

A Research Model of Consumers' Adoption and Continued Use of the Personally Controlled Electronic Health Record (PCEHR) System

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Abstract

Built on Xu and Quaddus's³⁹ model of adoption and continued use of knowledge management systems, this paper develops a model of Australian consumers' adoption and use of the Personally Controlled Electronic Health Record (PCEHR) system. Factors and variables of the developed model are discussed in detail, and hypotheses arising from the proposed model are developed as well. The developed model has both empirical and practical implications. It can be adapted for e-health applications in various contexts and different countries.

Keywords: Adoption, Continued Use, PCEHR System, E-health, Australian Consumers.

1. Introduction

With the exponential growth of Internet penetration coupled with advances in technologies, the e-health movement has been introduced and accepted as an essential and important element in healthcare systems. The adoption of e-health initiatives is expected to bring a paradigm shift in traditional healthcare systems by reducing medical errors, enhancing healthcare quality, minimising healthcare costs, and empowering consumers to understand their healthcare needs and make informed decisions on their healthcare. As a health information source, electronic health records (EHRs) underpin all the other e-health initiatives. Meanwhile, according to Department of Health and Ageing¹⁷ on average, every year an Australian has "22 interactions with healthcare providers, including 4 visits to GPs, 12 prescriptions, 3 visits to specialists", and most of the information of these interactions has been held in paper-based files or non-shared databases. The medical information may be inconsistent between files, inaccurate because of lack of standards, incorrect because of manual operation, and is often not available in emergency situations. It is estimated that 5,000 Australians die each year due to adverse medical events;

18% of medical errors in Australia occur from inadequate information; nearly 30% of unplanned hospital admissions are associated with prescription errors; and approximately 13% of healthcare provider consultations suffer missing information^{5,10,31}. Patients may need to undergo the same tests with different healthcare providers. It is not unusual that the same questions are asked every time when patients deal with a different provider. A solution to these problems is electronic health records (i.e., the PCEHR system in Australia), which can include such information as the patient's prescribed medications, test results, care plans, immunisation records, health alerts, event summaries, discharge summaries, Medicare data, and personal data. Real-time and convenient access to such information will improve the quality of healthcare, especially in emergency situations and special conditions³⁷.

It is widely believed in Australia the successful implementation of PCEHR system could provide great opportunities to improve the quality and safety of healthcare; reduce costs; improve continuity and health outcomes for patients; save lives, time, and money; make the Australian health system more efficient; and provide every Australian with equitable access to healthcare^{5,10}. In addition, according to an estimate

based on the economic modelling undertaken by Deloitte Consulting in 2010-2011, the PCEHR system could generate approximately \$11.5 billion in net direct benefits over the period of 2010 to 2025, with \$9.5 billion to Australian governments and \$2 billion to the private sector including public hospitals, GPs, specialists, allied health clinics, private hospitals and private health insurance providers (Department of Health and Ageing¹⁷).

Even though the Australian government has invested significantly in deploying the PCEHR system and its associated infrastructure (including required technological infrastructure, standards, legislations, and others), but the system has not been well received by consumers (see Xu et al. 2012⁴² and Xu et al. 2013⁴³ for discussion of some reported issues/concerns). The current release of the PCEHR system in Australia is far from mature and suffers criticisms from major stakeholders. The system is facing various challenges, and users are not enthusiastic in registering with and using the system. In addition, even in the recent PCEHR review ordered by the Federal government (the report was released in December 2013), the review panel members could have better representation from consumers, and many issues concerning individual users remain to be addressed. Consumer participation in the PCEHR system is essential for adoption and use of the system. At this stage, consumers have not been active in participation for different reasons and various concerns; and the interests of consumers may not have been properly represented in the development and implementation of the PCEHR system. For uncertain reasons, those activities by the National E-health Transition Authority (NEHTA) have not achieved the desired outcomes as evidenced by the current criticism and very low interest from potential system users (both individuals and health care providers).

In addition, there is a lack of comprehensive empirical studies of the current status and challenges/issues as well as the reasons and factors for success and failure of electronic health record systems, especially the PCEHR system. This study aims at addressing the gap via developing a model of adoption and continued use of the PCEHR system among Australian consumers by looking at two research questions:

- What are the factors influencing Australian consumers' decision to adopt the PCEHR system?

- What are the factors influencing Australian consumers' decision of continued use of the PCEHR system?

The outcomes of this research will go some way to answering concerns and issues associated with the PCEHR system and offer some insights and recommendation for significantly improving the efforts in deploying the system and bettering the efficiency of resources required for the implementation.

2. Background

Xu and Quaddus's³⁹ model of Adoption and Continued Use of Knowledge Management Systems (KMSs) (see Figure 1) will be used as the basis to structure the model for individuals' adoption and continued use of the PCEHR system. The model is built on the theory of diffusion of innovations³⁴, theory of reasoned action (TRA)⁴, and technology acceptance model (TAM)¹². These three theories are the primary theoretical foundations for many research projects on IT acceptance and use. While theory of diffusion of innovations focuses on the diffusion process of an innovation, TRA and TAM models attempt to explain the relationship between user attitudes, perceptions, beliefs, and actual use of a technology. Basically TRA and TAM suggest that some external factors influence the perceptions about a knowledge management system, which in turn affect the adoption of the innovation and lead to the use of the system, i.e. "External Factors" >> "Views & Perceptions" >> "Adoption Decision" (for pre-adoption stage) "Facilitating Condition/External Factors" >> Realization of Benefits & Consequences" >> "Continued Use" (for post-adoption stage). This simple model is generic in nature and is likely to be applicable, with some adjustments, in various innovation diffusion processes. This simple research model also serves as the conceptual framework for the development of the PCEHR adoption and continued use model.

Xu and Quaddus's³⁴ pre- and post-adoption model of KMSs is unique, and is different from other IS adoption/diffusion models, which only deal with either pre-adoption stage or post-adoption stage. In the pre-adoption stage, it suggests that external influences, including individual difference factors, organizational factors, task complexity factors, and organic factors, will influence the adoption of knowledge management

systems in an indirect way with their influence being mediated by the perceived benefits (usefulness) and

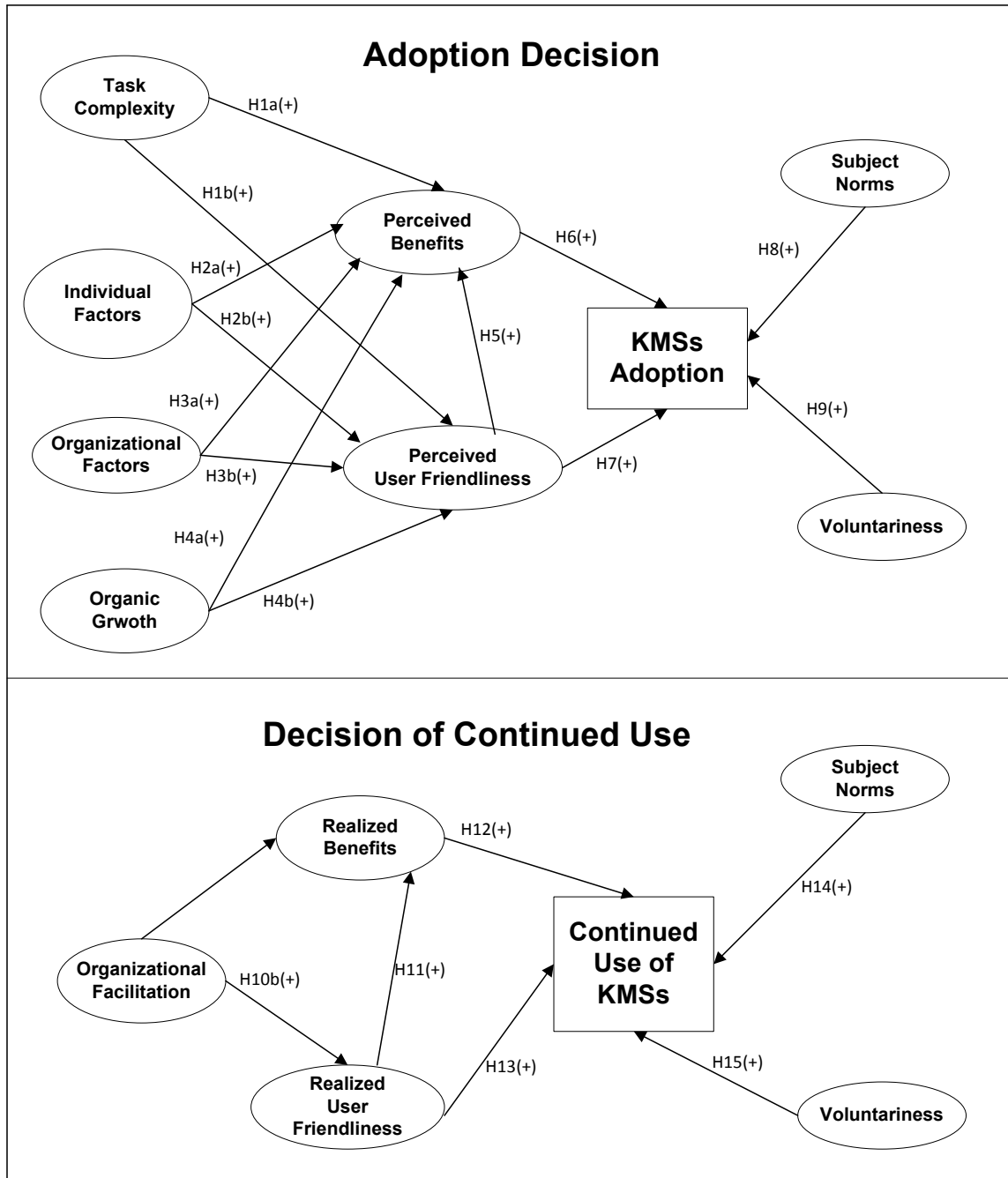


Fig. 1. Xu & Quaddus' Model of Adoption and Continued Use of KMSs

perceived user friendliness (ease of use) of KMSs^{2,4,12,13,23,24,25,27,29,34}. At the same time, the research

model postulates that the perceived factors of perceived benefits, perceived user-friendliness (ease of use),

subject norms (i.e., influence from people who are important to the user⁴), and perceived voluntariness (i.e., the degree of voluntary use³⁰ have direct effect on the adoption of KMSs. Also as per TAM^{12,13,14,15}, perceived user friendliness affects perceived usefulness. In the post-adoption stage, it is suggested that organizational facilitation factors will influence the continued use of knowledge management systems in an indirect way with their influence being mediated by the realized benefits (usefulness) and realized user friendliness (ease of use) of KMSs^{2,4,12,13,23,24,25,27,29,34}. At the same time, the research model postulates that realized benefits, realized user-friendliness (ease of use), subject norms, and voluntariness, have a direct effect on the continued use of KMSs. Also as per TAM^{12,13,14,15}, realized user friendliness affects realized usefulness.

3. The Research Model

Using Xu and Quaddus's³⁹ model as the basis, a research model of adoption and continued use of PCEHR system is developed. The research model (see Figure-2) includes two parts: (1) pre-adoption stage and post-adoption stage (see Figure-2).

In the pre-adoption stage, it suggests that the external factors including external environment & influences, individual differences, and PCEHR system characteristics will influence the adoption of the PCEHR systems in an indirect way with their influence being mediated by the perceived benefits (usefulness) and perceived user friendliness (ease of use) of the system. At the same time, the research model postulates that perceived benefits, perceived user-friendliness (ease of use), subject norms, and perceived voluntariness have direct effect on the adoption of the PCEHR system, and it also indicates that perceived user friendliness affects perceived usefulness.

In the post-adoption stage, it is suggested that the facilitating factors will influence the continued use of the PCEHR system in an indirect way with their influence being mediated by the realized benefits(usefulness) and realized user friendliness (ease of use) of the system^{2,4,12,13,23,24,25,27,29,34}. At the same time, the research model postulates that realized benefits, realized user-friendliness (ease of use), subject norms, and voluntariness have direct effect on the continued use of KMSs, and it also suggests realized user friendliness affects realized usefulness.

3.1. External Factors & Influences

In the proposed research model, external factors and influences consist of variables of regulations and policies, ICT Infrastructure development, mobility, availability of computing equipment and popularity of mobile devices, affordability and accessibility of Internet services, economic uncertainty, continuity of the government, unified approach, and transparency and communication of NEHTA's operations (see Table-1).

Table-1: External Factors and Influences

External Factors and Influences	Brief Explanation
Regulations and Policies	The Australian government has developed regulations and policies relevant to the PCEHR system (e.g., Healthcare Identifiers Act 2010, Personally Controlled Electronic Health Records Act 2012).
ICT Infrastructure Development	The deployment of national broadband and investments in e-health infrastructure by federal and state governments have laid the foundation for the implementation of the PCEHR system.
Mobility	The increasing mobility of population from one place to another needs accessible e-health applications (such as the PCEHR system) so people can receive medical treatment no matter where they are.
Availability of Computing Equipment and Popularity of Mobile Devices	The wide availability of computing equipment and the popularity of mobile devices have made e-health applications (such as the PCEHR system) more popular among Australian consumers.
Affordability and Accessibility of Internet Services	The high Internet penetration in Australia (more than 85%), as a result of good nationwide technology infrastructure and affordability, has made e-health applications (such as the PCEHR system) more appealing among Australian consumers.
Economic Uncertainty	The uncertainty of Australian economy will have impact on the future development of the PCEHR system and thus influence

Continuity of the Government	people's acceptance and use of the system. The instability of different levels of the government (especially Federal and State governments) will have an impact on the implementation of the PCEHR system, which is a complex project involving different governments and various parties across a number of years.
Unified Approach	Australia's multi-tier government system and large private sector has made the implementation of nation-wide e-health systems (e.g., the PCEHR system) extremely complex. It is a very challenging task to unify different levels of government and various stakeholders of e-health in Australia.
Transparency and Communication of NEHTA's Operations	Improved levels of transparency and communication regarding the operations of NEHTA is likely to have the impact on the implementation of the PCEHR system and improve the uptake of the system.

(Source: Developed for this study from Xu & Quaddus^{39,40,41}; Xu et al.⁴²; Xu et al.⁴³)

3.2. Individual Differences

Individual differences are represented by variables of involvement, experience/skill, personal innovativeness, age, education, occupation/profession, income, family composition, location, and attitude (see Table-2).

Table-2: Individual Differences

Individual Differences	Brief Explanation
Involvement	Australian consumers' involvement in the deployment of the PCEHR system would encourage the ownership and lead to the acceptance and use of the system.
Experience/Skill	Australian consumers' experience/skill in using new systems and new technologies will affect their acceptance and use of the PCEHR system. The more experienced they are, the more likely they would

Personal Innovativeness	accept and use the system. Australian consumers who are more innovative would be more likely to try new systems and new technologies (e.g., the PCEHR system).
Age	Younger generation of Australian consumers could be more likely to accept and use the PCEHR system.
Education	The education level of Australian consumers could have impact on their acceptance and use of the PCEHR system.
Occupation/Profession	The occupation/profession of Australian consumers could have impact on their acceptance and use of the PCEHR system.
Income	Australian consumers' income levels could have impact on their acceptance and use of the PCEHR system.
Family Composition	Family composition of Australian consumers could have impact on their acceptance and use of the PCEHR system.
Location	Location of Australian consumers could have impact on their acceptance and use of the PCEHR system.
Attitude	Australian consumers who don't feel comfortable and/or confident to manage and disseminate their medical information electronically are less likely to accept and use the PCEHR system.

(Source: Developed for this study from Xu & Quaddus^{39,40,41}; Xu et al.⁴²; Xu et al.⁴³)

3.3. PCEHR System Characteristics

PCEHR system characteristics is represented by variables of trialability, accuracy, completeness, and currency of information, visibility and transparency, control, children medical information management, accessibility, availability, regional/district integration, cross-state integration, international integration, maintenance, and delegation (see Table-3).

Table-3: PCEHR System Characteristics

PCEHR System Characteristics	Brief Explanation
Trialability	Australian consumers could try out the PCEHR system before they decide to use the system.
Accuracy, Completeness, and Currency of Information in the System	Information in the PCEHR system is accurate, complete, and current.
Visibility and Transparency	Australian consumers are able to see all the activities in their PCEHR system accounts.
Control	Australian consumers have full control of their medical information in the PCEHR system.
Children Medical Information Management	Australian consumers have full control of medical information of their children in the PCEHR system.
Accessibility	Australian consumer could access their electronic health records in the PCEHR system anywhere and anytime via different computing devices and channels.
Availability	The PCEHR system is available 24 hours, 365 days a year with very little and insignificant downtime.
Regional/District Integration	The PCEHR system is integrated well with applications and systems of various health care providers across the region/district.
Cross-State Integration	The PCEHR system is integrated well with applications and systems of various health care providers across the states.
International Integration	The PCEHR system is integrated well with applications and systems of various health care providers outside Australia.
Maintenance and Updates	The PCEHR system is maintained and updated regularly.
Delegation	The PCEHR system allows Australian consumers to delegate the management of their medical information in the system when necessary.

(Source: Developed for this study from Xu & Quaddus^{39,40, 41}, Xu et al.⁴²; Xu et al.⁴³)

3.4. Perceived Benefits

Perceived benefits are represented by variables of personal medical information management, better and new services, efficiency/productivity, effectiveness, quality, safety, time & cost reduction, continuity of health services, health/well-being, saving lives, and equitable access to health services (see Table-4).

Table-4: Perceived Benefits

Perceived Benefits	Brief Explanation
Personal Medical Information Management	The PCEHR system would help Australian consumers better manage their personal medical information (especially electronically).
Better and New Services	The PCEHR system would help create better and new health services for Australian consumers.
Efficiency/Productivity	The PCEHR system would help enhance the efficiency/productivity of health services for Australian consumers.
Effectiveness	The PCEHR system would help improve the effectiveness of health services for Australian consumers.
Quality	The PCEHR system would help improve the quality of health services for Australian consumers.
Safety	The PCEHR system would help improve the safety of health services for Australian consumers.
Time & Cost Reduction	The PCEHR system would help reduce time& cost of health services for Australian consumers.
Continuity of Health Services	The PCEHR system would ensure the continuity of health services for Australian consumers.
Health and Well-Being	The PCEHR system would improve the health/well-being of Australian consumers.
Saving Lives	The PCEHR system would help save lives.
Equitable Access to Health Services	The PCEHR system would help provide equitable access to health services for Australian consumers.

(Source: Developed for this study from Xu & Quaddus^{39,40, 41}, Xu et al.⁴²; Xu et al.⁴³)

3.5. Perceived User Friendliness

Perceived user friendliness includes dimensions of simple to learn and use, affordable to learn and use, speed, privacy, human assistance and interaction, multi-

channels and multiple touch points, and communities (see Table-5).

Table-5: Perceived User Friendliness

Perceived Friendliness	User	Brief Explanation
Simple to Learn and Use		The PCEHR system should be simple to learn and use with simple procedures.
Affordable to Learn and Use		The PCEHR system should be affordable to learn and use with simple procedures.
Speed		It should be fast to get the required information in the PCEHR system.
Privacy		The PCEHR system effectively should address the privacy concerns associated with using the system by establishing privacy policies and appropriate measures.
Security		The PCEHR system should effectively address the security concerns associated with using the system by establishing policies and appropriate measures.
Human Assistance and Interaction		Australian consumers should be provided with the opportunities to communicate with customer service personnel when they encounter issues with the PCEHR system.
Multi-Channels Communication and Multiple Touch Points		Australian consumers should be able to communicate with the operators of the PCEHR system via multiple channels and multiple touch points.
Communities		Australian consumers should be provided with the opportunities to network with other users of the PCEHR system (online and offline).

(Source: Developed for this study from Xu & Quaddus^{39,40, 41}; Xu et al.⁴²; Xu et al.⁴³)

3.6. Subject Norms on Adoption

Subject norms on adoption include dimensions of peer pressure/influence, following early users' lead, respected people's influence, doctor's recommendation, and media influence (see Table-6).

Table-6: Subject Norms on Adoption

Subject Norms on Adoption	Brief Explanation
Peer Pressure/Influence	Peers have influence on Australian consumers'

Following Early Users' Lead	acceptance and use of the PCEHR system. Australian consumers would follow earlier users' lead in accepting and using the PCEHR system.
Respected People's Influence	Australian consumers would accept and use the PCEHR system as a result of encouragement from respected people.
Doctor's Recommendation	Australian consumers would accept and use the PCEHR system as a result of the recommendation from their doctors.
Media Influence	Australian consumers would accept and use the PCEHR system as a result of the influence from media.

(Source: Developed for this study from Xu & Quaddus^{39,40, 41}; Xu et al.⁴²; Xu et al.⁴³)

3.7. Voluntariness of Adoption

Voluntariness of adoption includes dimensions of opt-in model and opt-out model (see Table-7).

Table-7: Voluntariness of Adoption

Voluntariness of Adoption	Brief Explanation
Opt-in Model	The current opt-in model for the adoption of the PCEHR system would make Australian consumers feel comfortable.
Opt-out Model	The opt-out model for the adoption of the PCEHR system would be more effective for the adoption of the PCEHR system among Australian consumers.

(Source: Developed for this study from Xu & Quaddus^{39,40, 41}; Xu et al.⁴²; Xu et al.⁴³)

3.8. PCEHR System Adoption

PCEHR system adoption includes dimensions of uploading and storing information, disseminating and sharing information, and managing information (see Table-8).

Table-8: PCEHR System Adoption

PCEHR System Adoption	Brief Explanation
Uploading and Storing Information	Australian consumers will upload and store their medical information into the PCEHR system.
Disseminating and Sharing Information	Australian consumers will disseminate and share their medical information with various health service providers and government agencies via the PCEHR system.

Managing Information Australian consumers will use the PCEHR system to manage their medical information.

(Source: Developed for this study from Xu & Quaddus^{39,40, 41}; Xu et al.⁴²; Xu et al.⁴³)

3.9. Facilitating Factors

Facilitating factors consist of incentives, imperatives, policy updates, system improvements, promotion of success stories and best practices, promotion of benefits, satisfying consumers’ needs, and making use of the PCEHR system a part of the user’s life (see Table-9).

Table-9: Facilitating Factors

Facilitating Factors	Brief Explanation
Incentives	Appropriate incentives would encourage Australian consumers to continue their use of the PCEHR system.
Imperatives	Appropriate imperatives would encourage Australian consumers to continue their use of the PCEHR system.
Policy Updates	Appropriate policy updates regarding the use of PCEHR system would encourage Australian consumers to continue their use of the PCEHR system.
System Improvements	Continuous system improvements would encourage Australian consumers to continue their use of the PCEHR system.
Promotion of Success Stories and Best Practices	Through promoting success stories and best practices of using the PCEHR system, Australian consumers will be encouraged to continue their use of the system.
Promotion of Benefits	Through promoting benefits of using the PCEHR system, Australian consumers will be encouraged to continue their use of the system.
Satisfying Consumers’ Needs Continuously	It should be ensured that the PCEHR system can continuously address Australian consumers’ needs of their medical information.
Making Use of the PCEHR System a Part of the User’s Life	Australian consumers should be encouraged to make the use of the PCEHR system a part of their life.

(Source: Developed for this study from Xu & Quaddus^{39,40, 41}; Xu et al.⁴²; Xu et al.⁴³)

3.10. Realized Benefits

Realized benefits are represented by variables of personal medical information management, better and new services, efficiency/productivity, effectiveness, quality, safety, time & cost reduction, continuity of

health services, health/well-being, saving lives, and equitable access to health services (see Table-10).

Table-10: Realized Benefits

Realized Benefits	Brief Explanation
Personal Medical Information Management	The PCEHR system has helped Australian consumers better manage their personal medical information (especially electronically).
Better and New Services	The PCEHR system has helped create better and new health services for Australian consumers.
Efficiency/Productivity	The PCEHR system has helped enhance the efficiency/productivity of health services for Australian consumers.
Effectiveness	The PCEHR system has helped improve the effectiveness of health services for Australian consumers.
Quality	The PCEHR system has helped improve the quality of health services for Australian consumers.
Safety	The PCEHR system has helped improve the safety of health services for Australian consumers.
Time & Cost Reduction	The PCEHR system has helped reduce time& cost of health services for Australian consumers.
Continuity of Health Services	The PCEHR system has ensured the continuity of health services for Australian consumers.
Health and Well-Being	The PCEHR system has improved the health/well-being of Australian consumers.
Saving Lives	The PCEHR system has helped save lives.
Equitable Access to Health Services	The PCEHR system has helped provide equitable access to health services for Australian consumers.

(Source: Developed for this study from Xu & Quaddus^{39,40, 41}; Xu et al.⁴²; Xu et al.⁴³)

3.11. Realized User Friendliness

Realized user friendliness includes dimensions of simple to learn and use, cheap to learn and use, speed, privacy, human assistance and interaction, multi-channels and multiple touch points, and communities (see Table-11).

Table-11: Realized User Friendliness

Realized User Friendliness	Brief Explanation
Simple to Learn and Use	The PCEHR system is simple to learn and use with simple procedures.
Cheap to Learn and Use	The PCEHR system is cheap to learn and use with simple procedures.
Speed	It is fast to get the required information in the PCEHR system.
Privacy	The PCEHR system effectively addresses the privacy concerns associated with using the system by establishing privacy policies and appropriate measures.
Security	The PCEHR system effectively addresses the security concerns associated with using the system by establishing policies and appropriate measures.
Human Assistance and Interaction	Australian consumers are provided with the opportunities to communicate with human beings when they have issues with the PCEHR system.
Multi-Channels Communication and Multiple Touch Points	Australian consumers are able to communicate with the operators of the PCEHR system via multiple channels and multiple touch points.
Communities	Australian consumers are provided with the opportunities to network with other users of the PCEHR system (online and/or offline).

(Source: Developed for this study from Xu & Quaddus^{39,40,41}; Xu et al.⁴²; Xu et al.⁴³)

3.12. Subject Norms on Continued Use

Subject norms on continued use includes dimensions of peer pressure/influence, following early users' lead, respected people's influence, doctor's recommendation, and media influence (see Table-12).

Table-12: Subject Norms on Continued Use

Subject Norms on Adoption	Brief Explanation
Peer Pressure/Influence	Peers have influence on Australian consumers' continued use of the PCEHR system.
Following Early Users' Lead	Australian consumers would follow earlier users' lead in continued use the

Respected People's Influence	PCEHR system. Australian consumers would continually use the PCEHR system as a result of encouragement from respected people.
Doctor's Recommendation	Australian consumers would continually use the PCEHR system as a result of the recommendation from their doctors.
Media Influence	Australian consumers would continually use the PCEHR system as a result of the influence from media.

(Source: Developed for this study from Xu & Quaddus^{39,40,41}; Xu et al.⁴²; Xu et al.⁴³)

3.13. Voluntariness of Continued Use

Voluntariness of continued use includes dimensions of opt-in model and opt-out model (see Table-13).

Table-13: Voluntariness of Continued Use

Voluntariness of Adoption	Brief Explanation
Opt-in Model	The current opt-in model for the use of the PCEHR system would encourage Australian consumers to continually use the system.
Opt-out Model	The opt-out model for the use of the PCEHR system would be more effective for the continued use of the PCEHR system among Australian consumers.

(Source: Developed for this study from Xu & Quaddus^{39,40,41}; Xu et al.⁴²; Xu et al.⁴³)

3.14. Continued Use of PCEHR System

Continued use of PCEHR system includes dimensions of uploading and storing information, disseminating and sharing information, and managing information (see Table-14).

Table-14: Continued Use of the PCEHR System

PCEHR System Adoption	Brief Explanation
Uploading and Storing Information	Australian consumers will continually upload and store their medical information into the PCEHR system.
Disseminating and Sharing Information	Australian consumers will continually disseminate and share their medical information with various health service providers and government agencies via the PCEHR system.
Managing Information	Australian consumers will continually use the PCEHR system to manage their medical information.

(Source: Developed for this study from Xu & Quaddus^{39,40,41}; Xu et al.⁴²; Xu et al.⁴³)

4. Hypotheses Development

Past studies (such as Grover²⁰; Premkumar, Ramamurthy & Crum 1997³²; Rai & Bajwa³³; Sarvary³⁵; Xu & Quaddus⁴⁰; Xu et al.⁴²; Xu et al.⁴³) report environmental factors are associated with the adoption of innovation. In addition, Davis's¹² technology acceptance model proposes that external factors, such as external factors & influences, will influence PCEHR system adoption by affecting perceived benefits and perceived user friendliness. The preceding discussion leads to the following hypothesis:

Hypothesis 1a: "External Factors & Influences" positively influence the "Perceived Benefits" of the PCEHR System.

Hypothesis 1b: "External Factors & Influences" positively influence the "Perceived User Friendliness" of the PCEHR System.

Individual differences have been found important in explaining the acceptance and successful implementation of information systems²⁴. Past research (such as Zmud⁴⁴; Brancheau & Wetherbe⁹; Rogers³⁴; Gefen & Straub¹⁸; Agarwal & Prasad²; Venkatesh, Morris & Ackerman³⁸; Agarwal & Prasad³; Xu & Quaddus³⁹; Xu & Quaddus⁴⁰; Xu et al.⁴²; Xu et al.⁴³) has indicated that the individual/end user characteristics/differences are important factors in explaining/predicting the adoption of innovations. In addition, Davis¹² technology acceptance model proposes that external factors, such as individual factors, will influence PCEHR system adoption by affecting perceived benefits and perceived user friendliness. The PCEHR system is only successful if the users of the system succeed with the system. Australian consumers' acceptance and use of the system is critical to the success of the system. Hence, it is hypothesised that:

Hypothesis 2a: "Individual factors" positively influence the "Perceived Benefits" of the PCEHR system.

Hypothesis 2b: "Individual factors" positively influence the "Perceived User Friendliness" of the PCEHR system.

Past studies (such as Kwon & Zmud²⁶; Davis, Bagozzi & Warshaw¹⁶; Rogers³⁴; Moore³⁰; Igbaria, Gumaraes & Davis²⁴; Chau & Tam¹¹; Beatty, Shim & Jones⁷; Hong et al.²¹; Xu & Quaddus³⁹; Xu & Quaddus⁴⁰; Xu & Quaddus⁴²; Xu et al.⁴³) indicate the importance of the innovation/system characteristics in the adoption and diffusion of innovation. In addition, Davis's¹² technology acceptance model proposes that

external factors, such as PCEHR system characteristics, will influence adoption of the system by affecting perceived benefits and perceived user friendliness. The above discussions lead to the following hypothesis:

Hypothesis 3a: "PCEHR System Characteristics" positively influence the "Perceived Benefits" of the PCEHR System.

Hypothesis 3b: PCEHR System Characteristics" positively influence the "Perceived User Friendliness" of the PCEHR System.

TAM^{12,13,14,15} and other related studies (such as Adams, Nelson & Todd¹; Igbaria, Guimaraes & Davis²⁴; Igbaria et al.²⁵; Venkatesh & Davis³⁸; Xu & Quaddus³⁹) have identified perceived user friendliness as an important determinant of system acceptance and use via perceived benefits and a causal determinant of perceived benefits. Perceived user friendliness has a direct and positive impact on perceived benefits. Therefore the following hypotheses are proposed:

Hypothesis 4: "Perceived User Friendliness" of PCEHR System positively influences the "Perceived Benefits" of the PCEHR System.

Hypothesis 10: "Realized User Friendliness" of PCEHR System positively influences the "Realized Benefits" of the PCEHR System.

The theory of diffusion of innovation³⁴, the theory of reasoned action⁴, and the technology acceptance model¹² all propose direct impacts of perceptions on intention to use the system. Meanwhile Bansler and Havn⁶ suggest that expectations/perceptions are key factors in determining organization's and individual's decision about whether or not to adopt a new knowledge management system. Furthermore Bhattacharjee⁸ find that users' confirmation of their initial use of information systems has a positive impact on their intention of continued use of the systems. As a result, it is proposed that perceived benefits and perceived user friendliness have a direct impact on PCEHR system adoption. As per the above discussions, it is hypothesised that:

Hypothesis 5: "Perceived Benefits" of PCEHR System positively influence the "Adoption" of the PCEHR System.

Hypothesis 6: "Perceived User Friendliness" of PCEHR System positively influence the "Adoption" of the PCEHR System.

Hypothesis 11: "Realized Benefits" of PCEHR System positively influence the "Continued Use" of the PCEHR System.

Hypothesis 12: “Realized User Friendliness” of PCEHR System positively influence the “Continued Use” of the PCEHR System.

Subject norms describe the social influence that may affect a person’s intention to use knowledge management systems. People often take action based on their perceptions of what others think they should do. Literature (such as Thompson, Higgins & Howell³⁶; Liker & Sindi²⁷; Lucas & Spitzer²⁸; Xu & Quaddus³⁹) has found that subject norms are positively associated with individual’s acceptance of new technology. Huber²² suggest that there is considerable ignorance in the literature on the impacts of the social-psychological forces such as the need to adhere to social norms, the need to comply with organizational norms (the right thing to do), the need for recognition, on knowledge sharing and participation in the knowledge management systems. Gray¹⁹ suggests that use of knowledge management systems may be a self-reinforcing process. Once the value of such system is established, the system use is likely to become routine and thus lead to widespread acceptance and use. The above discussions results in the following hypotheses:

Hypothesis 7: “Subject Norms” have positively influence impact on the “Adoption” of the PCEHR System.

Hypothesis 13: “Subject Norms” have positively influence impact on the “Continued Use” of the PCEHR System.

Voluntariness focuses on consumers’ voluntary adoption and use of PCEHR system. In the past, research (such as Bansler & Havn⁶; Xu & Quaddus³⁹) has suggested that voluntary-basis approach has a positive impact on people’s decision to adopt and use innovations/new systems. The current opt-in model is not working well, and it is argued that the opt-out model should be adopted to increase the adoption rate of the PCEHR system (Xu et al.⁴²; Xu et al.⁴³). The above discussions lead to the following hypotheses:

Hypothesis 8: “Voluntary use” of PCEHR System negatively influences the “Adoption” of the PCEHR System.

Hypothesis 14: “Voluntary use” of PCEHR System negatively influences the “Continued Use” of the PCEHR System.

Government faces the challenge of how to ensure consumers’ sustained use of PCEHR system after their adoption of the system. Sustained/continued use of PCEHR system means that use of the system has become a part of consumers’ life. By providing

facilitating measures (such as incentives, imperatives, policy updates, system improvements, promotion of success stories and best practices, promotion of benefits, satisfying consumers’ needs, and making use of the PCEHR system as a part of the user’s life), governments could developed consumers’ positive attitude to and perceptions of the system and thus lead to their continued use of the system. In addition, the theory of diffusion of innovations³⁴, the theory of reasoned action⁴, and the technology acceptance model¹² all propose direct impacts of perceptions on intention to use the systems. As a result, it is proposed that perceived benefits and perceived user friendliness have a direct impact on continued use of the PCEHR system. The above discussions results in the following hypotheses:

Hypothesis 10a: “Facilitating Factors” positively influence the “Realized Benefits” of the PCEHR System.

Hypothesis 10b: “Facilitating Factors” positively influence the “Realized User Friendliness” of the PCEHR System.

5. Conclusion and Future Directions

As far as the researchers are aware, the developed model of adoption and continued use of the PCEHR system will be the first one on accessing and improving the implementation of the PCEHR system in Australia. Identified factors and variables of the tested model will assist in understanding challenges and issues associated with the continuous development and implementation of the system and serve as guidelines to the successful implementation of the system. In addition, the outcomes of this research will make a contribution to the improvement of the awareness of the system among Australian consumers and will result in economic, environmental and social benefits to the Australian community. The immediate next step is to develop a survey questionnaire, based on the research model and some field studies examining any new factors and variables, refine the developed questionnaire via a pilot survey, and test the final questionnaire via a national survey of consumers in Australia. The future research also could look at developing and testing a model of adoption and continued use of the PCEHR system among health services providers.

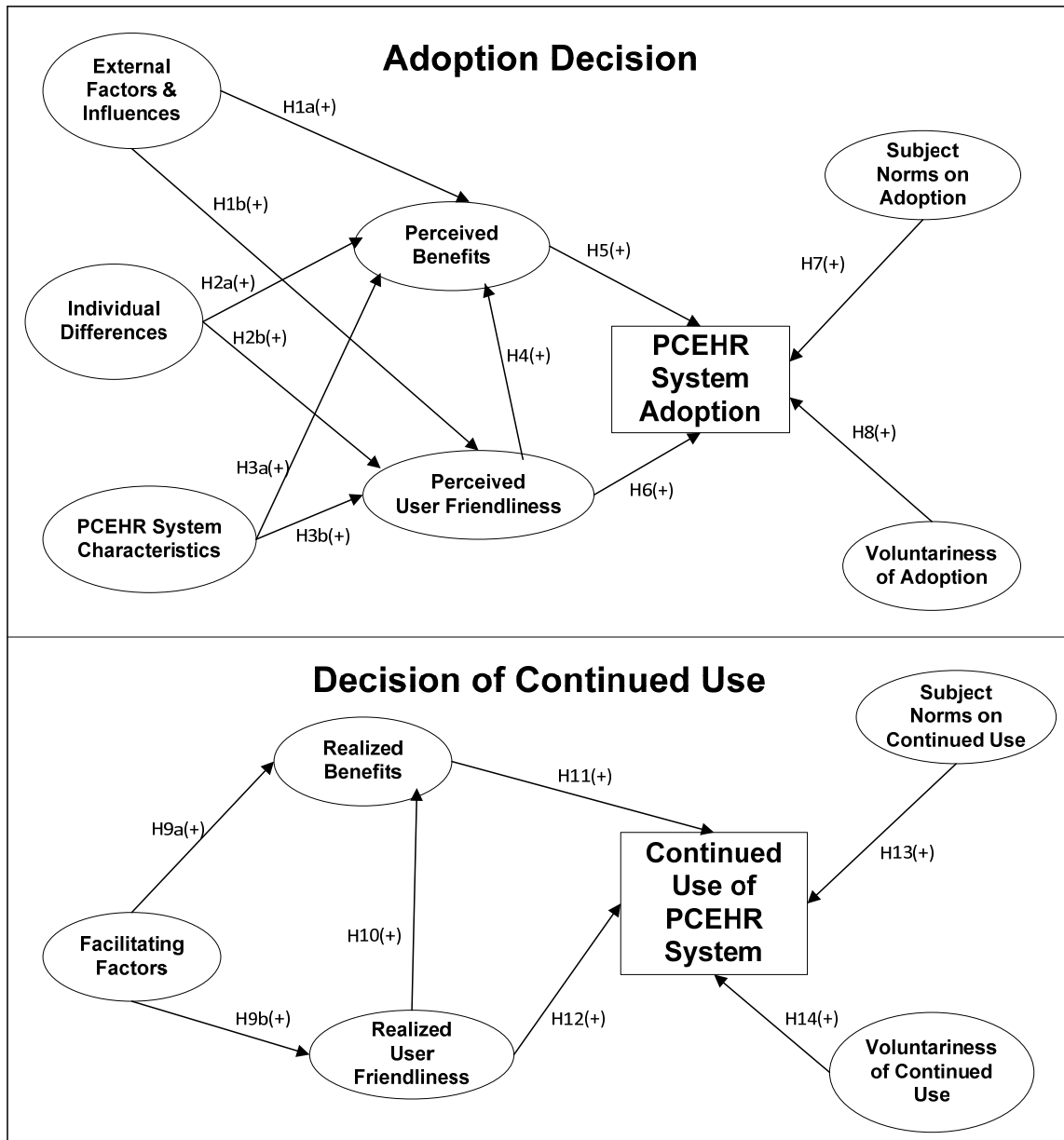


Fig. 2. The Model of Consumers' Adoption and Continued Use of the PCEHR System

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