000									
COMPATIBILITY	.551	.646	.533	.473	.452	1.000								
INTENTION TO_USE WIRELESS_TECHNOLOGY	.279	.297	.261	.312	.420	.430	1.000							
TR_FL	.427	.556	.898	.233	.317	.479	.235	1.000						
PR_FL	.857	.658	.408	.468	.339	.472	.239	.366	1.000					
SC_FL	.476	.366	.226	.873	.518	.413	.272	.203	.408	1.000				
OR_FL	.652	.849	.526	.356	.304	.549	.252	.472	.559	.311	1.000			
C_FL	.493	.578	.477	.423	.404	.894	.385	.428	.422	.369	.491	1.00(		
CP_FL	.377	.341	.337	.566	.953	.431	.401	.302	.323	.494	.290	.385	1.000	
ITU_FL	.263	.280	.247	.294	.397	.406	.944	.221	.226	.257	.238	.363	.378	1.000

Implied Covariances (Group number 1 - Default model)

	TR_FL	PR_FL	SC_FL	OR_FL	C_FL	CP_FL	ITU_FL
TR_FL	.222						
PR_FL	.092	.287					
SC_FL	.064	.147	.449				
OR_FL	.112	.150	.105	.252			
C_FL	.123	.138	.151	.150	.372		
CP_FL	.122	.148	.284	.125	.201	.735	
ITU_FL	.077	.090	.127	.088	.164	.240	.548

Implied Correlations (Group number 1 - Default model)

	TR_FL	PR_FL	SC_FL	OR_FL	C_FL	CP_FL	ITU_FL
TR_FL	1.000						
PR_FL	.366	1.000					
SC_FL	.203	.408	1.000				
OR_FL	.472	.559	.311	1.000			
C_FL	.428	.422	.369	.491	1.000		
CP_FL	.302	.323	.494	.290	.385	1.000	
ITU_FL	.221	.226	.257	.238	.363	.378	1.000

Residual Covariances (Group number 1 - Default model)

	TR_FL	PR_FL	SC_FL	OR_FL	C_FL	CP_FL	ITU_FL
TR_FL	.000						
PR_FL	.005	.003					
SC_FL	.026	-.010	-.001				
OR_FL	-.003	-.006	.025	.002			
C_FL	.004	-.002	.013	.003	.004		
CP_FL	.015	-.012	.009	.006	.007	.010	
ITU_FL	.006	-.008	.030	.003	.002	.003	.002

Standardized Residual Covariances (Group number 1 - Default model)

	TR_FL	PR_FL	SC_FL	OR_FL	C_FL	CP_FL	ITU_FL
TR_FL	-.004						
PR_FL	.339	.156					
SC_FL	1.537	-.476	-.016				
OR_FL	-.195	-.382	1.373	.089			
C_FL	.272	-.110	.558	.152	.155		
CP_FL	.688	-.469	.285	.279	.235	.178	
ITU_FL	.333	-.378	1.125	.136	.093	.093	.062

Total Effects (Group number 1 - Default model)

	PERCEIVED_READINESS	ORGANIZATIONAL_READINESS	TECHNICAL_READINESS	SOCIAL_CONTEXT	CLINICAL_PRACTICES	COMPATIBILITY
ORGANIZATIONAL_READINESS	.770	.000	.000	.000	.000	.000
TECHNICAL_READINESS	.479	.622	.000	.000	.000	.000
SOCIAL_CONTEXT	.551	.000	.000	.000	.000	.000
CLINICAL_PRACTICES	.396	.132	.212	.534	.000	.000
COMPATIBILITY	.552	.542	.214	.244	.138	.000
INTENTION TO_USE WIRELESS_TECHNOLOGY	.280	.202	.125	.226	.327	.304
TR_FL	.203	.264	.424	.000	.000	.000
PR_FL	.464	.000	.000	.000	.000	.000
SC_FL	.322	.000	.000	.586	.000	.000
OR_FL	.331	.429	.000	.000	.000	.000
C_FL	.303	.298	.118	.134	.076	.550
CP_FL	.326	.109	.175	.440	.824	.000
ITU_FL	.197	.142	.088	.159	.229	.213

Standardized Total Effects (Group number 1 - Default model)

	PERCEIVED_READINESS	ORGANIZATIONAL_READINESS	TECHNICAL_READINESS	SOCIAL_CONTEXT	CLINICAL_PRACTICES	COMPATIBILITY
ORGANIZATIONAL_READINESS	.768	.000	.000	.000	.000	.000
TECHNICAL_READINESS	.475	.619	.000	.000	.000	.000
SOCIAL_CONTEXT	.546	.000	.000	.000	.000	.000

	PERCEIVED_READINESS	ORGANIZATIONAL_READINESS	TECHNICAL_READINESS	SOCIAL_CONTEXT	CLINICAL_PRACTICES	COMPATIBILITY
CLINICAL_PRACTICES	.395	.132	.213	.538	.000	.000
COMPATIBILITY	.551	.543	.216	.245	.138	.000
INTENTION TO_USE WIRELESS_TECHNOLOGY	.279	.202	.126	.227	.326	.302
TR_FL	.427	.556	.898	.000	.000	.000
PR_FL	.857	.000	.000	.000	.000	.000
SC_FL	.476	.000	.000	.873	.000	.000
OR_FL	.652	.849	.000	.000	.000	.000
C_FL	.493	.486	.193	.219	.123	.894
CP_FL	.377	.126	.203	.513	.953	.000
ITU_FL	.263	.190	.119	.214	.307	.285

Direct Effects (Group number 1 - Default model)

	PERCEIVED_READINESS	ORGANIZATIONAL_READINESS	TECHNICAL_READINESS	SOCIAL_CONTEXT	CLINICAL_PRACTICES	COMPATIBILITY
ORGANIZATIONAL_READINESS	.770	.000	.000	.000	.000	.000
TECHNICAL_READINESS	.000	.622	.000	.000	.000	.000
SOCIAL_CONTEXT	.551	.000	.000	.000	.000	.000
CLINICAL_PRACTICES	.000	.000	.212	.534	.000	.000
COMPATIBILITY	.000	.409	.185	.170	.138	.000
INTENTION TO_USE WIRELESS_TECHNOLOGY	.000	.000	.000	.000	.285	.304
TR_FL	.000	.000	.424	.000	.000	.000

	PERCEIVED_READINESS	ORGANIZATIONAL_READINESS	TECHNICAL_READINESS	SOCIAL_CONTEXT	CLINICAL_PRACTICES	COMPATIBILITY
PR_FL	.464	.000	.000	.000	.000	.000
SC_FL	.000	.000	.000	.586	.000	.000
OR_FL	.000	.429	.000	.000	.000	.000
C_FL	.000	.000	.000	.000	.000	.550
CP_FL	.000	.000	.000	.000	.824	.000
ITU_FL	.000	.000	.000	.000	.000	.000

Standardized Direct Effects (Group number 1 - Default model)

	PERCEIVED_READINESS	ORGANIZATIONAL_READINESS	TECHNICAL_READINESS	SOCIAL_CONTEXT	CLINICAL_PRACTICES	COMPATIBILITY
ORGANIZATIONAL_READINESS	.768	.000	.000	.000	.000	.000
TECHNICAL_READINESS	.000	.619	.000	.000	.000	.000
SOCIAL_CONTEXT	.546	.000	.000	.000	.000	.000
CLINICAL_PRACTICES	.000	.000	.213	.538	.000	.000
COMPATIBILITY	.000	.410	.186	.171	.138	.000
INTENTION TO_USE WIRELESS_TECHNOLOGY	.000	.000	.000	.000	.284	.302
TR_FL	.000	.000	.898	.000	.000	.000
PR_FL	.857	.000	.000	.000	.000	.000
SC_FL	.000	.000	.000	.873	.000	.000
OR_FL	.000	.849	.000	.000	.000	.000
C_FL	.000	.000	.000	.000	.000	.894
CP_FL	.000	.000	.000	.000	.953	.000
ITU_FL	.000	.000	.000	.000	.000	.000

Indirect Effects (Group number 1 - Default model)

	PERCEIVED_READINESS	ORGANIZATIONAL_READINESS	TECHNICAL_READINESS	SOCIAL_CONTEXT	CLINICAL_PRACTICES	COMPATIBILITY
ORGANIZATIONAL_READINESS	.000	.000	.000	.000	.000	.000
TECHNICAL_READINESS	.479	.000	.000	.000	.000	.000
SOCIAL_CONTEXT	.000	.000	.000	.000	.000	.000
CLINICAL_PRACTICES	.396	.132	.000	.000	.000	.000
COMPATIBILITY	.552	.133	.029	.073	.000	.000
INTENTION TO_USE WIRELESS_TECHNOLOGY	.280	.202	.125	.226	.042	.000
TR_FL	.203	.264	.000	.000	.000	.000
PR_FL	.000	.000	.000	.000	.000	.000
SC_FL	.322	.000	.000	.000	.000	.000
OR_FL	.331	.000	.000	.000	.000	.000
C_FL	.303	.298	.118	.134	.076	.000
CP_FL	.326	.109	.175	.440	.000	.000
ITU_FL	.197	.142	.088	.159	.229	.213

Standardized Indirect Effects (Group number 1 - Default model)

	PERCEIVED_READINESS	ORGANIZATIONAL_READINESS	TECHNICAL_READINESS	SOCIAL_CONTEXT	CLINICAL_PRACTICES	COMPATIBILITY
ORGANIZATIONAL_READINESS	.000	.000	.000	.000	.000	.000
TECHNICAL_READINESS	.475	.000	.000	.000	.000	.000
SOCIAL_CONTEXT	.000	.000	.000	.000	.000	.000
CLINICAL_PRACTIC	.395	.132	.000	.000	.000	.000

	PERCEIVED_READINESS	ORGANIZATIONAL_READINESS	TECHNICAL_READINESS	SOCIAL_CONTEXT	CLINICAL_PRACTICES	COMPATIBILITY
ES COMPATIBILITY	.551	.134	.029	.074	.000	.000
INTENTION TO_USE WIRELESS _TECHNOLOGY	.279	.202	.126	.227	.042	.000
TR_FL	.427	.556	.000	.000	.000	.000
PR_FL	.000	.000	.000	.000	.000	.000
SC_FL	.476	.000	.000	.000	.000	.000
OR_FL	.652	.000	.000	.000	.000	.000
C_FL	.493	.486	.193	.219	.123	.000
CP_FL	.377	.126	.203	.513	.000	.000
ITU_FL	.263	.190	.119	.214	.307	.285

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	18	11.755	10	.302	1.175
Saturated model	28	.000	0		
Independence model	7	698.494	21	.000	33.262

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.011	.991	.975	.354
Saturated model	.000	1.000		
Independence model	.132	.537	.383	.403

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.983	.965	.997	.995	.997
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.476	.468	.475
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	1.755	.000	14.582
Saturated model	.000	.000	.000
Independence model	677.494	594.872	767.525

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	.032	.005	.000	.039
Saturated model	.000	.000	.000	.000
Independence model	1.873	1.816	1.595	2.058

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.022	.000	.063	.847
Independence model	.294	.276	.313	.000

AIC

Model	AIC	BCC	BIC	CAIC
Default model	47.755	48.544	118.391	136.391
Saturated model	56.000	57.227	165.879	193.879
Independence model	712.494	712.801	739.964	746.964

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Default model	.128	.123	.162	.130
Saturated model	.150	.150	.150	.153
Independence model	1.910	1.689	2.152	1.911

HOELTER

Model	HOELTER .05	HOELTER .01
Default model	581	737
Independence model	18	21