AN ANALYSIS OF ELECTRONIC HEALTH RECORDS INNOVATION AND ADOPTION IN THE AUSTRALIAN PRIVATE HEALTHCARE SECTOR

A Thesis submitted by

Salem Ouheda

MIT

For the award of

Doctor of Philosophy

2024

ABSTRACT

The adoption of electronic health records (EHRs) has become increasingly critical in modern healthcare settings due to its potential to enhance care delivery and operational efficiency. This manuscript integrates insights from three separate investigations to elucidate the complex array of challenges and innovations impacting the adoption of Electronic Health Records (EHRs) within the context of the Australian private healthcare sector. The first study highlights the importance of managing the adoption process in Australia by identifying key technological, organizational and environmental factors by producing a conceptual model for further empirical testing. It underscores the complexity of EHRs integration due to diverse factors affecting adoption at different organizational levels. The second study employs a cross-theory approach, integrating the Technology, Organization, and Environment (TOE) framework with stages of innovation, to examine how healthcare organizations can align their innovation capabilities with adoption processes, explicating the role of innovation in EHRs adoption. The third study shifts focus to the role of innovation practices and temporal factors in technology adoption, finding that while some innovation characteristics are well-understood, the importance of time and temporal pacing in adoption processes is often underestimated. Collectively, these studies contribute to a broader understanding of the technological, organizational, environmental and innovative dynamics that impact EHRs adoption, offering significant implications for policy development and organizational strategy in healthcare settings.

CERTIFICATION OF THESIS

I Salem Ouheda declare that the PhD Thesis entitled *An analysis of electronic health records innovation and adoption in the Australian private healthcare sector* is not more than 100,000 words in length including quotes and exclusive of tables, figures, appendices, bibliography, references, and footnotes.

This Thesis is the work of Salem Ouheda except where otherwise acknowledged, with the majority of the contribution to the papers presented as a Thesis by Publication. The work is original and has not previously been submitted for any other award, except where acknowledged.

Date:

Endorsed by:

Professor Peter A. Murray
Principal Supervisor

Associate Supervisor
Dr. Khorshed Alam

Student and supervisors' signatures of endorsement are held at the University.

STATEMENT OF CONTRIBUTION

All the work presented in this thesis was carried out by Salem Ouheda under the guidance of his supervisors Professor Peter A. Murray, Professor Khorshed Alam. I gratefully acknowledge the guidance and support of others during my PhD journey in the acknowledgement section of this thesis. The following detail is the agreed share of contribution for candidate and co-authors in the presented publications in this thesis:

Paper 1:

Ouheda, S., Murray, P. A. Hafeez-Baig, A., 2024. A Systematic Literature Review of Digital Health Records Adoption in the Australian Healthcare Sector (Submitted to the journal Sustainable Futures).

The overall contribution of Salem Ouheda was 80% to the concept development, data management, analyses, interpretation, and drafting the final manuscript. Prof Murray and Dr. Hafeez-Baig was instrumental in developing the concept, editing, and offering critical intellectual feedback (10%).

Paper 2:

Ouheda, S., Peter A. Murray, Alam, K., and Ali, O. 2023. Developing Innovation Capabilities and Knowledge Stocks for Assessing Digital Electronic Healthcare Technology Adoption. (Submitted and under second round review in the journal Management Research Review).

The overall contribution of Salem Ouheda was 65% to the concept development, data management, analyses, interpretation, and drafting the final manuscript; Peter A. Murray, Alam, K., and Ali, O were instrumental in developing the concept, editing, and offering critical intellectual feedback representing25%, 5% and 5%, respectively.

Paper 3:

Ouheda, S., Peter A. Murray, Alam, K., and Ali, O. 2024. Assessing the Impact of Innovation Processes on Electronic Systems Technology Adoption. (Accepted in the Emerging Science Journal).

The overall contribution of Salem Ouheda was 65% to the concept development, data management, analyses, interpretation, and drafting the final manuscript; Peter A. Murray, Alam, K., and Ali, O were instrumental in developing the concept, editing, and offering critical intellectual feedback representing 25%, 5% and 5%, respectively

ACKNOWLEDGEMENTS

I wish to formally recognise the support I have received during the duration of this project. I acknowledge the Australian Commonwealth Government contribution I received through the Research Training Program (RTP) Fee Offset scheme.

I acknowledge the scholars at the University of Southern Queensland who shared their time and expertise with me and taught me so very much about research and research writing:

First, I would like to extend my heartfelt gratitude to Prof. Peter A. Murray for his exemplary supervision during my PhD studies. Prof. Murray's guidance was crucial not only for the successful completion of my thesis but also in the publication of two scholarly articles. Despite his numerous commitments, including other PhD students and significant university responsibilities, Prof. Murray consistently made time to support and mentor me. His dedication to my academic and personal growth during this period has left a profound impact on me. Prof. Murray's ability to balance his demanding roles while providing attentive and insightful supervision speaks volumes about his commitment to nurturing future scholars. I am deeply appreciative of the time he invested in me and the wisdom he imparted throughout my PhD journey.

Secondly, I would like to express my sincere gratitude and deepest respect to Associate Supervisor Dr. Khorshed Allam. I also extend my thanks to Dr. Abdul Hafeez-Baig, who embarked on this PhD journey with me, particularly during my first publication.

I owe a profound debt of gratitude to my family, whose unwavering support and encouragement were instrumental throughout my PhD studies. To my parents, thank you for believing in me and for your endless encouragement. To my spouse, for the constant companionship, reassurance, and practical help, and for always being there to lift my spirits after long days. To my children, who brought joy and laughter into my days, reminding me of the importance of balance and perspective. Your collective faith in my abilities and your unconditional support have been the pillars of my success. This achievement is as much yours as it is mine. Thank you for being my greatest champions.

TABLE OF CONTENTS

ABBREVIATIONS

EHRs: Electronic Health Record system

EMR: Electronic Medical Record

NHCS: National Health Consumer Survey

EMRs: Electronic Medical Records

OPENMRS: Open Source Enterprise Electronic Medical Record System Platform System

NHS: National Health Service

NPfIT : National Programme for Information Technology

PCEHR: Personally Controlled Electronic Health Record

TOE: Technological-Organizational-Environmental Model framework

DOI: Diffusion of Innovations Theory

CHAPTER 1: INTRODUCTION

1.1. Overview

The first chapter provides a summary of the main components of the thesis. The chapter consists of an introduction to e- health, a background to the study, justification of the research, geographical context, research problem statement and other significant factors of the research.

1.2. Introduction and background to e-health systems

E-health and Health information systems are multidisciplinary involving healthcare, information technology, networking, and computer science (Dahleez et al., 2020). Significant updates in healthcare systems have been developed by information technology applications especially related to changing the workflow from paper-based to using computers systems specifically digital systems (Alsyouf et al., 2022). Healthcare providers such as health physicians, stakeholders, and policymakers are recently paying more attention to health information technology due to the benefits of this technology. These benefits include increasing the efficiency of work, decreasing medical errors, enhancing devotion to guidelines, helping to make the appropriate warnings, and reducing costs (Rudin et al., 2020).

Electronic healthcare records (EHRs) is a digital computer system related to gathering, saving and presenting patient's health information, where the patient records are kept in an electronic format instead of a paper-based format. This change has offered easy access to patient records for every doctor, nurse, pathologist and those healthcare workers who may have to deal with the record of the patient (Spiranovic et al., 2016). Black et al. (2011) and Häyrinen et al. (2008) defined EHRs as comprising a system that links all healthcare components into one system where patient data is stored in a digital format that can be saved, swapped securely and shared between healthcare settings.

In various industries, approximately 25 percent of technology projects experience outright failure (Bauer et al., 2020). Another 20 to 25 percent do not yield any return on investment with as many as 50 percent of technology projects requiring significant reworking post-launch (NAO, 2019). Similar failure rates are observed in

EHRs projects. According to the health care consulting firm, the Fox Group, about 20% of EHRs system installations can be categorized as failures where more than 50% of EHR systems either fail outright or do not achieve proper utilization (Bauer et al., 2020). However, there has also been widespread acceptance. For example, the widespread acceptance of fundamental EHR systems surged from a modest 6.6% to 81.2%, whilst the adoption rates for comprehensive EHR systems escalated from 3.6% to 63.2% in recent times (Jiang et al., 2023). This notable expansion underscores the effectiveness of federal initiatives aimed at transitioning healthcare records into digital formats.

Australia is one of the developed countries that have sophisticated and improved healthcare systems. A shared project of the Australian Federal Government and State and Territory governments founded the *HealthConnect* project in order to run a health information network program (Teoh et al., 2013). *HealthConnect* is a project founded to allow both public and private caregivers' sectors to adopt an EHRs system with an interoperability task (Teoh et al., 2013). In 2004, the Australian government assigned around $118.2 million to adopt the *HealthConnect* program within a four-year period (Gunter and Terry, 2005).

Australia's healthcare system encompasses both the public and private sector, with a growing involvement of private providers. Despite the expanding role of private healthcare, public hospitals in Australia predominantly rely on funding from the federal government (39 percent) and state or territory governments (53 percent). EHRs in Australia had a valuation of $339 million in 2022 and is anticipated to grow at a 5.5% Compound Annual Growth Rate (CAGR) from 2022 to 2030, reaching $521 million by the latter year. Australia allocates a substantial portion of its budget to healthcare, with healthcare expenditure constituting 9-11% of the GDP, varying by year. According to the Australian Institute of Health and Welfare (AIHW), the total health spending in 2019-20 amounted to $194.6 billion, equivalent to 9.5% of the GDP. The major share of this expenditure (68%) is funded by governments both state and federal, while the remaining 32% comes from private sources. Australia has emerged as a frontrunner in digital health, implementing various initiatives and programs to encourage the integration of technology in the healthcare sector.

However, there is limited understanding regarding the viewpoints of private healthcare providers on emerging digital electronic record forms, as well as the diverse innovation processes and healthcare policies necessary for their effective adoption. Despite an organizational decision to embrace new innovation such as EHRs, practical utilization in the private sector hinges on healthcare organisation implementation. Therefore, scrutinizing how employees within organizations adopt innovations becomes crucial, as the absence of acceptance among employees hinders the realization of desired benefits and may lead the organization to eventually abandon the innovation (Van Looy, 2021). Healthcare workers similar to most workers are inherently resistant to change, and require convincing evidence of the direct benefits (Ajzen, 1991). Formulating an effective approach to boost end-user acceptance and subsequent usage of innovation remains a persistent challenge that often lacks straightforward solutions. While advancements in hardware and software capabilities have progressed rapidly, the issue of underutilization of digital innovation in healthcare systems persists (Alsyouf et al., 2022).

This thesis will first investigate the various factors influencing EHRs adoption within the Australian private healthcare sector. The thesis will examine how different dimensions of technology, organization, and environment (TOE) contexts are influenced by different stages of innovation, knowledge stocks (KSs) and learning flows (LFs). The research will also examine which innovation and organizational factors help to shape the adoption of EHRs within the sector. The outcomes of the thesis bridges the knowledge gap between theory and practice by making more germane the link between EHRs adoption barriers, how innovation processes are related to knowledge stocks, and how the latter ultimately benefit the application of clinical healthcare measures within private healthcare institutions.

1.3. Justification of the research

The imperative for safer healthcare systems is essential to mitigate medical errors and enhance patient safety (Sieck et al., 2020). The efforts among healthcare stakeholders, including governments, policymakers, hospital administrators, and healthcare providers has been enhanced by devising effective strategies for elevating healthcare quality (Gui et al., 2020). The escalating complexity of healthcare systems necessitates improved mechanisms for managing patient health information to bolster healthcare quality that optimizes health outcomes. In this context, the adoption of health information technology (HIT), notably EHRs, emerges as a promising avenue for achieving these healthcare imperatives (Ebnehoseini et al., 2020).

EHRs are heralded as innovative and promising tools for enhancing care quality and patient safety (Upadhyay and Hu, 2022). As ubiquitous HITs, EHRs represent a novel boundary in medical data management catering to the contemporary and future needs of healthcare delivery. The US Office of the National Coordinator for Health Information Technology (2019) noted that EHRs' repository consist of comprehensive patient-related health information encompassing demographics, medical history, laboratory reports, medications, and progress assessment notes. Consequently, EHRs provide myriad clinical benefits, including enhanced access to historical health information and streamlined communication among healthcare providers, thereby enhancing the provision of high-quality and cost-effective care.

The escalating global adoption rates of EHRs across diverse healthcare settings underscore their perceived utility in healthcare enhancement endeavours. For example, the United States witnessed a twofold increase in EHRs adoption rates between 2008 and 2017, with office-based physicians' adoption surging from 42% to 86% during this period (Office of the National Coordinator for Health Information Technology, 2019b). Similarly, European countries, including the United Kingdom, Estonia, Finland, Sweden, and Denmark, embraced EHRs in primary care settings, with adoption rates reaching all or nearly all primary care practices. Asian nations moreover such as South Korea reported widespread EHRs adoption rates exceeding 95% in hospitals and clinics (Park and Han, 2017).

Despite the recognized benefits of EHRs, disparities persist in adoption rates across settings, with factors such as cost perceptions and healthcare professionals' attitudes impeding adoption efforts (Hossain et al., 2019). The exorbitant costs associated with EHRs implementation have emerged as a formidable barrier in various settings, necessitating nuanced approaches to overcome adoption impediments. Furthermore, the fundamental role of healthcare professionals' perceptions in EHRs implementation underscores the imperative of considering user perspectives for fostering successful adoption and utilization of EHRs across diverse healthcare settings (Cohen, 2016, Sharma and Aggarwal, 2016, Joukes et al., 2019).

Likewise, Australian healthcare systems face issues similar to their European healthcare professional counterparts (Ludwick and Doucette, 2009, Standing and Cripps, 2015, Oderkirk, 2017, Ammenwerth et al., 2020, Andargoli, 2021). Australia similarly has made significant steps in EHRs adoption, with many primary care practices and hospitals embracing digital health technologies towards enhancing care delivery (Najaftorkaman, 2016, Andargoli, 2021). The increasing adoption rates of EHRs in Australia signify a growing recognition of their value in modernizing healthcare systems and improving patient care. However, ongoing efforts are needed to address the unique complexities of EHR adoption in the Australian context, ensuring that these digital tools are effectively integrated into clinical workflows and contribute to the overall advancement of healthcare delivery in the country (NEHTA, 2016).

1.4. Geographical context of the study

The study which formed a component of this thesis was conducted in Toowoomba city, which is nestled in the Darling Downs region of Queensland. Toowoomba is governed by local authorities responsible for managing its development and infrastructure. The Toowoomba Regional Council oversees the city's municipal districts, working in tandem with various stakeholders to promote social, economic, and environmental sustainability. Toowoomba has experienced steady population growth driven by factors such as natural increases and migration (Treasury, 2017). This growth has been fuelled by Toowoomba's reputation as a regional hub for education, healthcare, and industry (Wright et al., 2017).

In response to the evolving needs of its residents, Toowoomba has invested in modern infrastructure and essential services, including healthcare. While Toowoomba may not have the same scale of healthcare facilities as big cities, it offers a comprehensive range of healthcare services through public health centres, clinics, and hospitals (Wright et al., 2017). These facilities provide essential primary care, specialist consultations, and emergency treatment to residents, ensuring access to quality healthcare close to home. Additionally, residents have the option to access private healthcare providers for specialized services or treatments the same as in the public system. As Toowoomba continues to grow and diversify, efforts to enhance healthcare delivery and accessibility remain a priority, underscoring the importance of efficient systems and collaborative partnerships within the healthcare sector (Wright et al., 2017).

1.5. Research problem statement

EHRs are believed to be the means of the future, where many healthcare providers are progressively turning to electronic records over traditional paper-based records. However, in healthcare settings, organisations continue to prioritise paper and legacy systems. Although great benefits exist for healthcare providers and patients, less than 40% of medical care providers for example in the US have adopted digital technology. In Australia, less than 60% of Australian providers currently use EHRs (Kruse et al. 2015; Pinaire 2009), although the adoption of EHRs in more recent times has improved (Andargoli, 2021) particularly in public institutions. While EHRs adoption is improving, slow adoption given the range of benefits problematizes how healthcare organizations innovate, how they create new knowledge, and how they develop learning routines designed to rapidly improve innovation performance in such settings. The researcher is not aware of any research that has examined the innovation and knowledge management contexts with respect to EHRs adoption in the private healthcare sector. An increasing focus on the issues suggests that difficulties in investigating the topic with decision-makers in mind is well overdue as noted by recent scholars (Burton-Jones et al., 2020, Cresswell et al., 2021, Tsiampalis and Panagiotakos, 2023).

Extant research points to the importance of creating innovation efficiency and effectiveness within the adoption process (Chen et al., 2021), to improve actual adoption success (Ali et al., 2022), where different innovation models are likely to play an influential role (Rogers, 1995; Davis et al., 1989). At their most basic, innovation models suggest that innovation adoption is a complex matter (Tornatzky et al., 1990) often influenced by other TOE barriers as well as other organisation contexts (Malik et al., 2021). Moreover, innovation adoption involves a greater appreciation of the phases of innovation (Fichman and Kemerer, 1997), how this relates to developing knowledge (Prieto and Revilla, 2006), and what learning routines are required to support the innovation (Murray et al., 2009; Örtenblad, 2018). Taken together, these issues remain unresolved in current EHRs adoption highlighting an important gap between innovation processes on the one hand and IT adoption and learning routines on the other. The thesis outlines these relationships in more detail in Sections 2, 3, and 4.

Given the range of issues involved, this thesis explores *what* kinds of barriers exist in relation to the adoption of new EHRs. The research explores *how* different processes of innovation can be matched to knowledge stocks by taking into consideration a number of innovation phases. Moreover, the thesis explores in greater detail different innovation models by asking *what* features of these models are more germane within the context of adopting EHRs. In sections 2 and 3 in particular, the thesis explores *how* innovation processes influence clinical best practice by presenting a new framework for integrating innovation, knowledge, and learning. The results of the thesis accordingly seek to make a major contribution to the existing literature relating to EHRs adoption by broadening scholarly and practitioner understanding of *what* new EHRs implementation and adoption looks like and *how* to develop innovation strategies within the private healthcare sector.

1.6. Objectives of the study

The objectives of this thesis include:

- Identifying and exploring the technology, organisation, and environment (TOE) barriers related to the adoption of EHRs within the Australian private healthcare sector;
- Identifying what kinds of innovation capabilities are best suited for assessing digital healthcare technology adoption. The thesis broadens scholarly understanding related to how contexts of technology, organization, and environment are informed by the stages of innovation, knowledge stocks (KSs) and learning flows (LFs) with implications for health policy settings;
- Understanding and assessing which innovation model characteristics and innovation strategies are more germane and help to better inform the EHR adoption process as well as successful implementation.

1.7. Research questions

To explore the research objectives, the following research questions were developed:

Study 1:

RQ 1: What are the factors influencing the adoption of EHRs in the private healthcare sector?

Study 2:

RQ2: What are the integrating features for adopting EHRs medical processes and clinical measures within the private healthcare sector in the light of TOE barriers and existing healthcare policy settings?

RQ3: How can TOE and innovation theory related to the private hospital context be broadened when innovation, knowledge, and learning capabilities are better integrated?

Study 3:

RQ4: What are the facilitating factors influencing the adoption of EHRs within the Australian private healthcare sector?

RQ5: What innovation strategies are required to mitigate adoption-related organizational IT problems?

1.8. Other significant factors of the research

This thesis is seeking to make a significant contribution to the literature by investigating factors influencing the adoption of EHRs within the Australian private healthcare context. The result of the thesis is expected to attract the attention of Government bodies, IT professionals, designers of applications and desktop systems, decision-makers, policymakers, providers of healthcare, and investigators interested in e-health to improve EHRs adoption success including healthcare outcomes more generally. This research involves different users of health information technology. The EHRs system is utilised in the investigation to discover the adoption factors connected to health caregivers. Moreover, this study qualitatively assesses perceptions of healthcare providers about the facilitators of, and barriers to, the EHR adoption process. The results of the thesis are expected to broaden and extend previous studies and to provide more detail and in-depth understanding of EHRs adoption from a user's perspective. The thesis explores how stakeholders in the healthcare domain are required to work jointly to achieve innovation success, with implications for senior managers as well as supporting policies and standards concerning the improvement of patient safety, techniques of documentation and standards of communication.

CHAPTER 2: LITERATURE REVIEW

2.1. Overview

In relation to electronic healthcare records, the first part of the chapter builds on Chapter 1 through definition and meaning, significance and benefits, and overall importance by providing a systematic literature review of the extant literature of electronic healthcare records within the Australian healthcare context. The latter part of Section 2 outlines the first of three papers based on the topic that have been submitted for publication.

2.2. Definitions of EHRs

The meaning and conception of EHRs range from storing and managing patients' records in a single healthcare setting to a more complicated system that is able to store, manage and share data among multiple health care settings (Handler et al., 2003). Spiranovic et al. (2016) defined EHRs as a set of functions that helps to provide safe and secure services in digital format to patients. These functions are computerised medical records, electronic medical records, clinical data, personal health records, and computerised patient records. However, this definition does not include health provider elements such as physicians or hospitals and other healthcare settings. Ajami and Bagheri-Tadi (2013) described EHRs as computerised medical information systems with the ability to gather, save and present patient information. Nevertheless, this definition does not address the intended users of the system in a specific manner. Scholars define EHRs as a system that links all health components and contains the minimum functions of EHRs where patient data is stored in a digital format that can be saved, swapped securely and shared between healthcare settings (Häyrinen et al., 2008, Black et al., 2011).

2.3. The significance of electronic healthcare records for patients

Patients have become accustomed to witnessing their healthcare providers inputting notes into a computer during their appointments. The transition from paper-based to digital systems has been more prolonged for the healthcare sector compared to other industries (Tsai et al., 2020). The situation of healthcare with and without EHRs is much different in terms of the level of patient care. For example, in the US, medical errors are the one of the main causes of 55,000 per year avoidable deaths resulting from poor communication such as unclear handwriting, missing medical and imprecise records (Sanderson et al. 2004). Also, studies suggest that up to 15% of prescriptions have been found to include errors while 3.7% of these were related to missing medical records (De Feijter et al. 2012). In a study of the quality of Australian health care, a population depending on research modelled on the Harvard study, researchers reviewed 14,179 admissions' medical records to 28 caregivers in South Australia and New South Wales in 1995 (Wilson et al. 1995). Here, 16.6% of admissions related to a negative event, leading to permanent disability in 13.7% of patients. Out of these, deaths accounted for 4.9% while 51% of negative experiences could have been avoidable (Weingart et al. 2000). Also, in Australia, studies have found that 19% of medical errors occurred due to a lack of information while nearly 30% were related to unplanned health caregiver admission errors. Out of these, nearly 13% of health caregiver consultation was related to missing information (Xu et al. 2013). Integrating insights from innovation, knowledge, learning, and information technology in this thesis represents a significant breakthrough to existing EHRs knowledge, by helping to improve the quality of healthcare more generally.

2.4. Benefits of EHRs

EHRs and its ability to electronically share health information can help to provide advanced quality and safer care for patients while creating tangible improvements for healthcare providers. EHRs enable healthcare providers to offer better quality care for patients and to deliver improved health care by:

- ✓ Providing precise, up-to-date information about patients at the point of care.
- ✓ Permitting fast access to records of the patient for more coordinated efficient care.
- ✓ Securely distributing electronic information with patients and relevant clinicians
- ✓ Helping clinicians to treat patients more effectively, lessening medical errors.
- ✓ Improving a communication and interaction between provider and patient.
- ✓ Enabling secure and more trusted prescribing.
- ✓ Helping enhance readable and streamlined coding and billing.
- ✓ Promoting privacy and security of patient information.
- ✓ Helping healthcare providers develop work-life balance and productivity
- ✓ Enabling healthcare providers to meet their business aims.

Decreasing costs through diminished paperwork, lowered duplication of testing, and improved

2.5. Adoption contexts

The term technology adoption refers to the acceptance, integration, and use of new technology in society (Salahshour Rad et al., 2018). Rogers (1995) defined technology adoption as a decision of an individual or organisation to take advantage of a new innovation. The technology adoption procedure breaks the adoption process into a number of stages which is discussed in more detail in Section 3, usually classified by the groups of people who use the technology (Boothby, et al. 2010). Although the adoption of EHRs is not a new idea, processes of adoption remain slow among all providers from small care settings to their much larger counterparts (Palabindala, et al. 2016).

Notably how Australia compares to other countries in relation to EHRs adoption success. One examples of this affair is the Vista system of Health Service in India, which showed that most physicians viewed its use positively and were willing to use it frequently. (Sequist et al., 2007). Some African countries such as Haiti (Fraser et al., 2004), and Peru (Fraser et al., 2006) have used the open source enterprise electronic medical record system platform system (OPENMRS). In Kenya, the productivity of staff was improved and patient waiting times were reduced after the Mosoriot Medical Record System was introduced (Rotich et al., 2003). In New Zealand, the rate of physicians using EHR systems has reached up to 80%. New Zealand accordingly has one of the highest levels of use of EHRs (Protti et al., 2008). By law, in New Zealand, all doctors have to capture data and submit their claims electronically. This system has succeeded because the government of New Zealand also invested in education to support the protection of patient confidentiality and to promote the advantages and development of EHRs to increase the quality of health care (Grant, 2012).

In the United Kingdom, the National Health Service (NHS) set a target in 1998 to have EMRs implemented in all its administrations by 2005 where 3% of administrations had achieved the target by 2002 (Hoeksma, 2002, Miller et al., 2005). Issues related to costs and standards were the cause of this low rate (Wanless, 2002). For this reason, the government assigned £2.3bn for a new national programme for information technology (NPfIT) (No-auther, 2002). However, the NPfIT has faced challenges in it is implementation (Hebert 1998). The plan to proceed towards EHRs has not reached the anticipated levels as a significant variance can be noticed in the program's progress. For example notable progress occurred in London while the progress was not going well in the different cities areas such as in the East, Midlands and North areas of London (Erstad, 2003, Labkoff and Yasnoff, 2007). In the context of the UK, specifically London, the implementation of EHRs has seen varying degrees of success. According to a study by the National Audit Office (NAO) in 2019, the implementation of EHR systems in the National Health Service (NHS) has faced significant challenges, with only 25% of NHS trusts fully meeting their digital goals. The NHS study highlights that despite substantial investment in digital infrastructure, many hospitals continue to struggle with interoperability, data integration, and user acceptance, which are crucial for the effective functioning of EHR systems.

In Australia, HealthConnect was founded by The National Electronic Health Records Taskforce in 2000 to gather and save health information and to develop the efficiency of health care using computerised information. The government founded experimental sites in different places in the country to test HealthConnect's effectiveness and to see what could be learned from electronic trials. The Federal Enterprise Architecture Framework was designed to ensure privacy, security, control of access, control of data, application and technology which underscored the policies and standards for EHRs (Al-aswad et al., 2013). Australia has established a national Personally Controlled Electronic Health Record (PCEHR) system for all Australians. The Government financed up to $466.7 million for the PCEHR system, while the plan was to allow all Australians to be registered in the system online from 2012-13 onwards. An outline of procedures was released to motivate informed discussion between government and stakeholders concerning design, build, characteristics and implementation of the PCEHR. From an adoption perspective, over sixty percent of General practitioners in Australia are linked to the PCEHR. National EHRs permeation in 2012 was estimated at sixty six percent for both ambulatory settings and hospitals. Eighty percent of the bed base in New South Wales hospitals have EHR functions in more recent times (Mossialos et al., 2015).

Significantly that there are many concerns in the area of EHRs adoption and that it is necessary to pay more attention to factors that influence the EHR adoption process such as privacy, financial, organisational, ethics and other factors as outlined by health scholars (Bernat, 2013, Ozair et al., 2015). An understanding of the different contexts, and past and current challenges facing EHRs adoption can be used as a basis to guide current decision makers in establishing adoption strategies going forward.

2.6. Adoption models and theories

While the global adoption of EHRs has escalated over the past three decades, this adoption has not been without its challenges. These challenges frequently stem from the absence of a structured and holistic methodology for implementing EHR systems (Oliveira & Martins, 2010). The deployment of EHRs necessitates a comprehensive evaluation of all facets of a healthcare organization, encompassing technological resources, human capital, and the broader organizational structure and culture, as well as the interrelationships among these elements (Marques, Oliveira, Dias & Martins, 2011). Furthermore, successful EHRs implementation, which is effectively the introduction of novel information technologies, also demands proficiency in change management and a deep understanding of the dynamics between new technologies and human behaviour.

Given the pervasive incorporation of information technology (IT) globally, numerous studies have employed various theoretical frameworks to facilitate the effective adoption of innovative IT systems (Oliveira & Martins, 2010). Since EHRs are predicated on developed IT, the literature on IT adoption models is exceptionally relevant to the problem setting of this thesis. This thesis adopted several widespread theories/models that are used in IT system applications including the Diffusion of Innovation (DOI) model, the Technology Acceptance Model (TAM), and the Technology, Organization, and Environment (TOE) framework. For example, the DOI model explores the mechanisms by which new technologies are adopted and successfully implemented, analysing the factors that influence organizational decision makers to adopt or reject a new IT innovation system (Oliveira & Martins, 2010). Despite its application across various fields, the DOI theory is sometimes viewed as limited due to its narrow scope, primarily promoting adoption behaviours without considering the prevention of undesirable behaviours or acknowledging the significant environmental constraints that occur in less developed nations (MacVaugh & Schiavone, 2010).

Conversely, TAM, developed by Davis (1989), places greater scrutiny on user behaviour and responses towards new computer systems (Morton, 2008). It posits that system adoption and utilization are influenced by user perceptions of the system's utility and its potential to enhance work efficiency and quality (Morton, 2008). TAM has been extensively cited and employed in research investigating attitudes towards new technologies (Chuttur, 2009). However, despite its wide usage, TAM has been critiqued for its reliance on subjective theories and its lack of empirical assessment of actual versus reported system use (Bagozzi, 2007; Chuttur, 2009). Critics argue that it insufficiently addresses the technological and organizational dimensions critical to EHRs implementation, focusing predominantly on user acceptance (Shroff et al., 2011; Chuttur, 2009).

In contrast, the TOE framework delineates three contexts—technological, organizational, and environmental—that influence IT system implementation (Tornatzky & Fleischer, 1990). This framework which has been applied in numerous international studies across different sectors including healthcare, offers a robust model to understand, implement, and evaluate information systems adoption success (Liu, 2011). Due to its comprehensive scope and demonstrated effectiveness, the TOE framework is selected as an appropriate framework for assessing a number of EHRs barriers that need to be considered by innovation adopters tied to the specific needs of Australian private hospitals. While criticisms have been noted when applying the singular features of IT models, the thesis explores why the integration of DOI, TAM, and TOE offer a more robust lens by which to investigate EHRs adoption success.

2.7. Levels and processes of innovation adoption

In technology adoption and information systems research, scholars have often explored the adoption process at three levels: individual (Venkatesh, et al. 2003), organisational level (Fichman and Kemerer 1997), and group level (Sambamurthy and Chin, 1994). In the context of organizational adoption, there are two main stages: initiation and implementation (Frambach and Schillewaert, 2002). The adoption decision takes place between the initiation and implementation stages. During the initiation stage, the organization becomes aware of the innovation, forms an attitude towards it, and evaluates the new product (Pichlak, 2016). This stage includes awareness, consideration, and intention sub-stages. In the implementation stage, the organization decides to purchase and use the innovation (Huda et al., 2021). However, organizational adoption decision marks only the beginning of implementation and the subsequent acceptance or assimilation within the organization becomes crucial (Pichlak, 2016, Huda et al., 2021). From the supplier's perspective, the innovation process is deemed successful only when the innovation is accepted and integrated into the organization, and the target adopters demonstrate commitment by continuing to use the product over time (Oliveira and Martins, 2011).

The technology adoption process involves several innovation stages before full implementation. One crucial factor is individuals' readiness for change, which must be addressed prior to the acceptance and integration of new IT innovations into practice (Rogers, 2002, Kim et al., 2017). Here, employees and stakeholders need to be convinced about the direct benefits of the change (Ajzen, 1991). Second, scholars suggest that supportive organisational policies, processes and systems are likewise very important for adoption success (Lewicka, 2011). Organisations need to support employees by providing training (Al-Gahtani and King, 1999), incentives (Bhattacherjee, 1998) and managerial support (Lewis et al., 2003) inter alia of other support mechanisms. Perceptions by decision makers that a new innovation will be useful as well as the degree to which the technology is easy to use is also important (Oliveira and Martins, 2010, Davis et al., 1989). Perceived usefulness for instance means the degree to which an individual believes that using a specific system would increase job performance (Davis, 1989), while ease of use helps decision makers to decide if the technology to be adopted is the right fit and easy to use (Morton, 2008, Venkatesh, 2000).

Moreover, the social environment is important. Social influence is the degree that individuals in a certain group can influence others about adoption benefits (Talukder and Quazi 2011). Fishbein and Ajzen (1977) suggest that normative beliefs about the suitability of innovation adoption forms the basis of adoption attitudes, such that social pressure through peers in a social network will influence the innovation process (Igbaria, et al. 1996). Consequently, it is important for organisations to comprehend the processes shaping new innovation adoption decisions. The levels and processes related to new technology adoption decisions are outlined and explained in more detail in Section 3 and 4.

2.8. The initial proposed model of EHRs adoption

This sub section now introduces paper 1 which was the first paper submitted for publication from this thesis. Paper 1 comprised a systematic literature review and a classification framework of the factors influencing the adoption of EHRs within the Australian Private Healthcare system. Systematic literature reviews (SLRs) represent a thorough investigation of relevant literature to detect, appraise and understand all available research relevant to particular research questions, or the phenomenon being addressed (Ali et al., 2022). SLRs have been used in the medical sector in the field of software engineering (Kitchenham, 2004) and in information systems research (Okoli, & Schabram, 2010). The significance of the SLR procedure is to ensure that a literature has been reviewed in a systematic and comprehensive manner. The most common reasons for conducting SLRs within a field of study include: 1) to sum up the current evidence related to a topic being addressed, 2) to identify gaps in knowledge, and 3) to deliver a model or framework to support current and future study (Kitchenham & Charters, 2007). The time and effort involved is one of the disadvantages of the SLR process. However, among the advantages includes reducing the likelihood of bias and the comprehensive manner in which a phenomenon is explored (Kitchenham & Charters, 2007, McDonagh 2013).

CHAPTER 3: PAPER 1

A SYSTEMATIC LITERATURE REVIEW OF DIGITAL HEALTH RECORDS ADOPTION IN THE AUSTRALIAN HEALTHCARE SECTOR

3.1. Introduction

The quality of healthcare delivery is complicatedly linked to the effective management EHRs, which have become increasingly widespread in healthcare settings worldwide. Despite the evident benefits of EHRs, challenges persist in their successful adoption and implementation within the healthcare sector. This study focuses on explaining the role of technological, organizational, and environmental factors that are fundamental in facilitating and enhancing the adoption process of EHRs. Specifically conducted within the healthcare sector in Australia, this research aims to contribute significantly to the scholarly understanding of EHRs adoption processes in this context.

By conducting a systematic literature review, this study identifies barriers to adoption and classifies key innovation adoption factors that healthcare leaders must consider for successful implementation. While previous studies in Australia have primarily focused on user perspectives and personal health records, this systematic review delves into the digital adoption process of EHRs within Australian hospitals offering insights that are crucial for healthcare leaders navigating the complexities of implementing EHR systems .

Through the lens of the Technology-Organization-Environment (TOE) framework, this research seeks to provide a comprehensive analysis of the factors influencing the adoption of EHRs within Australian hospitals. By integrating this framework into the systematic literature review process, the study aims to uncover emerging TOE factors and digital issues that inform the EHRs adoption process. This research not only aims to fill existing knowledge gaps but also to contribute to the development of strategies that can enhance the successful adoption of EHRs in healthcare settings. This study sets out to address Research Question 1: Which emerging TOE factors and underlying EHRs digital issues best inform the EHRs digital adoption process within Australian hospitals? By synthesizing existing literature and applying the TOE framework, this research endeavours to shed light on critical factors that influence the adoption of EHR systems , ultimately contributing to a more informed approach to digital innovation in healthcare delivery.

3.2. The paper

A Systematic Literature Review of Digital Health Records Adoption in the Australian Healthcare Sector

Salem Ouheda [a], Prof. Peter A. Murray [a] , Dr. Abdul Hafeez-Baig [a]

[a] *University of southern queensland, UniSQ, 487-535 West St, Darling Heights QLD, Toowoomba 4350, Australia.*

Salem.Ouheda@usq.edu.au

Peter.A.Murray@unisq.edu.au

Abdul.Hafeez-Baig@usq.edu.au (Corresponding author)

Abstract:

In today's digital age, electronic healthcare records (EHRs) have become a significant source of digital innovation in the public and private healthcare sector. EHRs reduce the reliance on legacy paper records and enhance the effectiveness of care through automated information transfer. The quality of healthcare delivery moreover depends significantly on the effective management of EHRs. Despite its obvious benefits, multiple concerns have arisen in relation to the successful adoption and implementation of digital records in the sector. In this context, the study highlights the role of the technology, organizational and environmental factors most likely to facilitate and enhance the adoption process of EHRs. The study makes a major contribution to scholarly understanding of the EHRs adoption process within the healthcare sector within Australia. Using a systematic literature review, the study identifies the barriers to adoption. It also classifies the most important innovation adoption factors that healthcare leaders must carefully consider for successful adoption. While previous studies within the Australian context have mainly focused on user, personal and *my health* records, this is the first systematic review study to explore the TOE digital EHRs adoption process within Australian hospitals which have important and far-reaching consequences for health care leaders.

Keywords: Electronic health record, Implementation, Health sector, EHRs, Australian Healthcare Sector

1. Introduction

In recent years, the adoption of Electronic Health Records (EHRs) has escalated globally, with a growing number of hospitals implementing these systems. Digital initiatives in countries such as Australia, USA, and the United Kingdom have been driven by government mandates and financial incentives [1]. These initiatives are motivated by the promise of improved integration and accessibility of patient data, the need to enhance efficiency and cost-effectiveness, and the necessity to manage an increasingly complex and rapidly changing healthcare landscape[2] . EHR systems vary widely and refer to a range of electronic information used in healthcare. They can be implemented within individual organizations as interoperable systems across affiliated healthcare units, regionally, or on a national scale [3]. Healthcare entities that utilize EHRs include hospitals, pharmacies, general practitioner clinics, and other healthcare providers [4].

The adoption of hospital-wide EHRs systems is a complex endeavor, influenced by numerous factors involving financial resources, culture, quality of staff, skills and competencies, and organizational infrastructure [5]. Implementing new technology in healthcare providers present significant challenges because of the complication of data, concerns about security and confidentiality, and lack of perception about the advantages of new technology innovations such as EHRs [6]. The sector has multiple clinical and best practice aims that need to cater for medical professionals, complex and varied medical structures and processes, and high levels of medical knowledge and independence [7]. These distinctive characteristics highlight the need for focused studies within Australia that identify and broaden previous findings within the EHRs context.

The current study focuses on the implementation of EHRs utilizing the technology, organization, and environment (TOE) framework [8], that enables researchers to categorize a range of organizational factors to appropriately understand planned digital change. The framework is commonly used in organizational case studies and healthcare innovation research [9],, and is thus useful in better comprehending EHRs implementation efforts. It helps for instance to underpin the SLR process by facilitating the inclusion of diverse themes from selected articles [10], as well as enabling researchers to broadly understand the emerging issues of the technology adoption process [11]. The technological dimension for example enables a more fine-grained analysis of the complexity, compatibility, and relative advantage of technology adoption [12], while the organizational dimension shifts attention to the internal factors. These might include for example in the organizational context such things as size, structure, culture, and strategic resources [13]. The environmental dimension by comparison considers other external factors such as regulatory policies, competitive pressure, and the overall size of technological infrastructure requirements [14].

There is no evidence indicating that comprehensive reviews have been conducted to examine the literature on EHR implementation within the Australian hospital context. A study by de Mesquita and Edwards [15], centred on user perspectives within a national *My Health Record* context. Studies by Al Ani, et al. [16] and Yan, et al. [17], focused on a different sets of health objectives. Other converging studies have explored different aspects of e-health [11], yet have stopped short in exploring how digital records and innovation adoption occur within Australian hospitals. Mostly, studies have involved broader contexts such as small clinics and national or regional EHRs initiatives. This systematic literature review (SLR) by comparison fills this knowledge gap by contributing a more focused and detailed analysis of the existing body of knowledge in this area.

Navigating the difficulties of EHRs implementation in hospitals requires a comprehensive understanding of existing knowledge of the EHRs innovation adoption process [5]. This research aims to identify, classify, and analyse the findings of the extant literature concerning the implementation of EHRs digital innovation. Increased knowledge of the factors and barriers of EHRs digital adoption potentially enhances the literature related to the underlying patterns and complicated relationships that exist. Moreover, extant research suggests that strategies that provide solutions to these issues are increasingly required [18]. This study accordingly identifies and elaborates on what these complicated relationships and underlying patterns look like and how they influence the EHRs adoption process. In sum, the discussions culminate in an overall research question to be explored as follows:

Research Question 1: Which emerging TOE factors and underlying EHRs digital issues best inform the EHRs digital adoption process within Australian hospitals?

Taken together, the integration of TOE within the SLR process is expected to facilitate a comprehensive understanding of the emerging EHR issues for determining adoption success. First, the study outlines and explains the SLR methodology process. Second, we position the emerging themes within the TOE framework to gain a broader understanding of the relevant EHRs factors and facilitators for digital adoption. We then illustrate the emerging conceptual framework followed by a discussion of the study's contribution to knowledge and relevant literature.

2. Methodology

2.1 Search Strategy

The researchers conducted a comprehensive investigation into the factors influencing the adoption of Electronic Health Records (EHRs). The initial search utilized terms and keywords derived from the research question, which facilitated the identification of additional relevant keywords. This process led to the formulation of search strings. Table 1 below illustrates the Search Strategy used in this review.

Table 1 Search Strategy

Element	Description
Databases to be Searched	ScienceDirect, Google Scholar, PubMed
Search Period	2008 to 2024
Primary Keywords	"Electronic Health Record" OR "EHR", "Electronic Medical Record" OR "EMR", "Electronic Patient Record" OR "EPR", "Personal Health Record" OR "PHR", "Electronic Healthcare Record"
Secondary Keywords	"Adoption", "Implementation", "Factors", "Determinants", "Barriers", "Facilitators"
Combination of Keywords	1. "Electronic Health Record" AND ("Adoption" OR "Implementation" OR "Factors" OR "Determinants" OR "Barriers" OR "Facilitators") 2. "Electronic Medical Record" AND ("Adoption" OR "Implementation" OR "Factors" OR "Determinants" OR "Barriers" OR "Facilitators") 3. "Electronic Patient Record" AND ("Adoption" OR "Implementation" OR "Factors" OR "Determinants" OR "Barriers" OR "Facilitators")

	4. "Personal Health Record" AND ("Adoption" OR "Implementation" OR "Factors" OR "Determinants" OR "Barriers" OR "Facilitators")
Search Filters	Language: English. Publication Type: 1. Academic journals, 2.Academic and professional conferences, ,3. Theses and Dissertations, 4.Reviews, 5. Books and Book Chapters, 6. Conference abstracts, 7. Reports. Access: Full-text available
Search Strategy Steps	1. Identify Initial Search Terms. 2. Conduct Preliminary Searches. 3. Formulate Search Strings. 4. Apply Search Filters. 5. Perform Database Searches. 6. Compile and Organize Results.

2.2 Results of initial search.

The initial search used three major databases: ScienceDirect, Google Scholar, and PubMed. The search conducted in ScienceDirect yielded 94 Australian studies relevant to the implementation and adoption of EHRs. Google Scholar produced 65 studies on the same topic, reflecting a broader but slightly less focused range of publications. PubMed, known for its extensive collection of biomedical literature, returned 117 studies, indicating a substantial amount of research available in this area. These initial results highlight the significant body of literature across various databases, providing a solid foundation for a comprehensive systematic literature review on EHRs.

2.3 The criteria of Inclusion / Exclusion

Inclusion and exclusion criteria were pre-defined characteristics that determined the eligibility of a study for inclusion [19]. For this research, studies needed to meet the following criteria: challenges associated with EHR adoption, factors that facilitate or hinder the adoption of EHRs applications in healthcare environments, and studies addressing the Australian environment. Only studies published between 2009 and 2024 were included. All studies needed to be in English. Similarly, all studies that did not relate to the research question or those not linked to the adoption or implementation of EHRs were excluded. Moreover, studies that examined other scientific healthcare aspects were not included.

2.4 Assessing the Quality of Studies

Quality assessment involved evaluating the quality of potential primary studies through full-text analysis [20]. All included studies were assessed using a quality checklist; comprehensive documentation of all decisions was made during this process to ensure transparency in the SLR process. Kitchenham [21] proposed a checklist of quality criteria. A modified version of this checklist is presented in Table 2. The checklist operated as follows: A score of 1 was assigned to an element if the criterion was met. A score of 0 was assigned if the criterion was not met. The threshold score that a primary study must achieve was 3. Any study scoring less than 3 was excluded from the review.

Table 2 Quality assessment checklist Criteria

Aspect	Description
Study Aim	The study's objectives are clearly outlined.
Research Question	The research question is precisely stated.
Data Collection Methods	The data collection methods are detailed.
EHR Adoption Issues	Issues surrounding EHRs adoption are discussed.
Context	The context specific to Australia is considered.

Before the quality assessment checklist was applied, seventy five studies were included in the review. Using Table 2 as a basis to determine the quality of articles, forty six studies were retained for analysis and data extraction (see Table 3).

Table 3 Quality assessment checklist

Study	Is the aim of the study obviously defined	Is research question obviously specified	Are the methods of data collection explained	Are EHRs adoption issues addressed	Is Australia context addressed	Total
(Jha, 2008)	1	1	1	1	1	5
(Aarts, 2009)	1	1	1	1	1	5
(Saleh, 2009)	1	1	1	1	1	5
(Deutsch, 2010)	1	1	1	1	1	5
(Moxey, 2010)	1	1	1	1	1	5
(McGinn, 2011)	1	1	1	1	1	5
(Morrison, 2011)	1	1	1	1	1	5
(Showell, 2011)	1	1	1	1	1	5
(Cripps, 2012)	1	1	1	1	1	5
(Cripps, 2012)	1	1	1	1	1	5
(Foster, 2013)	1	1	1	1	1	5
(Grunwell, 2013)	1	1	1	1	1	5
(Pearce, 2013)	1	1	1	1	1	5
(Tavakoli, 2013)	1	1	1	1	1	5
(Wang, 2013)	1	1	1	0	1	4
(Xu, 2013)	1	1	1	1	1	5
(Abbott, 2014)	1	1	1	1	1	5
(Andrews, 2014)	1	1	1	1	1	5
(Garrety, 2014)	1	1	1	1	1	5
(Knight, 2014)	1	1	1	1	1	5
(Pearce, 2014)	1	1	1	1	1	5
(Bailie, 2015)	1	1	1	1	1	5
(Safdari, 2015)	1	1	1	1	1	5
(Standing, 2015)	1	1	1	1	1	5
(Zhang, 2015)	1	1	1	1	1	5
(Baysari, 2016)	1	1	1	1	1	5
(Liaw, 2016)	1	1	1	1	1	5
(Mitchell, 2016)	1	1	1	1	1	5
(Ross, 2016)	1	1	1	1	1	5
(Alan, 2017)	1	1	1	1	1	5
(Almond, 2017)	1	1	1	1	1	5
(Bidargaddi, 2017)	1	1	1	1	1	5
(HARDIE, 2017)	1	1	1	1	1	5
(Liaw, 2017)	1	1	1	1	1	5
(Muhammad, 2018)	1	1	1	0	1	4
(Eden, 2019)	1	1	1	1	1	5
(Yu, 2020)	1	1	1	1	1	5
(Liu, 2020)	1	1	1	1	1	5
(Schwarz, 2020)	1	1	1	0	1	4
(Lloyd, 2021)	1	1	1	1	1	5

(Jedwab, 2022)	1	1	1	1	1	5
(Feely, 2023)	1	1	1	1	1	5
(Singh, 2023)	1	1	1	1	1	5
(Ng, 2023)	1	1	1	1	1	5
(Lloyd, 2023)	1	1	1	1	1	5
(Hareem, 2024)	1	1	1	1	1	5

2.5 Selection process of research

All initially selected studies underwent a series of iterative steps to make sure their relevance to the area of the systematic literature review as outlined in Table 4.

Table 4 Inclusion Procedure

Process	Outcome	Percentage of included research
Primary search	286	
Eliminate duplicates	166	58%
Screen titles and abstracts	75	26.2%
Apply quality assessment	46	16%

An exhaustive and rigorous process was conducted to identify studies for inclusion in the review as detailed in Table 4. Following the application of all selection criteria, 46 studies (Tables 3 and 4) were eventually included, representing 16% of the overall studies initially selected. The process began with the removal of duplicate search results, reducing the initial 286 studies to 166, meaning 58% of studies were retained at this stage. Subsequently, titles and abstracts were screened to exclude studies irrelevant to EHRs adoption, resulting in 75 studies remaining, which is 26.2% of the total results. Following this, inclusion/exclusion criteria and quality assessments were applied which excluded an additional 29 studies. In sum, 46 studies representing 16% of the initial research results were deemed eligible for review after the application of the quality assessment checklist. Figure 1 illustrates the phases.

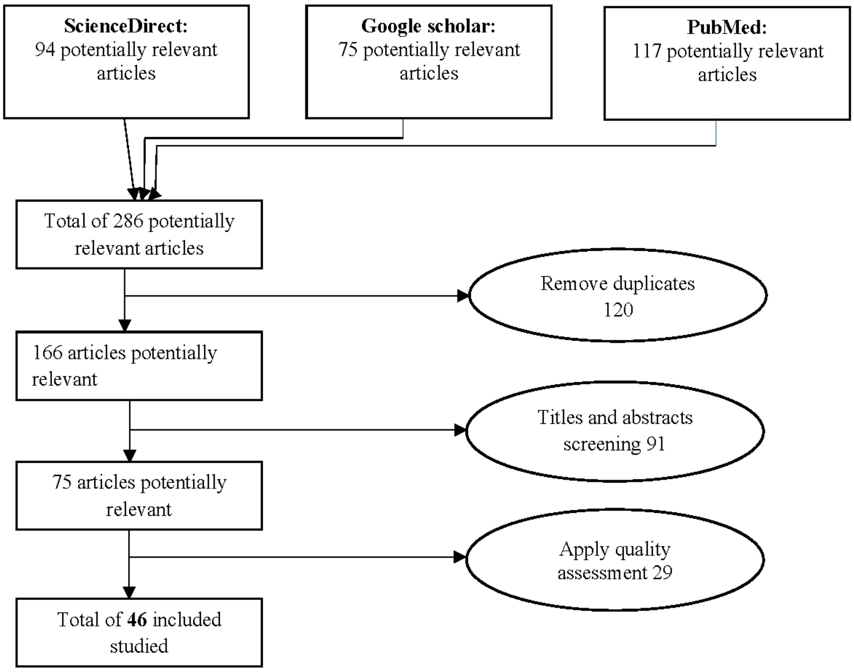


Figure 1 Selection procedure

2.6 Documenting the Search Strategy

To ensure precise reporting and to enable future researchers to replicate the strategy and quality assessment applied, systematic reviews require comprehensive documentation of the search strategy [22]. In this study, the search strategy was methodically informed and detailed by organizing article characteristics such as name of the author , study title, year, database used, and Journal name (Table 5).

Table 5 List of included studies

Authors	Study Title	Year	Database Searched	Journal Name
Jha et al.	The use of health information technology across seven nations	2008	PubMed	International Journal of Medical Informatics
Aarts & Koppel	Implementation of computerized physician order entry in seven countries	2009	PubMed	Health Affairs
Saleh & Burgess	Factors impacting the adoption and use of ICT in the Malaysian SME sector	2009	Google Scholar	Electronic Journal of Information Systems Evaluation
Deutsch et al.	Critical areas of national electronic health record programs	2010	PubMed	Journal of Medical Systems
Moxey et al.	Computerized clinical decision support for prescribing: provision does not guarantee uptake	2010	Google Scholar	Journal of the American Medical Informatics Association

McGinn et al.	Comparison of user groups' perspectives of barriers and facilitators to implementing electronic health records: a systematic review	2011	Google Scholar	BMC Medicine
Morrison et al.	Understanding contrasting approaches to nationwide implementations of electronic health record systems: England, the USA and Australia	2011	Google Scholar	BMC Health Services Research
Showell	Citizens, patients and policy: a challenge for Australia's national electronic health record	2011	PubMed	Health Information Management Journal
Cripps & Standing	Building patient trust in electronic health records	2012	Google Scholar	The Electronic Journal of Health Informatics
Cripps et al.	An exploratory study of the implementation of electronic health records in two countries	2012	Google Scholar	International Journal of Medical Informatics
Foster & Lejins	E-health security Australia: The solution lies with frameworks and standards	2013	Google Scholar	Health Information Management Journal
Grunwell et al.	Improving usefulness of E-health systems: the role of understanding end-user perceptions	2013	Google Scholar	International Journal of Medical Informatics
Pearce et al.	The computerized medical record as a tool for clinical governance in Australian primary care	2013	PubMed	Studies in Health Technology and Informatics
Tavakoli et al.	Patient access to electronic health record: A comparative study on laws, policies, and procedures in selected countries	2013	PubMed	International Journal of Health Policy and Management
Wang et al.	Description and comparison of quality of electronic versus paper-based nursing care plan in Australian aged care homes	2013	ScienceDirect	International Journal of Medical Informatics
Xu et al.	Implementation of e-health record systems in Australia	2013	Google Scholar	Journal of Medical Systems
Abbott et al.	Complexity and the science of implementation in health IT	2014	ScienceDirect	Journal of Biomedical Informatics
Andrews et al.	The Australian general public's perceptions of having a personally controlled electronic health record (PCEHR)	2014	PubMed	BMC Medical Informatics and Decision Making
Garrety et al.	National electronic health records and digital disruption: The case of the Australian Personally Controlled Electronic Health Record	2014	PubMed	Journal of Medical Internet Research
Knight et al.	The eCollaborative: using a quality improvement collaborative to implement the National eHealth Record System in Australian primary care practices	2014	PubMed	Journal of Medical Internet Research
Pearce & Bainbridge	A personally controlled electronic health record for Australia	2014	PubMed	Journal of the American Medical Informatics Association
Bailie et al.	Consistency of denominator data in electronic health records in Australian primary healthcare services: enhancing data quality	2015	PubMed	Journal of the American Medical Informatics Association
Safdari et al.	Electronic health records: Critical success factors in implementation	2015	PubMed	International Journal of Medical Informatics
Standing & Cripps	Critical success factors in the implementation of electronic health records: a two-case comparison	2015	ScienceDirect	Health Information Management Journal
Zhang et al.	Using diffusion of innovation theory to understand the determinants of health technology adoption: a case study in China	2015	PubMed	Health Information Science and Systems
Baysari et al.	Implementation of electronic medication management systems in hospitals: a literature review of the advantages and disadvantages	2016	Google Scholar	International Journal of Medical Informatics
Liaw et al.	Optimising the use of EHR data to improve health care and knowledge discovery	2016	PubMed	Journal of Biomedical Informatics
Mitchell & Andrew	National E-Health Transition Authority Ltd. Evolution of eHealth in Australia	2016	Google Scholar	Journal of Telemedicine and Telecare
Ross et al.	Factors that influence the implementation of e-health: a systematic review of systematic reviews (an update)	2016	PubMed	Implementation Science

Alan	Adoption of Electronic Health Record System in Community-Based Physiotherapy Clinics	2017	PubMed	BMC Health Services Research
Almond et al.	An Approach for Enhancing Adoption, Use and Utility of Shared Digital Health Records in Rural Australian Communities	2017	PubMed	Studies in Health Technology and Informatics
Bidargaddi	Learning from development of a third-party patient-oriented application using national PHR system	2017	Google Scholar	International Journal of Medical Informatics
Hardie et al.	User acceptance of electronic medication management systems in pediatric settings	2017	Google Scholar	Journal of the American Medical Informatics Association
Liaw et al.	Informatics capability maturity in general practice: A new approach	2017	PubMed	BMC Family Practice
Muhammad & Wickramasinghe	Critical Issues in Implementing and Adopting National Electronic Health Records: A Case Study of Australia's My Health Record	2018	PubMed	Journal of Medical Internet Research
Eden et al.	Digitising an Australian hospital: qualitative analysis of staff-reported impacts	2019	Google Scholar	Australian Health Review
Liu & Edye	Implementation of electronic health records systems in surgical units: a review of the literature	2020	PubMed	Journal of Surgical Research
Schwarz et al.	Perceptions of allied health staff on the implementation of an electronic medical record: a qualitative analysis	2020	Google Scholar	Journal of Allied Health
Yu et al.	The contribution of electronic health records to risk management in aged care	2020	Google Scholar	Journal of the American Medical Informatics Association
Lloyd et al.	Comparative usability assessment of electronic medical records: A cross-sectional survey	2021	PubMed	International Journal of Medical Informatics
Jedwab et al.	Nurses' perceptions of electronic medical records: a qualitative study	2022	ScienceDirect	International Journal of Nursing Studies
Feely et al.	Allied health professionals' experiences with electronic medical record implementation in a hospital setting: a qualitative study	2023	ScienceDirect	BMC Health Services Research
Lloyd et al.	Clinician perspectives on EMR usability: a comparative analysis of medical and nursing professions	2023	Google Scholar	Journal of the American Medical Informatics Association
Ng et al.	Digital health adoption and technology adoption in health improvement: a comparative study	2023	Google Scholar	International Journal of Medical Informatics
Singh & Kumari	National culture influence on EHR adoption: A comparative study of India and Australia	2023	PubMed	Journal of Medical Systems
Hareem et al.	Pharmacy technology utilization: A comparative study of EHR and e-prescribing in Australian community pharmacies	2024	PubMed	International Journal of Pharmacy Practice

2.7 Temporal distribution and evolution of included studies

The selected articles included a diverse collection of attributes particularly concerning their publication years (Figure 2) which spanned from 2008 to 2024. The year 2008 provided first evidence of the introduction of EHRs in Australia. This temporal range reflected the evolution and sustained interest in EHRs over more than a decade. Out of these, there was a marked increase in the number of studies published in the years following 2010, peaking around 2013 and maintaining a relatively high volume of publications through the early 2020s. This pattern suggested a growing recognition of the importance of EHRs in improving healthcare delivery and a corresponding rise in scholarly investigation. The more recent years, particularly 2023 and 2024, also showed continued research activity, indicating ongoing advancements and persistent challenges in the field. The articles' distribution by year highlighted the dynamic and ever-evolving scene of EHRs research, with newer studies likely building upon the foundational work of earlier years, thus providing a broad and longitudinal perspective on the subject.

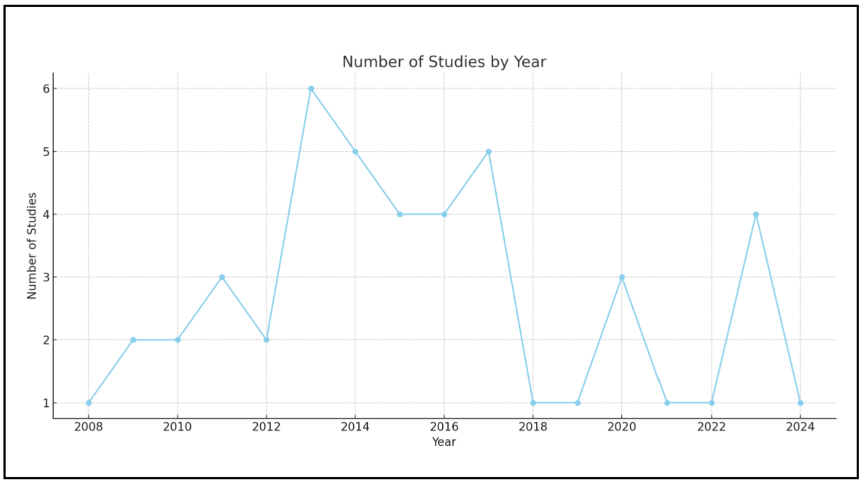


Figure 2. Publications by year. Source: Author's

2.8 Data Extraction

Data extraction entails the organized gathering of pertinent information from the studies that are part of the review [23]. In our review, data extraction was carried out according to the following steps: First, each included study was meticulously reviewed with data related to factors that either impede or drive EHRs adoption being extracted from the results and discussion sections. Second, four primary classifications of factors were established with each classification representing distinct groups of sub-factors. Third, this phase involved reading and coding each study, while concurrently identifying and categorizing factors into their respective categories.

2.9 Data Synthesis

Data synthesis is the process of summarizing and aggregating the outcomes of primary research studies included in this SLR [21]. A descriptive synthesis technique was employed due to the qualitative nature of the study. Descriptive synthesis provides a well-established approach for qualitative research, maintaining a clear and transparent linkage between the primary study texts and their conclusions. Additionally, it facilitates the development of new concepts and retains essential elements critical to the SLR process [24].

3. Results

The results of this study provide a comprehensive overview of various factors influencing the adoption and implementation of Electronic Health Records (EHR) systems, categorized into technological, organizational, environmental (TOE), and individual factors. The analysis -

grounded in primary studies - offers a nuanced understanding of the multifaceted considerations that stakeholders must navigate in the adoption process.

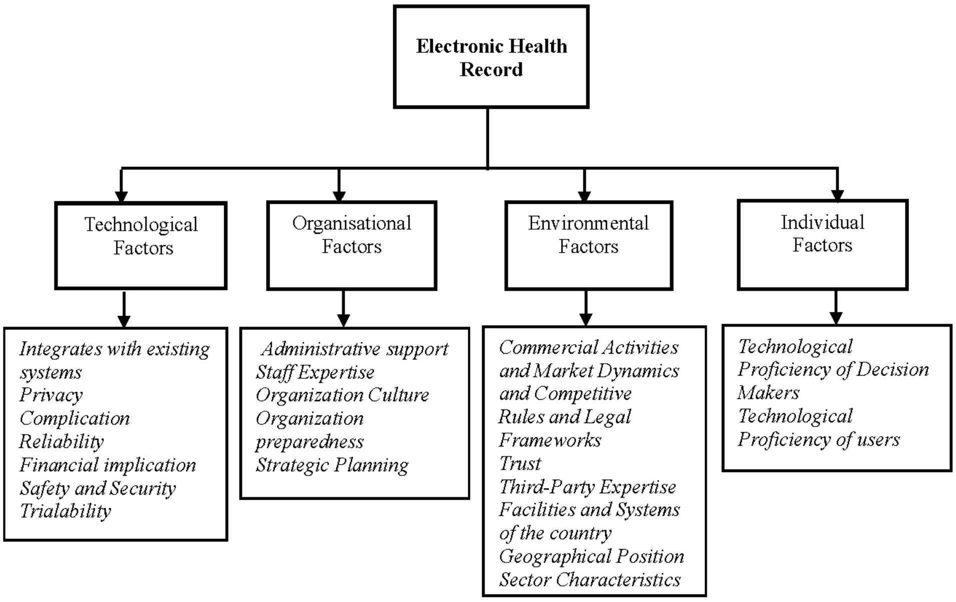


Figure 3 The conceptual framework

3.1. Technological Factors

The technological factors (Table 6) highlight seven primary factors and twenty-four sub-factors. Financial implications emerged as the most frequently discussed factor covered in 47.8% of studies. This underscores the critical importance of cost considerations in technology adoption decisions, particularly in resource-constrained environments [25-27]. Costs associated with implementation, maintenance, and potential savings are critical in decision-making processes emphasizing the need for a balanced cost-benefit analysis in EHRs adoption.

Table 6: Technological Factors

Key-factor	Subsidiary-factors	The studies addressing the factor	Covering rate
Integrates with existing systems	Compatibility, suitability of the technology for the tasks it is intended to perform, Functional Suitability and how well it fits within the current technological environment.	13	28%
Privacy	the protection of personal and sensitive information from unauthorized access and misuse ,privacy of individuals, data confidentiality, the measures in place to ensure that private information is kept secure.	17	36.9%
Complication	Complexity , the degree of difficulty associated with using and implementing a technology, technical complexities, the effort required to facilitate its use, and how user-friendly or simple the technology is.	13	28%
Reliability	Reliability, the technology's ability to operate under expected conditions , the technology's robustness over time.	12	26%
Financial implications	Financial implications associated with adopting and maintaining a technology ,initial implementation costs, ongoing maintenance, training expenses, infrastructure costs, and the potential cost savings the technology may offer.	22	47.8%
Safety and Security	Security pertains to the measures and protocols in place to protect data and systems from breaches, threats, and unauthorized access, concerns about data loss, privacy risks, and security of the technology.	14	30.4%
Trialability	The ease with which the technology can be trialed, effectiveness of trialability, suitability of trialability.	4	8.6%

Privacy concerns, addressed in 36.9% of studies, are another significant factor. The increasing attention to privacy issues reflects broader societal concerns about data security [27]. Privacy, encompassing data protection and confidentiality is essential in building user trust and ensuring compliance with regulatory requirements [27, 28]. Security was covered by 30.4% of the studies and highlights the necessity of implementing comprehensive security protocols to safeguard sensitive information and mitigate the risks associated with cyber threats [2, 29-31].

Compatibility and complexity which evaluate the ease of integration and user-friendliness of technologies each covered 28% of studies. Compatibility with existing systems [30, 32, 33] and the simplicity of technology use [28, 34, 35] are fundamental for smooth adoption and minimizing user resistance. Reliability discussed in 26% of studies, underscores the importance of technology's consistency and durability. Reliability is crucial for ensuring continuous operation and maintaining user confidence particularly in sectors where technology failures have significant consequences such as in the healthcare sector [31, 36-38].

Trialability was the least covered factor at 8.6%, indicating the importance of testing technologies before full-scale implementation. Despite its low coverage, the literature emphasized trialability as critical for reducing uncertainties and enhancing user acceptance [29, 30, 33]. The comprehensive analysis of technological factors reveals the diverse considerations influencing the successful implementation and acceptance of new technologies. Future research should continue exploring these factors in greater depth, primarily those less frequently addressed, to provide a more holistic understanding of technology adoption dynamics.

3.2. Organizational Factors

Table 7 provides a detailed overview of various organizational factors impacting EHRs adoption. Organizational culture emerged as the most extensively covered factor, with 52.1% of studies focusing on training, skill development, and change adaptability. This significant coverage underscores the critical role of organizational culture in shaping an organization's ability to adapt, innovate, and succeed [31, 39, 40].

In 36.9% of studies, staff expertise highlights the importance of a knowledgeable and skilled workforce in achieving organizational goals and driving performance [31, 39, 41]. Organization preparedness, involving IT assets, infrastructure, and technological expertise are addressed in 39.1% of studies reflecting the strong recognition of the importance of being prepared for technological advancements and operational changes [30, 41-43] .

In 19.5% of studies administrative support included IT leadership backing and senior managerial support [30, 31, 41]. Although its coverage is relatively low, administrative support facilitates organizational changes and innovations [28, 41]. Strategic planning, addressed in 21.7% of studies underscores the importance of guiding organizational actions and decision-making through effective planning [41, 42].

Organization size including facility type and centralization is covered in 19.5% of studies [27, 30, 44]. Although it impacts various aspects of performance and structure, it receives less research attention than other factors. Overall, the varying degrees of focus on different organizational factors suggest potential areas for further research, with organizational culture and preparedness receiving the most attention.

Table 7 Organizational Factors

Key-factor	Subsidiary-factors	The studies addressing the factor	Covering rate
Administrative support	Administrative Methods, IT Leadership Backing, The position of the executive authority, Interpretability and Comprehensibility, Executive support, Involvement of Senior Leadership, Leadership Commitment to Innovation, Senior Managerial Support.	9	19.5%
Staff Expertise	Technical Proficiency, Organizational Procedures, Practical Knowledge, Innovation Potential, Workforce Proficiency, In-House Knowledge, Personal Abilities ,Technical Ability, Prior Experience.	17	36.9%
Organization Culture	Training and Skill Development, Absorptive Capacity, receptivity of transformation, Change Adaptability, Cooperative Efforts, Perspective towards the new Technology, Consciousness, Agility, Creativity.	24	52.1%
Organization preparedness	Organizational IT Assets, Facilitating Conditions, Infrastructure, Organizational Preparedness, Technological Expertise, Resources, Enterprise Systems, Anticipated Effort.	18	39.1%

Strategic Planning	Emphasis on Primary Skills, Service Quality, Service Standards, Information Density, Maintain Excellence, Define Business Needs, Successful Approach, End-User Satisfaction, Organizational Plans	10	21.7%
Organization size	Facility Type, Centralized Control, Organisational Scale, Organization Characteristics, Centralization, Organizational Framework, Leadership Hierarchy.	9	19.5%

3.3. Environmental Factors

Environmental factors highlighted in Table 8 involve diverse considerations influencing EHRs implementation. Rules and legal frameworks with a significant coverage rate of 41.3% emphasize the central role of regulatory and legal aspects in facilitating EHRs adoption [28, 35, 45, 46]. A robust legal framework ensures data privacy, security, and compliance with healthcare standards essential for successfully deploying and operating EHRs systems [27, 45, 47].

Trust is another critical factor with a coverage rate of 36.9% and involves sub-factors such as data accuracy, privacy concerns, and the integrity of interactions between providers and users [38, 39, 48]. Building trust is necessary for EHRs implementation as it directly affects user acceptance and effective utilization of the system [42, 45]. Third-party expertise, with a coverage rate of 26%, highlights the critical role of external support, including service provider assistance and independent system assessments in successful EHR implementation [25, 39, 45, 49].

The country's facilities and systems were covered in 21.7% of studies including the overall level of technology adoption e.g., standardization of Data, Telecommunications Services [27, 29], including government support [27, 50, 51]. These factors influenced the readiness and capability of healthcare systems within Australia to implement EHRs effectively [52]. Geographical position and sector characteristics with lower % coverage rates of 8.6%, still play a role in EHRs implementation by affecting the availability of resources and the readiness of different healthcare sectors [29, 41, 50]. Sector characteristics moreover included the sector's readiness for adopting new initiatives [25, 46], change management strategies, the volume and complexity of data [53, 54], and patient population and care models [33, 51]. These factors assessed how prepared the sector was for change, the effectiveness of change management processes, the challenges in managing large and complex datasets, and the demographics and health conditions of the patient population. Despite their importance, only four studies (8.6%) specifically addressed these sector characteristics, indicating a relatively lower focus compared to other factors like rules and legal frameworks or trust. This suggests that while sector characteristics are critical for tailoring interventions and improvements to the sector's specific needs, they are less frequently studied or reported in the literature.

Table 8 Environmental factors

Key-factor	Subsidiary-factors	The studies addressing the factor	Covering rate
Commercial Activities and Market Dynamics and Competitive	Outside Pressure, Competitive Pressure, Social Influences, Degree of Market Competition, Partner Influence	5	10.8%
Rules and Legal Frameworks	Governance Policy, Foster a regulatory environment, Advance Legal Architecture, Advance Regulatory Setup, Adherence to Rules, Rules and Laws	19	41.3%
Trust	Transparency, Accuracy and Integrity of Data, Contracts, Interaction between Providers and Users, Data Privacy Concerns, Secondary Use.	17	36.9%
Third-Party Expertise	Innovation and Updates, Provider Initiatives, Independent Assessment of the system, Service Provider Assistance, Supplier Availability, Provider Competence	12	26%
Facilities and Systems of the country	The overall level of technology adoption, standardization of Data, Telecommunications Services, Internet and Network Connectivity, Government Support and Policies, Health sector Systems	10	21.7%
Geographical Position	Internet and Network Availability, Access to Resources and Support, Different regions may have varying health regulations and compliance requirements.	4	8.6%
Sector Characteristics	The sector's readiness for adopting technology, Change Management, The volume and complexity of data, Patient Population and Care Models.	4	8.6%

3.4. Individual Factors

Table 9 presents individual factors focusing on the technological proficiency of decision-makers and users, each with a coverage rate of 6.5%. Decision-makers' technological proficiency covers their awareness of Information and Communication Technology, ability to evaluate technological solutions, and role in designing and overseeing training programs [25, 28]. Decision-makers with high technological proficiency are better equipped to manage EHRs implementation effectively, ensuring systems align with organizational goals and addressing technical challenges [29, 34].

The technological proficiency of users, including their job roles, personal attitudes toward technology, and ability to handle stress, is equally crucial. Users' technological proficiency impacts their ability to integrate EHRs systems into their daily routines, affecting overall system utilization and acceptance [29, 42, 53]. Practical training and support are essential for improving users' technological skills and managing workload and stress related to EHRs adoption [30, 43, 45].

Training programs tailored to different job roles and levels of technological familiarity can help users feel more comfortable and competent with the technology. Additionally, addressing personal attitudes toward technology and providing strategies to manage stress related to EHRs use can enhance user acceptance and satisfaction. Therefore, prioritizing comprehensive training and support helps healthcare organizations to ensure that technological advancements translate into improved patient care and operational efficiency and enhancing the overall effectiveness of EHRs systems.

Table 9 Individual factors

Key-factor	Subsidiary-factors	The studies addressing the factor	Covering rate
Technological Proficiency of Decision Makers	Proficiency of Decision Makers , Decision Makers Awareness of ICT, Ability of Evaluation, Decision Design and Oversee Training Programs.	3	6.5%
Technological Proficiency of users	Job Role and Responsibilities, Personal Attitudes and Perceptions, Motivation and Commitment, Workload and Stress	3	6.5%

4. Discussions

The aims of this paper were to explore the adoption of EHRs within the Australian hospital sector using the TOE framework. Our study identified and categorized the key factors required for EHRs adoption success by exploring the following research question: Which emerging TOE factors and underlying EHRs digital issues best inform the EHRs digital adoption process within Australian hospitals?

In order to answer research question 1, the focus of the current study on the TOE framework enabled a detailed classification of technological, organizational, and environmental factors related to the EHRs adoption process. Examining which factors were more pervasive within the process helps to provide actionable and practical insights for policymakers, hospital managers, and other stakeholders. This is the first study to our knowledge that provides a comprehensive framework for future action that informs the EHRs adoption process in the hospital sector within Australia.

While the current study is not an empirical investigation, the findings nonetheless broaden more recent studies of Australian pharmaceuticals by [38]. In the pharmaceutical study, data completeness, technical issues, and usability were common concerns for electronic adoption while user-centric design, standardised practices, and robust infrastructure were the basis of successful adoption integration (2024: p. 4). Previous research also found that strong allied health leadership has positive benefits for user experience where continuous evaluation of electronic medical records drove future improvements [43]. This suggests that strong leadership is required to address the TOE barriers. For instance, EHRs might be evaluated on the basis of improvements in accountability for care, in better time management, and in assisting in career development [31; p. 681], where adoption success is more transparent through continuous adoption. For instance, [40] found that a perception of comfort was established post implementation when EHRs became common practice. Whilst in prior studies, speed and efficiency and quality of care did not have significant effects on study variables, our study notes that all of these attributes are important within the EHRs adoption context and should not be swept aside. Arguably the current findings help to expand the fine nuances of what health leaders need to pay attention to in the future.

The most significant findings in relation to TOE were sourced from the technology theme based on the number of papers citing financial implications (47.8%) and organization culture (52.1%) under the organization theme. Given their underlying importance, the study potentially broadens scholarly focus on factors that underscore whether a new technology will or will not be adopted by drawing greater attention to the most pervasive themes within a phenomenon. For example, cost features underly whether health organisations are in a position to adopt the new technology while the cultural aspects of training and development may well represent a bridge too because of the cost (and time required) for training. For instance, Singh [55] found that increased commitment was required from top managers as well as increased education and training for healthcare managers. In addition, cost factors were related mainly to start-up and ongoing maintenance costs along with cost concerns placing pressure on revenue [30].

Taken together, the current study underscores the importance of the continuous evaluation and adaptation of EHRs systems to meet evolving healthcare needs and technological advancements. Many gaps can be potentially explored in future research as a result of the findings of the current study. In integrating insights from these and other studies, our systematic review classifies the attributes for successful adoption through a more comprehensive approach. We believe that the compilation of the TOE factors more broadly provides an important and informative lens for healthcare leaders within the Australian healthcare sector.

5. Limitations of the Research

Despite the comprehensive insights from existing research and the current study, several aspects of EHR implementation remain unexplored. Prior studies, including the current one, have primarily focused on technological, organizational, and environmental (TOE) factors, neglecting individual-level factors like the attitudes, perceptions, and behaviours of healthcare providers and patients. These individual factors are crucial as they significantly impact the acceptance and effective use of EHR systems. Additionally, the dynamic nature of technology adoption has not been sufficiently considered. Factors influencing EHR adoption can change over time due to technological advancements, regulatory changes, and shifting organizational priorities. The current study does not fully capture these temporal changes and their implications. For instance, previous studies highlighted the importance of organizational culture and technological readiness but did not explain how these factors might evolve. The interplay between different factors and their collective influence on EHR adoption also remains underexplored. For example, how to motivate staff to support implementation strategies is not well understood. Furthermore, the specific needs and challenges faced by different types of healthcare organizations, such as small clinics versus large hospitals, have not been thoroughly examined. The current study focuses on the healthcare sector without distinguishing between various organizational contexts. Future research should address individual-level factors, temporal dynamics, factor interdependencies, and specific organizational contexts to develop a more comprehensive understanding of EHR adoption and its implications for healthcare improvement.

6. Conclusion

In conclusion, the adoption of EHRs has witnessed a significant upsurge in recent years, with numerous hospitals globally implementing these systems. The motivation for EHRs implementation initiatives are rooted in the anticipated benefits of enhanced integration and accessibility of patient data, the imperative to bolster efficiency and cost-effectiveness, and the necessity to navigate the complexities of a rapidly evolving healthcare landscape. The TOE framework emerges as a robust model for understanding the adoption and implementation of EHRs within the private healthcare system. By examining the technological, organizational, and environmental dimensions influencing organizational change, the TOE framework here provides a comprehensive perspective of the factors influencing EHRs adoption in the Australian healthcare sector. Accordingly, this SLR bridges the knowledge gap in the literature by exploring the EHRs adoption factors within Australian healthcare context.

Authors' contributions

Author 1 read all articles, writing, performed data extraction, and prepared the concept paper. Authors 2 review and editing, conceptualisation, writing. Authors 1 and 3 prepared the final manuscript for submission. All authors contributed to the research design, the development and application of in/exclusion criteria, the data extraction form, the data synthesis, and the manuscript.

Declaration of competing interest

The authors have no competing interests to declare.

Acknowledgements

None.

Funding sources

This research is supported by an Australian Government Research Training Program (RTP) Scholarship.

References

[1] S. J. Darlington, "Converging Outcomes in Nationally Shareable Electronic Health Records (NEHRs): An Historical Institutionalist Explanation of Similar NEHR Outcomes in Australia, England and the United States of America," The Australian National University (Australia), 2020.

[2] S. Lloyd *et al.*, "Medical and nursing clinician perspectives on the usability of the hospital electronic medical record: A qualitative analysis," *Health Inf Manag,* Mar 3 (2023), p. 18333583231154624, doi: 10.1177/18333583231154624.

[3] M. J. A. Salomi and P. B. Claro, "Adopting Healthcare Information Exchange among Organizations, Regions, and Hospital Systems toward Quality, Sustainability, and Effectiveness," (2020).

[4] B. Aldughayfiq and S. Sampalli, "Digital health in physicians' and pharmacists' office: a comparative study of e-prescription systems' architecture and digital security in eight countries," *Omics: a journal of integrative biology,* vol. 25, no. 2, (2021), pp. 102-122.

[5] J. K. Kabukye, N. de Keizer, and R. Cornet, "Assessment of organizational readiness to implement an electronic health record system in a low-resource settings cancer hospital: A cross-sectional survey," *PloS one,* vol. 15, no. 6, (2020), p. e0234711.

[6] P. Gatiti, E. Ndirangu, J. Mwangi, A. Mwanzu, and T. Ramadhani, "Enhancing healthcare quality in hospitals through electronic health records: a systematic review," *Libraries,* (2021).

[7] N. K. Mensah *et al.*, "Electronic health records post-implementation challenges in selected hospitals: A qualitative study in the Central Region of southern Ghana," *Health Information Management Journal,* (2022), p. 18333583221096899.

[8] L. Tornatsky and M. Fleischer, *The process of technology innovation.* Lexington, MA: Lexington Books, 1990.

[9] H. Ahmadi, M. Nilashi, and O. Ibrahim, "Organizational decision to adopt hospital information system: An empirical investigation in the case of Malaysian public hospitals," *International journal of medical informatics,* vol. 84, no. 3, (2015), pp. 166-188.

[10] J. D. Bryan and T. Zuva, "A review on TAM and TOE framework progression and how these models integrate," *Advances in Science, Technology and Engineering Systems Journal,* vol. 6, no. 3, (2021), pp. 137-145.

[11] S. Faber, M. van Geenhuizen, and M. de Reuver, "eHealth adoption factors in medical hospitals: A focus on the Netherlands," *International journal of medical informatics,* vol. 100, (2017), pp. 77-89.

[12] M. T. Woldemariam and W. Jimma, "Adoption of electronic health record systems to enhance the quality of healthcare in low-income countries: a systematic review," *BMJ Health & Care Informatics,* vol. 30, no. 1, (2023).

[13] S. K. Singh, M. Del Giudice, S. Y. Tarba, and P. De Bernardi, "Top management team shared leadership, market-oriented culture, innovation capability, and firm performance," *IEEE Transactions on Engineering Management,* (2019).

[14] F. Reza, J. T. Prieto, and S. P. Julien, "Electronic health records: origination, adoption, and progression," *Public Health Informatics and Information Systems,* (2020), pp. 183-201.

[15] R. C. de Mesquita and I. Edwards, "Systematic literature review of my health record system," *Asia Pacific Journal of Health Management,* vol. 15, no. 1, (2020), pp. 14-25.

[16] M. Al Ani, G. Garas, J. Hollingshead, D. Cheetham, T. Athanasiou, and V. Patel, "Which electronic health record system should we use? A systematic review," *Medical Principles and Practice,* vol. 31, no. 4, (2022), pp. 342-351.
[17] Q. Yan, Z. Jiang, Z. Harbin, P. H. Tolbert, and M. G. Davies, "Exploring the relationship between electronic health records and provider burnout: a systematic review," *Journal of the American Medical Informatics Association,* vol. 28, no. 5, (2021), pp. 1009-1021.
[18] H. Alzghaibi, A. H. Alharbi, Y. H. Mughal, M. H. Alwheeb, and A. S. Alhlayl, "Assessing primary health care readiness for large-scale electronic health record system implementation: Project team perspective," *Health Informatics Journal,* vol. 29, no. 1, (2023), p. 14604582231152790.
[19] M. McDonagh, K. Peterson, P. Raina, S. Chang, and P. Shekelle, "Avoiding bias in selecting studies," (2013).
[20] K. Allen, J. Zoellner, M. Motley, and P. A. Estabrooks, "Understanding the internal and external validity of health literacy interventions: a systematic literature review using the RE-AIM framework," *Journal of health communication,* vol. 16, no. sup3, (2011), pp. 55-72.
[21] B. Kitchenham, "Procedures for performing systematic reviews," *Keele, UK, Keele University,* vol. 33, no. 2004, (2004), pp. 1-26.
[22] E. Aromataris and D. Riitano, "Systematic reviews: constructing a search strategy and searching for evidence," *AJN The American Journal of Nursing,* vol. 114, no. 5, (2014), pp. 49-56.
[23] M. B. Elamin *et al.*, "Choice of data extraction tools for systematic reviews depends on resources and review complexity," *Journal of clinical epidemiology,* vol. 62, no. 5, (2009), pp. 506-510.
[24] J. Thomas and A. Harden, "Methods for the thematic synthesis of qualitative research in systematic reviews," *BMC medical research methodology,* vol. 8, no. 1, (2008), p. 45.
[25] A. S. Saleh and L. Burgess, "Factors impacting the adoption and use of ICT in the Malaysian SME sector," (2009).
[26] H. Alzghaibi *et al.*, "The impact financial resources on implementation of large-scale electronic health records in the Saudi Arabia's primary healthcare centers: Mixed methods," *Frontiers in Public Health,* vol. 10, (2022), p. 1037675.
[27] H. P. Singh and R. Kumari, "Digital Technologies in Healthcare Management: A Study of Influence of National Culture for Adoption of Electronic Health Records in India and Australia," *Archives of Business Research,* vol. 11, no. 8, (2023), pp. 206-217, doi: 10.14738/abr.118.15354.
[28] K. Bail *et al.*, "Using health information technology in residential aged care homes: An integrative review to identify service and quality outcomes," *Int J Med Inform,* vol. 165, Sep (2022), p. 104824, doi: 10.1016/j.ijmedinf.2022.104824.
[29] C. A. McGinn *et al.*, "Comparison of user groups' perspectives of barriers and facilitators to implementing electronic health records: a systematic review," *BMC Med,* vol. 9, Apr 28 (2011), p. 46, doi: 10.1186/1741-7015-9-46.
[30] J. Ross, F. Stevenson, R. Lau, and E. Murray, "Factors that influence the implementation of e-health: a systematic review of systematic reviews (an update)," *Implement Sci,* vol. 11, no. 1, Oct 26 (2016), p. 146, doi: 10.1186/s13012-016-0510-7.
[31] R. Eden, A. Burton-Jones, J. Grant, R. Collins, A. Staib, and C. Sullivan, "Digitising an Australian university hospital: qualitative analysis of staff-reported impacts," *Aust Health Rev,* vol. 44, no. 5, Sep (2020), pp. 677-689, doi: 10.1071/AH18218.

[32] L. Andrews, R. Gajanayake, and T. Sahama, "The Australian general public's perceptions of having a personally controlled electronic health record (PCEHR)," *Int J Med Inform,* vol. 83, no. 12, Dec (2014), pp. 889-900, doi: 10.1016/j.ijmedinf.2014.08.002.

[33] X. Zhang, P. Yu, J. Yan, and A. M. S. I. Ton, "Using diffusion of innovation theory to understand the factors impacting patient acceptance and use of consumer e-health innovations: a case study in a primary care clinic," *BMC Health Serv Res,* vol. 15, Feb 21 (2015), p. 71, doi: 10.1186/s12913-015-0726-2.

[34] P. A. Abbott, J. Foster, F. Marin Hde, and P. C. Dykes, "Complexity and the science of implementation in health IT--knowledge gaps and future visions," *Int J Med Inform,* vol. 83, no. 7, Jul (2014), pp. e12-22, doi: 10.1016/j.ijmedinf.2013.10.009.

[35] I. Muhammad and N. Wickramasinghe, "Australia Critical Issues in Implementing and Adopting National eHealth Solutions," (2018).

[36] R. Bailie, J. Bailie, A. Chakraborty, and K. Swift, "Consistency of denominator data in electronic health records in Australian primary healthcare services: enhancing data quality," *Aust J Prim Health,* vol. 21, no. 4, (2015), pp. 450-9, doi: 10.1071/PY14071.

[37] S. Lloyd *et al.*, "A National Survey of EMR Usability: Comparisons between medical and nursing professions in the hospital and primary care sectors in Australia and Finland," *Int J Med Inform,* vol. 154, Oct (2021), p. 104535, doi: 10.1016/j.ijmedinf.2021.104535.

[38] A. Hareem, I. Stupans, J. S. Park, J. E. Stevens, and K. Wang, "Electronic health records and e-prescribing in Australia: An exploration of technological utilisation in Australian community pharmacies," *Int J Med Inform,* vol. 187, Jul (2024), p. 105472, doi: 10.1016/j.ijmedinf.2024.105472.

[39] S. T. Liaw *et al.*, "The informatics capability maturity of integrated primary care centres in Australia," *Int J Med Inform,* vol. 105, Sep (2017), pp. 89-97, doi: 10.1016/j.ijmedinf.2017.06.002.

[40] M. Schwarz, A. Coccetti, M. Draheim, and G. Gordon, "Perceptions of allied health staff of the implementation of an integrated electronic medical record across regional and metropolitan settings," *Aust Health Rev,* vol. 44, no. 6, Dec (2020), pp. 965-972, doi: 10.1071/AH19024.

[41] C. Standing and H. Cripps, "Critical Success Factors in the Implementation of Electronic Health Records: A Two-Case Comparison," *Systems Research and Behavioral Science,* vol. 32, no. 1, (2015), pp. 75-85, doi: 10.1002/sres.2209.

[42] R. M. Jedwab, E. Manias, A. M. Hutchinson, N. Dobroff, and B. Redley, "Understanding nurses' perceptions of barriers and enablers to use of a new electronic medical record system in Australia: A qualitative study," *Int J Med Inform,* vol. 158, Nov 29 (2022), p. 104654, doi: 10.1016/j.ijmedinf.2021.104654.

[43] K. Feely *et al.*, "Allied health professionals' experiences and lessons learned in response to a big bang electronic medical record implementation: A prospective observational study," *Int J Med Inform,* vol. 176, Aug (2023), p. 105094, doi: 10.1016/j.ijmedinf.2023.105094.

[44] N. Wang, P. Yu, and D. Hailey, "Description and comparison of quality of electronic versus paper-based resident admission forms in Australian aged care facilities," *Int J Med Inform,* vol. 82, no. 5, May (2013), pp. 313-24, doi: 10.1016/j.ijmedinf.2012.11.011.

[45] M. Baysari, L. Richardson, W. Y. Zheng, and J. Westbrook, "Implementation of electronic medication management systems in hospitals: A literature scan," (2016).

[46] J. Aarts and R. Koppel, "Implementation of computerized physician order entry in seven countries," *Health Aff (Millwood),* vol. 28, no. 2, Mar-Apr (2009), pp. 404-14, doi: 10.1377/hlthaff.28.2.404.

[47] N. Tavakoli, S. S. Isfahani, Z. Piri, and A. Amini, "Patient access to electronic health record: a comparative study on laws, policies and procedures in selected countries," *Med Arch,* vol. 67, no. 1, (2013), pp. 63-7, doi: 10.5455/medarh.2013.67.63-67.

[48] A. Yung, "Adoption of electronic health record system in community-based physiotherapy clinics: a pilot case study," in *Building Capacity for Health Informatics in the Future*: IOS Press, 2017, pp. 395-400.

[49] E. Deutsch, G. Duftschmid, and W. Dorda, "Critical areas of national electronic health record programs-is our focus correct?," *Int J Med Inform,* vol. 79, no. 3, Mar (2010), pp. 211-22, doi: 10.1016/j.ijmedinf.2009.12.002.

[50] Z. Morrison, A. Robertson, K. Cresswell, S. Crowe, and A. Sheikh, "Understanding Contrasting Approaches to Nationwide Implementations of Electronic Health Record Systems England, the USA and Australia.pdf," (2011), pp. 25–41.

[51] A. W. Knight, C. Szucs, M. Dhillon, T. Lembke, and C. Mitchell, "The eCollaborative: using a quality improvement collaborative to implement the National eHealth Record System in Australian primary care practices," *International journal for quality in health care,* vol. 26, no. 4, (2014), pp. 411-417.

[52] K. Garrety, I. McLoughlin, R. Wilson, G. Zelle, and M. Martin, "National electronic health records and the digital disruption of moral orders," *Social Science & Medicine,* vol. 101, (2014), pp. 70-77.

[53] H. Cripps, C. Standing, and V. Prijatelj, "An exploratory study of the implementation of electronic health records: a two country comparison," (2012).

[54] B. Foster and Y. Lejins, "Ehealth security Australia: the solution lies with frameworks and standards," (2013), doi: 10.4225/75/579810e331b3e.

[55] S. K. Singh, M. Del Giudice, S. Y. Tarba, and P. De Bernardi, "Top management team shared leadership, market-oriented culture, innovation capability, and firm performance," *IEEE Transactions on Engineering Management,* vol. 69, no. 6, (2019), pp. 2544-2554.

3.3. Links and implications for next study

Paper 1 lays the groundwork for understanding the adoption of electronic health records (EHRs) by identifying key technological, organizational, and environmental factors influencing their implementation within Australian hospitals. This study, by utilizing the Technology-Organization-Environment (TOE) framework, highlights the emerging TOE factors and digital issues crucial for EHRs adoption. Building on this foundational knowledge, Paper 2 explores these insights in greater detail by focusing on the private healthcare sector and examining how innovation and knowledge management techniques impact EHR adoption. The misalignment found in Paper 2 between the stages of innovation and organizational capabilities reflects the broader challenges identified in Paper 1. This connection underscores the importance of integrating TOE factors with knowledge stocks and learning flows to address EHRs adoption barriers. Through expanding the understanding of how these elements interact, Paper 2 provides practical recommendations for aligning organizational strategies with information systems to enhance EHRs adoption and improve healthcare outcomes, thus extending the theoretical insights of Paper 1 into actionable practices within the private healthcare sector.

CHAPTER 4: PAPER 2

DEVELOPING INNOVATION CAPABILITIES AND KNOWLEDGE STOCKS FOR ASSESSING DIGITAL HEALTHCARE TECHNOLOGY ADOPTION

4.1. Introduction

This study investigates the technological barriers to adopting digital healthcare records (EHRs) within the private healthcare sector, particularly in Australia. By utilizing a qualitative research approach, the research explores how innovation and knowledge management techniques influence EHR adoption in a private healthcare institution. Interviews conducted both face-to-face and online provided insights into the effectiveness of technology when assessed against innovation and knowledge criteria. The study aims to match different stages of innovation with knowledge stocks and learning flows to evaluate the current adoption capability in healthcare organizations.

The findings reveal that the EHR adoption process was not adequately aligned with the relevant stages of innovation, preventing the organization from identifying the necessary capabilities for successful innovation. This misalignment has significant implications for the management practices of healthcare institutions aiming to adopt new digital technologies. The study broadens the existing literature on EHRs by using a cross-theory approach, demonstrating that innovation stages and the Technology-Organization-Environment (TOE) framework are better assimilated when evaluated against knowledge stocks and learning flows. This framework offers replicable insights for other healthcare settings, making a substantial contribution to the field.

Furthermore, the study emphasizes the importance of considering TOE barriers and existing healthcare policies before making EHR adoption decisions. The research highlights that senior managers often overlook the connection between innovation features, learning routines, and knowledge stocks, which limits the effectiveness of leadership practices in the private healthcare sector. The study calls for a more integrated approach, suggesting that better alignment of organizational strategy with information systems strategy can enhance patient care and reduce healthcare expenses. The research questions guide the exploration of integrating features for EHR adoption and broadening TOE and innovation theory through better integration of innovation, knowledge, and learning capabilities.

4.2. The paper

Developing Innovation Capabilities and Knowledge Stocks for Assessing Digital Healthcare Technology Adoption

Structured Abstract

Purpose - The purpose of this research is to explore the technological factors that hinder the effective adoption of digital healthcare records from the perspective of the private healthcare sector. The study explores how different stages of innovation can be matched against knowledge stocks and learning flows to assess the current capacity of adoption capability in health organisations.

Design/methodology/approach - This study adopts a qualitative research approach to explore how relevant innovation and knowledge management techniques influence the adoption of digital electronic healthcare within a private healthcare institution in Australia. Interviews were conducted face-to-face and online with 8 decision makers. A cross theory framework was analysed to measure the effectiveness of technology against certain innovation and knowledge criteria.

Findings - The study found that EHRs adoption was not adequately matched to a relevant stage of innovation such that the organization in question could not identify the level of capability required for innovation to be successful. The findings have important and far-reaching implications for the management practices of health institutions wishing to adopt new digital technology.

Originality - This study broadens the existing literature related to EHRs. Using a cross theory approach, we showed that the stages of innovation and a TOE approach will be better assimilated when assessed against knowledge stocks and learning flows. The framework used could be replicable in other health settings making an original and important contribution.

Study limitation - The findings of this study may not be applicable in regions other than the study setting. The study findings are limited by exploring a case study of a private healthcare institution as distinct from a broader subset of institutions.

Keywords -Electronic health records (EHRs); Private healthcare sector; Technology-Organization-Environment; Innovation capability

1. Introduction

The aim of this study is to identify and broaden a range of innovation capabilities for assessing digital healthcare technology adoption. A secondary aim is to broaden scholarly understanding related to how different dimensions of technology, organization, and environment (TOE) contexts (Tornatzky and Fleischer, 1990) are influenced by different stages of innovation (Rogers, 1995), knowledge stocks (KSs) (Prieto and Revilla, 2006) and learning flows (LFs) (Crossan *et al.*, 1999) with implications for health policy settings. Prior studies of IT readiness have tended to focus on individuals' personal preferences, such as doctors, nurses, IT staff, and patients in public health settings (Kruszyńska-Fischbach *et al.*, 2022, Ball *et al.*, 2024), and have been limited by difficulties in investigating the topic with decision-makers (Vitari and Ologeanu-Taddei, 2018, Tsiampalis and Panagiotakos, 2023). No studies in the field have explored the stages of EHRs innovation adoption with learning flows and knowledge stocks. Recent literature highlights gaps in connecting EHR adoption stages with dynamic learning mechanisms and organizational knowledge frameworks. While studies exist on EHR adoption challenges and facilitators, they often focus on external factors like technology and policy rather than the deeper interactions involving learning flows and knowledge management (Antunes and Pinheiro, 2020, Alerasoul *et al.*, 2022, Duan *et al.*, 2022)
Electronic healthcare records are an important aspect of health services by helping to increase the quality of care and service features of hospitals. They refer to computer-based medical information systems used to collect, store, and display a patient's clinical information (Tsiampalis and Panagiotakos, 2023). For instance, EHRs are designed to keep records and access to information of patients organized and secure while replacing legacy and traditional paper-based medical record-keeping systems. Little is known about private healthcare providers' perspectives however on new digital forms of electronic records or the various innovation processes and healthcare policies required for successful adoption.

Recent research has offered limited but valuable insight into the intersection of IT adoption, innovation, and knowledge management but mostly in other contexts. Agnes *et al.* (2023) for instance explored the critical success factors (CSF) for implementing Knowledge Management Systems (KMS) in Small Medium Enterprises (SMEs), while Gupta *et al.* (2022) investigated how knowledge management (KM) practices impact the adoption of cloud-based software services in distributed software development and innovation settings. Additionally, Pai *et al.*

(2022) analysed the relationship between Artificial Intelligence (AI) and knowledge management, finding that AI enhances knowledge management quality and performance. Saratchandra *et al.* (2022: p. 12) moreover found that a knowledge ambidextrous approach was beneficial for SMEs but only after the intervention of cloud computing in SMEs which dramatically facilitated knowledge sharing opportunities. While these studies provide important related themes, they stop short in highlighting the interconnectedness between IT adoption, innovation, knowledge management and learning flows. Moreover, we argue that within the context of enriching and adding value through knowledge stocks (Prieto and Revilla, 2006; Saratchandra et al., 2022), learning flows become critical (Crossan et al., 1999), thus extending scholarly understanding of how existing innovation capability can be enhanced. The current study therefore closes these gaps by analysing the relationships between intersecting themes by providing greater clarity and more granular insight of what these relationships look like for healthcare leaders and future learning.

This study is the first to use a TOE framework to investigate EHRs adoption issues within the Australian private sector. While similar studies have noted the effects of TOE contexts on e-health and personal healthcare records (Faber *et al.*, 2017, Harahap *et al.*, 2022) including systematic reviews of barriers to EHRs adoption (Woldemariam and Jimma, 2023), very few studies have examined how hospitals more generally consider the stages of innovation with KSs and LFs. The researchers are not aware within a hospital setting of any studies that illustrate the important role played by existing innovative knowledge and learning flows, and how these influence new technology adoption in health settings. Yet, in many contexts other than healthcare, innovative capabilities are known to significantly increase organizational innovation efficiency and effectiveness (Chen *et al.*, 2021), new technology innovation success (Ali *et al.*, 2022) and high-tech company performance (Chen *et al.*, 2021). More often, studies have stopped short on theorizing the implications of TOE barriers which the current study addresses, while exactly how TOE-related theories and ideas can be broadened within the context of private healthcare innovations has not been a high priority in existing studies, both public and private (Harahap *et al.*, 2022). Our findings for instance show that senior managers do not connect the different features of innovation with learning routines and knowledge stocks thus limiting the effectiveness of leadership practices within the private healthcare sector. This has major implications for clinical best practices which we outline later.

The study explores the following research questions in relation to the Australian private healthcare sector:

Research Question 1: What are the integrating features for adopting EHRs medical processes and clinical measures within the private healthcare sector in the light of TOE barriers and existing healthcare policy settings?

Research Question 2: How can TOE and innovation theory related to the private hospital context be broadened when innovation, knowledge, and learning capabilities are better integrated?

2. Developing the Theoretical Construct

2.1 Technology-organization-environment framework

This study focuses on how healthcare providers implement new technology adoption processes within the private healthcare sector in Australia. Here, the technology, organization, and environment (TOE) innovation framework (Tornatzky *et al.*, 1990) helps to synthesize more precise justifications for implementing organizational innovation (Amini and Jahanbakhsh Javid, 2023). Within the TOE framework, the technological construct explores the attributes of the technological factors that must be considered before organizational adoption is successful (Bryan and Zuva, 2021). The organizational construct refers to the organization's resources, such as organization size, intra-firm communication, and linking structures among employees, including the availability of skilled resources (Narmetta and Krishnan, 2020). The environmental construct refers to the industry's structure, technology support, the extent of availability of technology service providers, competitors, and the regulatory environment (Narmetta and Krishnan, 2020). While the links between technological factors and new innovation is well known (Wang *et al.*, 2021), new innovations should be *compatible* with existing socio-cultural values and beliefs, past experiences and needs of potential adopters, nor should they be perceived as too *complex* according to (Rogers, 1995: p. 223).

While there are many features of TOE, the key point is that the TOE framework is a useful way to explore the innovation barriers and problems that should be unravelled before a new innovation can be adopted. Several studies have applied the TOE model within the healthcare sector such as in big data adoption readiness (Ghaleb *et al.*, 2021), and in developing policy related to the best ways of encouraging EHRs diffusion (Wang *et al.*, 2021). Most studies are more relevant to different contexts with respect to location as well as innovation content. Faber *et al.* (2017) for instance explored e-health within medical hospitals in the Netherlands while Harahap *et al.* (2022) examined the barriers and facilitators of personal health care records in Indonesia. Other studies have examined different IT innovative features such as cloud computing in healthcare (Gao and Sunyaev, 2019). While collectively these studies provide integrative insights for healthcare professionals, scholars have stopped short in seeking to inform how emerging TOE barriers influence innovation capabilities and knowledge stocks. While scholars and practitioners know much about EHRs, they know much less about why innovation capabilities (discussed next) are important for innovation processes and health policies.

2.2 Innovation Capabilities, Knowledge Stocks, and Learning Flows

The adoption of EHRs is a new innovation that will be influenced by the systemic capabilities and learning practices of a health organization. Scholars suggest that formal innovation adoption processes are decided by top managers while local adoption decisions are made by end users such as medical professionals (Ali *et al.*, 2022). Here we draw from the IT-implementation innovation model (Cooper and Zmud, 1990), that illustrates how organizations move through each innovation stage (Table I). Similar to Faber *et al.* (2017), we add interest and ex-ante evaluation or before-the-event evaluation to reflect not only the transition and final adoption phase but also the pre-adoption stage (Fichman and Kemerer, 1997).

Table I about here

In addition to TOE and the stages of innovation, a cross-theory approach for conceptualising integrative theories is used to explore the stages of innovation (Fichman and Kemerer, 1997), with knowledge management stocks (Annosi *et al.*, 2020) and learning flows (Ortenblad, 2018). Here, an innovation stage can be matched to existing knowledge stock(s) (KSs) and learning flows (LFs) such that an innovation capability level reached is indicative of the organizations capacity to fully implement an innovation.

Learning flows and knowledge stocks form the basis of confronting the stability-change paradox common to many organizations and the difference between routine-level inertia and organizational-level inertia (Annosi *et al.*, 2020). That is, an organizations learning innovative capability is a latent (dormant, covert, or underlying) construct that is influenced by a firms existing KSs and LFs. If knowledge stocks (e.g. existing information related to EHRs) is low, coupled with low learning flows (e.g. how learning flows across the firm), then innovative capability will be low (Murray *et al.*, 2009). *Inclusive* innovative capability on the other hand reflects both high KS and LFs. In the latter scenario, hospital users would not only know a lot about EHRs but would also possess established learning systems. Relative capability will also exist between the two extremes of low and inclusive capability (Table II).

Table II about here

In adapting the stocks and flows model of Prieto and Revilla (2006), it is possible to observe the stages of IT innovation (Cooper and Zmud, 1990), with the current level of innovative capability (Ortenblad, 2018). As illustrated in Table I and Table II, for the *awareness and interest* stage of IT innovation, *minimized capability* reflects low KS and LFs because stakeholders are still learning about innovation and the knowledge is yet to be acquired. At the *ex-ante and adoption* stage, KSs are being challenged through evaluation and resources committed however the knowledge learned is not evident in the learning flows across the organization reflecting *static capability*. At the *adapt and implement* and *acceptance* stage of innovation, learning flows will now be high reflecting *dynamic capability* as new knowledge flows across the organization but since this knowledge is yet to be embedded or institutionalized, KSs remains low. Conversely however, *inclusive innovative capability* reflects both high KS and high LFs since the innovation is routine and innovation adoption is fully acquired (fully used) reflecting stronger innovation capability. In drawing therefore on the cross-theory benefits of these relationships, we believe the model in Table II is useful for exploring the relative nuances of the EHRs innovation adoption process and in terms of how hospital leaders build innovation capability.

2.3 *Matching Innovation Capabilities with Health Standards and Best Practice*

Extant research of IT innovations from cloud computing across IT adoption related fields have surprisingly stopped short in addressing how electronic healthcare policies can be developed to reflect IT enhanced innovation capability. Yeh *et al.* (2015: p. 443) suggested that IT capabilities have a significant influence on the promotion of e-business while (Harahap *et al.*, 2022: p. 7) noted that policies should be developed that support personal health records. Similarly, Faber *et al.* (2017: p. 84-86) suggested that new indicators for e-health measurement are required for IT governance and IT security, learning from trial and error in the first adoption stage, and sharing and collaborating with others in later innovation stages. Across all studies, scholars stop short in addressing how specific healthcare policies relate to innovation capabilities reflecting knowledge and learning.

Healthcare settings in particular must conform to industry standard best practice evident by a number of clinical measures (Watts *et al.*, 2021) . Building on prior, typical clinical measures from an e-health perspective should relate to 1) improving the quality of care, 2) improving the finances of the organization, 3) the extent to which the EHRs innovation is compliant with health standards, 4) improvements in monetary and IT-specific resources, 5) data security and privacy, and 6) administrative involvement in medical services and input of stakeholders (Gao and Sunyaev, 2019). For instance, improvements in the quality of care reflects a health organizations core services yet managers will need to carefully assess how the new EHRs innovation enables goal attainment (Parthasarathy *et al.*, 2021). Further, the extent to which EHRs innovation is compliant with healthcare standards is a precondition of adoption. While clinical measures will help health organizations to assess the value of EHRs within context-specific circumstances, following strict regulatory environments reflects the organizations social values and concerns for public health (Jianxun *et al.*, 2021). However, different TOE factors (discussed next) represent barriers to health policy best practice.

2.4 Technological Factors

2.4.1 Cost, Installation, and Maintenance (Relative Advantage)

Implementing EHRs involves numerous technological factors, with cost, maintenance, and external supplier expenses being significant barriers (Wikansari and Santoso, 2022). Enhancing skills for EHRs creation and implementation requires considerable management resources (Huang *et al.*, 2020).

2.4.2 From Compatibility to Interoperability

Compatibility refers to how well an innovation fits with existing technological and social environments (Rogers, 1995). Interoperability ensures efficient data exchange between providers, improving communication and efficiency (Li *et al.*, 2021). Poor interoperability is a major challenge, leading to increased workload and fatigue among healthcare professionals (Muhiyaddin *et al.*, 2022).

2.4.3 Security, Accuracy, and Reliability (Complexity)

New IT adoption can lead to safety issues and reduced provider efficiency (Upadhyay and Hu, 2022). While EHRs increase efficiency, data accuracy and reliability (Mashoufi *et al.*, 2023), these issues affect service quality and collaboration (Kissi *et al.*, 2023), causing time strain and stress among nurses (Vehko *et al.*, 2019).

2.5 Organizational Factors

2.5.1 ICT Skills

Lack of computer skills and poor understanding of IT features are primary barriers for EHR adoption (Fennelly *et al.*, 2020). Organizational factors include the lack of prior exposure to EHRs, and the time needed to integrate them into work practices.

2.5.2 Organization Structure & Involvement

Complex organizational structures hinder change, causing slow adoption and inter-departmental conflict (Guimaraes Jr, 2020). Poor end-user involvement in planning and selection processes also hampers adoption (Fennelly *et al.*, 2020).

2.5.3 Top Management Support & Workforce Planning

Structure also reflects top management support (TMS) for acquiring, implementing, and maintaining new systems (Scott and Lee, 2005). Lack of TMS involvement thwarts innovative strategies (Singh *et al.*, 2019). EHR adoption issues impede job practices, leading to workarounds that compromise patient data and safety (Zheng *et al.*, 2020).

2.6 Environmental Factors

2.6.1 Environmental Uncertainty

Organizations in uncertain environments are more proactive in protecting resources (Pye *et al.*, 2024). Competition drives IT adoption, considering supplier and customer information demands as well as internal motives (Chouki *et al.*, 2020). How a health organisation responds to uncertainty is thus critical.

2.6.2 External Experts/Technology Vendor Support

Healthcare organizations often seek external advice for innovation due to the limitations of internal expertise (Gui *et al.*, 2020). Lack of vendor technical assistance and communication skills hinders EHR adoption processes (Huang *et al.*, 2020).

2.6.3 Regulations & Healthcare Standards

Australia's multi-tiered government structure complicates e-health system design and implementation (Xu *et al.*, 2013). The National E-Health Transition Authority (NEHTA) sets national standards for electronic health information gathering and sharing, including the creation of Unique Healthcare Identifiers (UHIs) (Gajanayake *et al.*, 2012).

3. Research method

3.1 Study Sample and Setting

This study used an exploratory qualitative research design approach. The study was conducted at a private hospital in South-East Queensland - referred to as Allan's Private Hospital (APH) - for confidentiality purposes. Interviews were conducted with 8 of decision makers both face-to-face and online following the implementation of a EHR system at APH. Purposive sampling was used to select participants. According to Ellis (2016), a sample size of 6 to 20 participants is suitable for phenomenological studies, while Boyd (2001) suggests 2 to 10 participants are sufficient to reach saturation. Moser and Korstjens (2018) indicate that fewer than ten interviews may suffice when participants are senior decision-makers. Yardley (2000, p. 221) suggested that rigor in qualitative research depends on the sample's ability to provide comprehensive information. Therefore, the study sample consisted of only senior decision makers involved in the adoption of the EHRs innovation process (Table III).
Participants were provided with an overview of the study, emphasizing confidentiality and voluntary participation, and interviews were recorded with consent to ensure accuracy in analysis. The protocol concluded with open-ended questions, allowing participants to add any

additional insights or concerns. This approach facilitated a nuanced understanding of the complexities of EHRs adoption while maintaining ethical research practices, such as obtaining informed consent and ensuring secure data handling. This qualitative methodology provided robust data that supported the study's objectives and contributed to the broader understanding of EHRs adoption.

Table III about here

3.2 Data Collection Tool

Semi-structured interviews were used for data collection, conducted in the participants' natural settings (Adhabi and Anozie, 2017). The interviews included heads of departments from various specializations at APH. Initial interviews were conducted with the hospital director and the ICT department director to gather background information. Through purposive sampling (Phillips-Pula et al., 2011), seven key decision-makers involved in the EHR planning process were selected. The data provided valuable insights into the challenges related to EHRs implementation. Research ethics approval was obtained from the supporting institution, with interviews conducted between June and December 2019. The TOE themes were subsequently matched to the stages of innovation, existing knowledge stocks and observed learning flows.

3.3 Data Analysis

To analyze the TOE themes, all interviews were audio-recorded, transcribed and uploaded into qualitative data analysis software QSR NVivo 12. Different TOE factors were identified from the literature through thematic analysis, and the representation of these factors reflected the research questions. The thematic analysis used in this study is one of the most widespread approaches in qualitative studies (Joffe and Yardley, 2004), based on patterns and themes emerging from the data set under analysis (Braun and Clarke, 2006). The researchers developed a precursory coding dictionary based on the guide of semi-structured interviews and employed this dictionary to pare down any coding variations. We then reviewed all coded transcripts and themes and added new codes to the dictionary whenever new themes arose. The research team resolved any data discrepancies, such as missing data, and reached a consensus about the emerging themes.

4. Results

Figure 1 illustrates the TOE (Technological, Organizational, Environmental) factors and relevant barriers identified. This section discusses the results of the barriers which was informed by the first research question which asked: Which technological, organizational, and environmental barriers impact EHR adoption?

Insert Figure 1 about here

4.1 Technological Factors

4.1.1 Cost and Incompatibility

The results reveal that ongoing costs and system incompatibility are significant barriers to EHRs adoption. Participants highlighted the substantial costs associated with staff training and system maintenance: "The cost of staff training is huge, and the new system has an ongoing cost as well" (Participant 1). Compatibility issues with legacy systems and IT infrastructure posed challenges: "Building to meet Australian standards has been the biggest challenge" (Participant 3).

4.1.2 Readiness and Resources

Many staff members were accustomed to paper records, which posed a challenge for transitioning to digital systems: "We have a lot of people where all they've ever known is the paper record for the last 20 to 30 years. So, unless you start bringing people on the journey, they won't adapt to a digital record" (Participant 3). Concerns were also raised about lacking appropriately trained resources for project implementation: "We struggled with the fact that we didn't necessarily have the appropriately trained, appropriate resources" (Participant 3).

4.1.3 Interoperability

Interoperability issues emerged with reported difficulties in exchanging information between different parts of the system, leading to complaints and workarounds: "There have been a lot of complaints and extra work-arounds due to difficulties in exchanging information" (Participant 6).

4.1.4 Security and Reliability

Data privacy and system reliability led to unauthorized access and data breaches: "Health data privacy breach and security matters and unauthorized access is a huge challenge." Reliability issues also contributed to frustration among users: "Some processes in the system are slower or quicker, and not knowing how it all works has made it more difficult" (Participant 7).

4.1.5 Initial and Past Medical Data

Managing initial and past medical data led to data entry complexities and contradictions between legacy systems: "Uniform terminologies do not incorporate all conceptions associated with nursing care," (Participant 4), while Participant 3 suggested that "Contradictions between ICU information needs and EHR integration have been an ongoing issue."

4.1.6 Infrastructure and Capability

Infrastructure issues were noted, particularly in older hospital buildings that required updates to support the new systems: "Our building is quite old, and infrastructure itself needs to be developed. We are concerned about the cost of resourcing it" (Participant 7).

4.2 Organizational Factors

4.2.1 ICT Skills and Flexibility

Low levels of ICT skills and a lack of flexibility in adapting to new systems were a major issue: "We have a workforce with some challenges with ICT skills. Most people have basic computer skills, but meeting new digital requirements will require a lot of training" (Participant 6). The bureaucratic nature of the organization also hindered flexibility: "Some big players here will make enough noise if they're resistant to a certain type of system that's being introduced" (Participant 7).

4.2.2 Workflow Disruptions and End-User Participation

Workflow disruption related to software interfaces, multitasking, and inadequate training were common: "Finding time to train a whole hospital is challenging, and there is very little downtime" (Participant 5). Additionally, end-user participation in system design was limited: "Sharing knowledge during the building stage has been challenging due to different practices in various areas" (Participant 6). Some staff members were also resistant to the changes: "Staff in some departments are not keen on the coming changes, and this could limit the success of the new system" (Participant 2).

4.2.3 Staff Shortages and Time

Staff shortages and time constraints were critical barriers. Finding qualified personnel for EHR management and managing the time required for data conversion were challenging: "Finding professional users with the necessary qualifications is essential" (Participant 7) while Participant 5 added "The time and energy involved in collating data has created a lot of work stress."

4.2.4 Resistance to Change and Managerial Capability

Resistance to change from experienced staff were notable: "Nurses who have been nursing for 15 years find moving to a computer challenging" (Participant 5). The need for experienced management was also highlighted: "We need competent and experienced management, but currently lack adequate capability across the hospital" (Participant 1).

4.2.5 Pressure of Change

The pressure of organizational change led to increased stress and resistance: "Reorganizing the organization and handling this transformation is a massive job, and technical problems will increase pressure on the project team" (Participant 6).

4.3 Environmental Factors

4.3.1 Healthcare Standards

Data formatting challenges were identified as a barrier, particularly in aligning paper-based practices with digital systems: "Matching what we do well on paper with digital formats is a challenge" (Participant 3).

4.3.2 Legislative and Regulatory Responsibility of the Vendor

Vendor responsibility issues and compliance with standards and regulations were highlighted: "It's the responsibility of the vendor to ensure we meet standards and regulations, but this hasn't happened yet" (Participant 4).

4.3.3 External Training and Vendor Options

External training and limited vendor options were significant concerns: "We have to hire consultants for on-site training or use external courses, which limits availability" (Participant 7). Dissatisfaction with vendor options was also noted: "There are limited vendor choices, and the lack of support has made us underprepared" (Participant 2).

Taken together, the results underscored the complex array of social and technical barriers influencing the EHRs adoption process. Based on the cross theory approach discussed earlier, the researchers then compared the level of existing knowledge stocks and flows by measuring these against the desired or aspirational level of stocks and flows to gain a better understanding of the overall innovation capability of APH.

5. Discussion

The aim of this study was to identify the challenges and barriers to the adoption of electronic healthcare records (EHRs) innovation within the private healthcare setting in Australia. A secondary aim was to broaden scholarly understanding related to how different TOE contexts could be influenced by the stages of innovation, and knowledge stocks (KSs) and learning flows (LFs) with implications for innovation capability and policy settings. Overall, what was noticeable was the lack of preparedness by APH in tackling the new innovation adoption process particularly in the technical and organizational areas, which placed increasing pressure on the existing capabilities of APH. This prevented new innovation capability to be developed. We next discuss how the existing literature can be broadened and extended by elaborating on the sample illustrations in Table IV.

Table IV about here

6. Broadening Existing Literature

In relation to research question 1, organizations must consider the TOE barriers before an adoption and EHRs innovation decision is made. For APH, these limitations were not considered within the context of their TOE impact and/or were not fully articulated to operational staff. Many operational staff were not involved in the EHRs process. With respect to Table IV and the emerging capability and sample TOE data, APH displayed minimized and static capability, with less evidence of dynamic capability (low KSs and high LFs) particularly in the technical area. There was no evidence of inclusive capability across all TOE factors meaning that no mechanism existed for APH to generate high knowledge stocks and high learning flows much less understand them. The lack of inclusive capability translated into suboptimal responses to new technology adoption. Participants for instance were unaware of the importance of KSs and LFs suggesting that the innovation process was ad hoc and poorly understood.

In relation to research question 2, the results suggested a need to identify the clinical measures that best define the organizations values and goals after which leaders could identify the TOE barriers that prevented the clinical measures from being achieved. The findings suggest that when participants are subject to a new innovation adoption process, they must be cognisant of how KSs and LFs interact with stages of innovation. The research noted that without this level of evaluation, leaders and managers' innovation efforts will be unresolved falling short of the innovation capabilities required for successful IT adoption.

Second, this study broadens the existing literature related to electronic health records by illuminating the importance of LFs and KSs by evaluating these against innovation capability. Using a cross theory approach, we showed that the stages of innovation (Fichman and Kemerer, 1997, Rogers, 1995) and a TOE approach (Tornatzky *et al.*, 1990), will be better assimilated when assessed against knowledge stocks (Annosi *et al.*, 2020) and learning flows (Crossan *et al.*, 1999, Ortenblad, 2018). Our findings in addition answer calls by recent scholars to extend knowledge related to the application of digital IT innovation in specific contexts (Saratchandra *et al.*, 2022). We believe that in matching an organizations existing capabilities with a desired stage of innovation will help health organizations to achieve their clinical goals more effectively. Once the innovation capabilities are identified, health organizations will be better placed to cultivate a range of policy levers to boost collective IC (Figure 2). Moreover, the current study broadens the findings of Agnes *et al.* (2023) related to the critical success factors (CSF) for implementing Knowledge Management Systems by focusing more attention on how innovation and learning spurs clinical best practices within a health context. While Pai *et al.* (2022) and Saratchandra *et al.* (2022) found valuable insights between AI as an innovative technology and KM best practices, the current study broadens these findings by placing a greater focus on the interrelationships between innovation, knowledge management, and learning, with the effects of learning flows and knowledge stocks not previously represented in prior studies.

Figure 2 about here

7. Practical Implications

In Figure 2, we suggest that managers will need to align the TOE barriers with the clinical measures which in turn inform various policy levers. Policy levers are manifest by the clinical measures since they form the basis of how a health organization adds value to its core business of providing health services. Broadening extant research from the current study more generally relates to: 1) The need to identify the clinical measures of healthcare services related to a specific healthcare provider, 2) The importance of assessing the barriers and limitations to

EHRs innovation adoption that will prevent clinical measures from being achieved, 3) The need to determine how KSs and LFs inform the stages of IT innovation which in turn will help address the TOE factors, and 4) The importance of developing a range of policy levers that bolster organizational innovation capability. In thus integrating insights from previous research, our theoretical framework in Figure 2 and Table IV should help health professionals to navigate better the internal and external factors influential to EHRs innovation adoption.

8. Research Limitations and Future Research

The present study is potentially limited by differences in social, cultural, economic, regional, legal and other contextual aspects of hospital sectors across countries. We also studied the EHRs IT innovation outcomes related to a private hospital such that the results may not be generalizable to other public settings. It is recommended that a comprehensive methodology is employed to investigate the barriers to the adoption of EHRs in both private and public health care settings in future studies based on ownership of the hospital, location, size, and the hospital's accreditation level to reach a generalizable conclusion. We believe however that researchers could replicate the cross -theory approach adopted here as a valuable way to inform the IT innovation adoption approach.

9. Conclusion

In conclusion, this qualitative study identified the critical barriers to electronic health records adoption from a TOE perspective. Despite the benefits and positive effects of adopting EHRs, the adoption rate for EHRs is still relatively low within the health care sector. In the current study, the researchers identified how healthcare organizations can adopt and implement IT innovation pertaining to EHRs by matching the IT innovation stage with the organizations KSs and LFs to determine IC.

References

ADHABI, E. & ANOZIE, C. B. (2017). Literature review for the type of interview in qualitative research. *International Journal of Education,* 9, 86-97.

AGNES, A., HUTAMA, A. T., SENSUSE, D. I. & LUSA, S. (2023). Knowledge Management System Adoption Approach and the Critical Success Factors in Small Medium Enterprise: A Systematic Literature Review. *Jurnal RESTI (Rekayasa Sistem dan Teknologi Informasi),* 7, 996-1002.

ALERASOUL, S. A., AFELTRA, G., HAKALA, H., MINELLI, E. & STROZZI, F. (2022). Organisational learning, learning organisation, and learning orientation: An integrative review and framework. *Human Resource Management Review,* 32, 100854.

ALI, O., MURRAY, P. A., MUHAMMED, S., DWIVEDI, Y. K. & RASHITI, S. (2022). Evaluating Organizational Level IT Innovation Adoption Factors among Global Firms. *Journal of Innovation & Knowledge,* 7, 100213.

AMINI, M. & JAHANBAKHSH JAVID, N. (2023). A multi-perspective framework established on diffusion of innovation (DOI) theory and technology, organization and environment (TOE) framework toward supply chain management system based on cloud computing technology for small and medium enterprises. *Organization and Environment (TOE) Framework Toward Supply Chain Management System Based on Cloud Computing Technology for Small and Medium Enterprises (January 2023). International Journal of Information Technology and Innovation Adoption,* 11, 1217-1234.

ANNOSI, M. C., MARTINI, A., BRUNETTA, F. & MARCHEGIANI, L. (2020). Learning in an agile setting: A multilevel research study on the evolution of organizational routines. *Journal of Business Research,* 110, 554-566.

ANTUNES, H. D. J. G. & PINHEIRO, P. G. (2020). Linking knowledge management, organizational learning and memory. *Journal of Innovation & Knowledge,* 5, 140-149.

BALL, S. L., KIM, B., CUTRONA, S. L., MOLLOY-PAOLILLO, B. K., AHLNESS, E., MOLDESTAD, M., SAYRE, G. & RINNE, S. T. (2024). Clinician and staff experiences with frustrated patients during an electronic health record transition: a qualitative case study. *BMC Health Services Research,* 24, 535.

BOYD, C. O. (2001). Philosophical Foundations of qualitative research. *Nursing research: A qualitative perspective*, 14, pp.65-90.

BRAUN, V. & CLARKE, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology,* 3, 77-101.

BRYAN, J. D. & ZUVA, T. (2021). A review on TAM and TOE framework progression and how these models integrate. *Advances in Science, Technology and Engineering Systems Journal,* 6, 137-145.

CHEN, Q., WANG, C.-H. & HUANG, S.-Z. 2021. Effects of organizational innovation and technological innovation capabilities on firm performance: evidence from firms in China's Pearl River Delta. *Inside the Changing Business of China.* Routledge.

CHOUKI, M., TALEA, M., OKAR, C. & CHROQUI, R. (2020). Barriers to information technology adoption within small and medium enterprises: A systematic literature review. *International Journal of Innovation and Technology Management,* 17, 2050007.

COOPER, R. B. & ZMUD, R. W. (1990). Information technology implementation research: a technological diffusion approach. *Management science,* 36, 123-139.

CROSSAN, M. M., LANE, H. W. & WHITE, R. E. (1999). An organizational learning framework: From intuition to institution. *Academy of management review,* 24, 522-537.

DUAN, Y., YANG, M., HUANG, L., CHIN, T., FIANO, F., DE NUCCIO, E. & ZHOU, L. (2022). Unveiling the impacts of explicit vs. tacit knowledge hiding on innovation quality: The moderating role of knowledge flow within a firm. *Journal of Business Research,* 139, 1489-1500.

ELLIS, P. (2016). The language of research (part 8): Phenomenological research. *Wounds UK,* 12, 128-129.

FABER, S., VAN GEENHUIZEN, M. & DE REUVER, M. (2017). eHealth adoption factors in medical hospitals: A focus on the Netherlands. *International journal of medical informatics,* 100, 77-89.

FENNELLY, O., CUNNINGHAM, C., GROGAN, L., CRONIN, H., O'SHEA, C., ROCHE, M., LAWLOR, F. & O'HARE, N. (2020). Successfully implementing a national electronic health record: a rapid umbrella review. *International Journal of Medical Informatics,* 144, 104281.

FICHMAN, R. G. & KEMERER, C. F. (1997). The assimilation of software process innovations: An organizational learning perspective. *Management science,* 43, 1345-1363.

GAJANAYAKE, R., LANE, B., IANNELLA, T. & SAHAMA, T. (2012). Legal issues related to Accountable-eHealth systems in Australia.

GAO, F. & SUNYAEV, A. (2019). Context matters: A review of the determinant factors in the decision to adopt cloud computing in healthcare. *International Journal of Information Management,* 48, 120-138.

GHALEB, E. A., DOMINIC, P., FATI, S. M., MUNEER, A. & ALI, R. F. (2021). The assessment of big data adoption readiness with a technology–organization–environment framework: a perspective towards healthcare employees. *Sustainability,* 13, 8379.

GUI, X., CHEN, Y., ZHOU, X., REYNOLDS, T. L., ZHENG, K. & HANAUER, D. A. (2020). Physician champions' perspectives and practices on electronic health records implementation: challenges and strategies. *JAMIA open,* 3, 53-61.

GUIMARAES JR, P. R. (2020). The structure of ecological networks across levels of organization. *Annual Review of Ecology, Evolution, and Systematics,* 51, 433-460.

GUPTA, C., FERNANDEZ-CREHUET, J. M. & GUPTA, V. (2022). Measuring impact of cloud computing and knowledge management in software development and innovation. *Systems,* 10, 151.

HARAHAP, N. C., HANDAYANI, P. W. & HIDAYANTO, A. N. (2022). Barriers and facilitators of personal health record adoption in Indonesia: Health facilities' perspectives. *International Journal of Medical Informatics,* 162, 104750.

HUANG, C., KOPPEL, R., MCGREEVEY III, J. D., CRAVEN, C. K. & SCHREIBER, R. (2020). Transitions from one electronic health record to another: challenges, pitfalls, and recommendations. *Applied clinical informatics,* 11, 742-754.

JIANXUN, C., ARKORFUL, V. E. & SHULIANG, Z. (2021). Electronic health records adoption: Do institutional pressures and organizational culture matter? *Technology in Society,* 65, 101531.

JOFFE, H. & YARDLEY, L. (2004). Content and thematic analysis. *Research methods for clinical and health psychology,* 56, 68.

KISSI, J., ANNOBIL, C., TIJANI, A. & KISSI, A. A. (2023). Electronic health record impact on data quality: An integrated review. *Integrated Health Research Journal,* 1, 77-85.

KRUSZYŃSKA-FISCHBACH, A., SYSKO-ROMAŃCZUK, S., NAPIÓRKOWSKI, T. M., NAPIÓRKOWSKA, A. & KOZAKIEWICZ, D. (2022). Organizational e-health readiness: How to prepare the primary healthcare providers' services for digital transformation. *International Journal of Environmental Research and Public Health,* 19, 3973.

LI, E., CLARKE, J., NEVES, A. L., ASHRAFIAN, H. & DARZI, A. (2021). Electronic health records, interoperability and patient safety in health systems of high-income countries: a systematic review protocol. *BMJ open,* 11, e044941.

MASHOUFI, M., AYATOLLAHI, H., KHORASANI-ZAVAREH, D. & BONI, T. T. A. (2023). Data quality in health care: main concepts and assessment methodologies. *Methods of Information in Medicine,* 62, 005-018.

MOSER, A. & KORSTJENS, I. (2018). Series: Practical guidance to qualitative research. Part 3: Sampling, data collection and analysis. *European journal of general practice,* 24, 9-18.

MUHIYADDIN, R., ELFADL, A., MOHAMED, E., SHAH, Z., ALAM, T., ABD-ALRAZAQ, A. & HOUSEH, M. (2022). Electronic health records and physician burnout: a scoping review. *Informatics and Technology in Clinical Care and Public Health,* 481-484.

MURRAY, P. A., SYED, J. & ROBERTS, Z. (2009). Structures of learning for dynamic markets. *Management decision,* 47, 271-288.

NARMETTA, M. & KRISHNAN, S. Competitiveness, change readiness, and ICT development: An empirical investigation of TOE framework for poverty alleviation. Re-imagining Diffusion and Adoption of Information Technology and Systems: A Continuing Conversation: IFIP WG 8.6 International Conference on Transfer and Diffusion of IT, TDIT 2020, Tiruchirappalli, India, December 18–19, 2020, Proceedings, Part II, 2020. Springer, 638-649.

ORTENBLAD, A. (2018). What does "learning organization" mean? *The Learning Organization.*

PAI, R. Y., SHETTY, A., SHETTY, A. D., BHANDARY, R., SHETTY, J., NAYAK, S., DINESH, T. K. & D'SOUZA, K. J. (2022). Integrating artificial intelligence for knowledge management systems–synergy among people and technology: a systematic review of the evidence. *Economic research-Ekonomska istraživanja,* 35, 7043-7065.

PARTHASARATHY, R., GARFIELD, M., RANGARAJAN, A. & KERN, J. L. (2021). The case of organizational innovation capability and health information technology implementation success: As you sow, so you reap? *International Journal of Healthcare Information Systems and Informatics (IJHISI),* 16, 1-27.

PHILLIPS-PULA, L., STRUNK, J. & PICKLER, R. H. (2011). Understanding phenomenological approaches to data analysis. *Journal of Pediatric Health Care,* 25, 67-71.

PRIETO, I. M. & REVILLA, E. (2006). Assessing the impact of learning capability on business performance: empirical evidence from Spain. *Management learning,* 37, 499-522.

PYE, J., RAI, A. & DONG, J. Q. (2024). How Hospitals Differentiate Health Information Technology Portfolios for Clinical Care Efficiency: Insights from the HITECH Act. *Information Systems Research.*

ROGERS, E. M. (1995). Diffusion of Innovation. 4th. *New York: The Free.*

ROGERS, E. M. (1995). Diffusion of Innovations: modifications of a model for telecommunications. *Die diffusion von innovationen in der telekommunikation*, 25-38.

ROGERS, E. M. (1995). Lessons for guidelines from the diffusion of innovations. *The Joint Commission journal on quality improvement,* 21, 324-328.

SARATCHANDRA, M., SHRESTHA, A. & MURRAY, P. A. (2022). Building knowledge ambidexterity using cloud computing: Longitudinal case studies of SMEs experiences. *International Journal of Information Management,* 67, 102551.

SCOTT, R. E. & LEE, A. (2005). E-health and the Universitas 21 organization: 3. Global policy. *Journal of telemedicine and telecare,* 11, 225-229.

SINGH, S. K., DEL GIUDICE, M., TARBA, S. Y. & DE BERNARDI, P. (2019). Top management team shared leadership, market-oriented culture, innovation capability, and firm performance. *IEEE Transactions on Engineering Management.*

TORNATZKY, L. & FLEISCHER, M. 1990. The process of technology innovation, Lexington, MA. Lexington Books.

TORNATZKY, L. G., FLEISCHER, M. & CHAKRABARTI, A. K. 1990. *Processes of technological innovation,* Lexington books.

TSIAMPALIS, T. & PANAGIOTAKOS, D. (2023). Methodological issues of the electronic health records' use in the context of epidemiological investigations, in light of missing data: a review of the recent literature. *BMC Medical Research Methodology,* 23, 180.

UPADHYAY, S. & HU, H.-F. (2022). A qualitative analysis of the impact of electronic health records (EHR) on healthcare quality and safety: Clinicians' lived experiences. *Health Services Insights,* 15, 11786329211070722.

VEHKO, T., HYPPÖNEN, H., PUTTONEN, S., KUJALA, S., KETOLA, E., TUUKKANEN, J., AALTO, A.-M. & HEPONIEMI, T. (2019). Experienced time pressure and stress: electronic health records usability and information technology competence play a role. *BMC medical informatics and decision making,* 19, 1-9.

VITARI, C. & OLOGEANU-TADDEI, R. (2018). The intention to use an electronic health record and its antecedents among three different categories of clinical staff. *BMC health services research,* 18, 1-9.

WANG, X., SUN, J., WANG, Y. & LIU, Y. (2021). Deepen electronic health record diffusion beyond breadth: game changers and decision drivers. *Information Systems Frontiers*, 1-12.

WATTS, P. I., MCDERMOTT, D. S., ALINIER, G., CHARNETSKI, M., LUDLOW, J., HORSLEY, E., MEAKIM, C. & NAWATHE, P. A. (2021). Healthcare simulation standards of best practiceTM simulation design. *Clinical Simulation in Nursing,* 58, 14-21.
WIKANSARI, N. & SANTOSO, D. B. (2022). What are the barriers to the implementation of electronic medical records? A review of recent studies. *Jurnal Riset Kesehatan,* 11, 83-88.
WOLDEMARIAM, M. T. & JIMMA, W. (2023). Adoption of electronic health record systems to enhance the quality of healthcare in low-income countries: a systematic review. *BMJ Health & Care Informatics,* 30.
XU, J., GAO, X., SORWAR, G. & CROLL, P. (2013). Implementation of e-health record systems in Australia. *The International Technology Management Review,* 3, 92-104.
YARDLEY, L. (2000). Dilemmas in qualitative health research. *Psychology and health,* 15, 215-228.
YEH, C.-H., LEE, G.-G. & PAI, J.-C. (2015). Using a technology-organization-environment framework to investigate the factors influencing e-business information technology capabilities. *Information Development,* 31, 435-450.
ZHENG, K., RATWANI, R. M. & ADLER-MILSTEIN, J. (2020). Studying workflow and workarounds in electronic health record–supported work to improve health system performance. *Annals of internal medicine,* 172, S116-S122.

4.3. Tables of paper 2

Tables

Stage	**Description**	**Knowledge stocks (KS) & Learning Flows (LFs)**
Awareness	Key decision makers are aware of innovation	*Minimized capability (Low KS & Low LFs)*
Interest	The organization is committed to active learning about the innovation	
Ex-ante evaluation	The organization has initiated ex-ante evaluation and trial	*Static capability (High KS & Low LFs)*
Adoption	A decision is reached to invest resources necessary to accommodate adoption effort	
Adapt & implement	The innovation is developed, installed and maintained, & available for use	*Dynamic capability (Low KS & High LFs)*
Acceptance	The innovation is fully employed in organizational work; personnel are committed	
Routinization	Use of the innovation is encouraged as a normal activity	*Inclusive capability (High KS & High LFs)*
Full use	Use of the innovation to its fullest potential and in a comprehensive way	

Adapted from Cooper and Zmud (1990); Faber et al. (2017), and Robert, Greenhalgh, MacFarlane, and Peacock (2009)

Table I: Aligning Organizational Innovation Adoption with Knowledge Stocks & Learning Flows

		Learning Flows (LFs)	
		Low	**High**
Knowledge Stocks (KS)	**Low**	Minimized innovative capability	Dynamic innovative capability
	High	Static innovative capability	Inclusive innovative capability

Table II: Knowledge Stocks and Learning Flows.
Adapted from Prieto and Revilla (2006).

Participant	Gender	Age Range	Education Level	Work Experience	Current Role
P1	Male	30 to 40 years	Bachelor's	6 to 10 years	Clinical Informatics Manager
P2	Female	20 to 30 years	Bachelor's	6 to 10 years	Clinical Educator
P3	Female	30 to 40 years	Bachelor's	More than 10 years	Nurse Unit Manager
P4	Male	40 to 50 years	Bachelor's	More than 10 years	ICT Manager
P5	Female	40 to 50 years	Bachelor's	More than 10 years	Director of Nursing
P6	Female	40 to 50 years	Diploma	More than 10 years	Patient Administration
P7	Female	20 to 30 years	Master's	6 to 10 years	Patient Administration

Table III: Participant demographics
Source: Authors

Innovation Stage	Description	Emerging Capability Knowledge stocks (KS) & Learning Flows (LFs)	Sample Key Emerging TOE Themes
Awareness	Key decision makers are aware of innovation	**Minimized capability (Low KS & Low LFs)**	**Technical:** *"Financially, of course, it will be an expensive journey."* *"Just because they do something overseas and it's very different doesn't mean we do it here."* *"All they've ever known is the paper record."* **Organization** *"Change will be seen with contempt as soon as the technical problems occur."* *"The organization lacks in-house expertise to train staff."* **Environment** *"We do really well now on paper, and to be able to match that in a system, I think that's a challenge."*
Interest	The organization is committed to active learning about the innovation		
Ex-ante evaluation	The organization has initiated ex-ante evaluation and trial	**Static capability (High KS & Low LFs)**	**Technical** *"The documents and the workflow involved with doing those processes is somewhat standardized."* *"Just the whole structure of the building to be able to do that is critical".* *"It's very important to have well-integrated systems and I can't say we have these."* **Organization**
Adoption	A decision is reached to invest resources necessary to accommodate adoption effort		

			"*Do we have enough staff in ICT? Probably not.*" "*Also, the management did not take immediate actions on issues about new system adoption.*" "[doctors] *are resistant to an electronic records systems.*" **Environment** "*We do really well now on paper, and to be able to match that in a system, I think that's a challenge.*" "*To meet those regulations is going to be very challenging.*" "*We have to identify that the legislation has changed. We have to identify how and what impacts it has on the system.*"
Adapt & implement	The innovation is developed, installed and maintained, & available for use	**Dynamic capability (Low KS & High LFs)**	**Technical** Unresolved response **Organization** "*We've had to work with teams from all over the hospital in the building on what we're doing now for our new system*". **Environment** "*It has not been an easy way to find the right vendors.*" "*We chose the best option for us.*"
Acceptance	The innovation is fully employed in organizational work; personnel are committed		
Routinization	Use of the innovation is encouraged as a normal activity	**Inclusive capability (High KS & High LFs)**	The TOE responses are **unresolved**. No evidence of inclusive capability
Full use	Use of the innovation to its fullest potential and in a comprehensive way		

Table IV: Alignment between innovation, knowledge stocks and flows, and TOE factors
Source: Authors

4.4. Figures of paper 2

Figures

Figure 1: Research model of constraining factors influencing EHRs adoption.

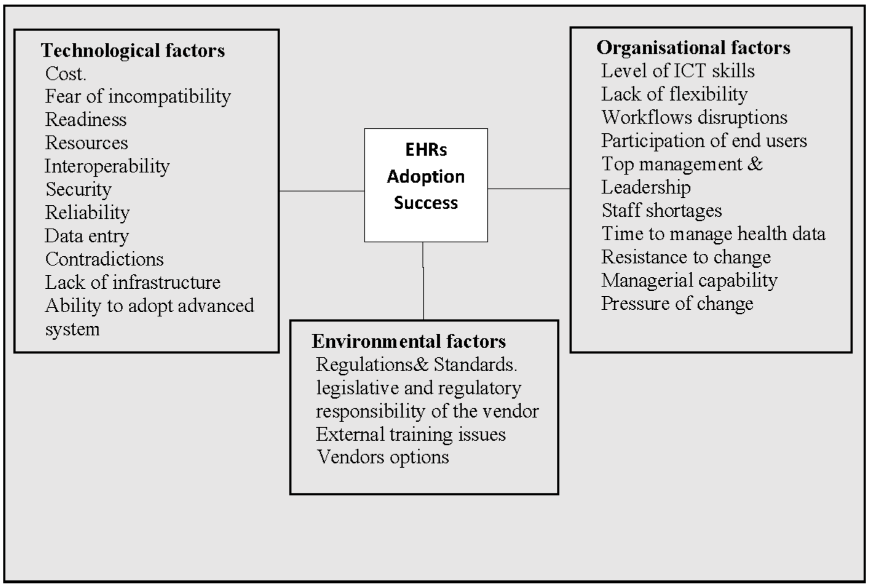
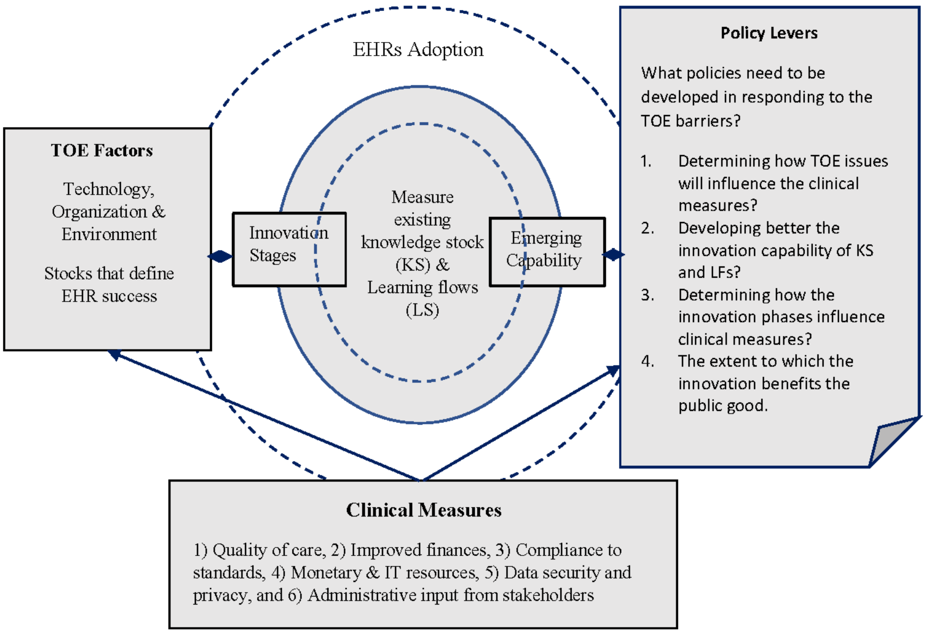


Figure 2: Integrating factors that influence EHR innovation adoption within healthcare settings.



4.5. Title page of paper 2

Assessing the Impact of Innovation Processes on

Electronic Systems Technology Adoption

Authors:

Salem.Ouheda@unisq.edu.au

Peter.A.Murray@unisq.edu.au

Omar.ali@aasu.edu.kw

Khorshed.Alam@unisq.edu.au

Corresponding Author's Email: **Peter.A.Murray@unisq.edu.au**

Please Note: There are no conflicts of interest associated with this paper

4.6. Links and implications for Paper 3

Paper 2 exploration of technological and organizational barriers in EHR adoption highlights the critical need for alignment between innovation stages and organizational capabilities. This foundational understanding of how knowledge management and TOE factors impact adoption processes sets the stage for Paper 3, which builds upon these insights by incorporating additional innovation models and introducing the concept of time as a crucial element. While Paper 2 underscores the importance of addressing misalignments between technological innovations and organizational readiness, Paper 3 extends this analysis by examining how temporal factors influence the adoption process. This integrated approach broadens the perspective on EHRs adoption, emphasizing that successful implementation requires not only aligning technological and organizational factors but also considering the dynamic role of time. Together, these studies provide a comprehensive framework for understanding EHRs adoption challenges and offer practical implications for healthcare managers to improve their strategies and enhance patient care.

CHAPTER 5: PAPER 3

ASSESSING THE IMPACT OF INNOVATION PROCESSES ON ELECTRONIC SYSTEMS TECHNOLOGY ADOPTION

5.1. Introduction

The integration of technology in healthcare has revolutionized the management and utilization of patient information with EHRs being a key advancement. Despite their potential to enhance patient care and streamline healthcare processes, the adoption of EHRs in the Australian private healthcare sector remains fraught with challenges. This study seeks to address these challenges by exploring the adoption of EHRs through the lens of three prominent innovation models: the Technology Acceptance Model (TAM), the Diffusion of Innovation (DOI) model, and the Technology-Organization-Environment (TOE) framework. By combining these models, the study aims to provide a comprehensive understanding of the factors that influence the successful implementation of EHRs and to identify the key elements that facilitate or hinder their adoption. Utilizing a qualitative research design, data were collected through interviews with senior managers at a private hospital in South-East Queensland. The findings highlight the critical factors for EHRs adoption. This research contributes to the existing body of knowledge by offering a holistic approach to understanding EHRs adoption in the private healthcare sector, introducing the concept of time as a critical factor in the innovation process. The research emphasizes the role of time as a crucial yet often overlooked artifact in innovation adoption models, particularly in the context of Electronic Health Records (EHRs). While traditional models focus on individual characteristics and perceived ease of use, this study highlights the need to measure temporal effects at both micro and macro levels. The findings suggest that time-based factors significantly influence adoption processes, with time pacing emerging as a key element. This insight broadens the understanding of innovation practices beyond individual behavior, underscoring the importance of longitudinal studies to capture dynamic relationships among variables. Practically, managers should prioritize innovation attributes that enhance patient care and reduce costs, aligning organizational strategies with information systems strategies. The study also calls for future research to explore the impact of time on technology adoption across different industries, addressing the current study's limitations in generalizability due to its focus on private healthcare.

5.2. The paper

Assessing the Impact of Innovation Processes on Electronic Systems Technology Adoption

Salem Ouheda [1], Peter A. Murray [1*], Khorshed Alam [1], Omar Ali [2]

[1] University of southern queensland, UniSQ, 487-535 West St, Darling Heights QLD, Toowoomba 4350, Australia.

[2] Abdullah Al Salem University, Firdous Street, Khalidiya 71801, Kuwait.

Objectives: This study aims to explore the adoption of electronic health records (EHRs) in the Australian private healthcare sector by integrating three prominent innovation models: the Technology Acceptance Model (TAM), the Diffusion of Innovation (DOI) model, and the Technology-Organization-Environment (TOE) framework. The objective of the study is to understand how these combined models can better inform the EHR adoption process and identify the key factors influencing successful implementation. ***Methods/Analysis***: An exploratory qualitative research design employing a phenomenological approach was utilized to investigate the research. Data were collected through semi-structured interviews with senior managers at a private hospital in South-East Queensland. Purposive sampling was employed to select participants, ensuring representation from key decision-makers involved in the EHRs planning process. Thematic analysis, guided by the reflexive thematic analysis (RTA) approach of Braun and Clarke, was used to analyse the data and derive insights into the factors influencing EHRs adoption. ***Findings***: Key findings indicate that perceived usefulness and job relevance (from TAM), innovation attributes and communication channels (from DOI), and technological, organizational, and environmental contexts (from TOE) framework are critical elements for successful EHRs implementation. The study also highlights the importance of user engagement, comprehensive training, leadership support, and financial resources. ***Novelty/Improvement***: This study offers a novel contribution by integrating TAM, DOI, and TOE models to provide a more holistic understanding of EHRs adoption in the private healthcare sector. Also, it introduces the concept of time as a critical innovation artifact, highlighting its significance in the adoption process.

Keywords: Electronic health records (EHRs); Private healthcare sector; Technology-Organization-Environment; Innovation Processes.

Article History:

Received:

Revised:

Accepted:

Published:

1- Introduction

In the current competitive landscape, the efficient utilization of technology across all departments of an organization stands out as a critical success factor. Throughout history, the Information and Communication Technology (ICT) sector has been at the forefront of driving innovation in service optimization, enabled seamless communication across the globe and empowered businesses to operate more efficiently [1]. This drive for efficiency and innovation has also extended to the healthcare sector, where the adoption of Electronic Health Records (EHRs) has revolutionized the way healthcare information is managed and utilized. EHRs are digital-based electronic systems that collect, save, manage, and exchange information related to patient data and health records including details of the healthcare provider [2]. The primary purpose of the EHRs system is to deliver better healthcare services to patients and users including more efficient diagnosis, better testing processes, monitoring of patient data, access to information, treatment of patients, and patient handling [3].

Despite the clear benefits of EHRs adoption, there are challenges and barriers that hinder its widespread implementation in the Australian private healthcare sector. Limited empirical studies have investigated the factors influencing EHRs adoption specifically within the context of Australian private healthcare organizations [4]. Little is known about the innovation context within the private healthcare sector as to why innovation adoption rates are not higher. Thus far, related studies by Mendelson [5] shed light on the issue of consent for data processing in relation to national EHRs within both the European Union and Australia. Likewise, Tomlinson [6] explored concerns related to the implementation aspects of national EHRs within the context of private specialist healthcare settings. Hambleton and Aloizos [7] scholarly inquiry moreover investigated the various national initiatives undertaken as part of Australia's digital health transformation. Similarly, a study by Hareem et al [8] evaluated the adoption rates and challenges encountered in the utilization of EHRs within Australian Community Pharmacies. Taken together, these studies point to barriers and challenges in the adoption of EHRs but stop short in discussing what these issues look like in relation to innovation. Prior systematic reviews of EHRs adoption have been noted such as the technological, organizational and environmental factors (TOE) effects on e-health [9], cost effectiveness of EHRs adoption [10], and adoption EHRs in developing and developed countries [11,12]. However extant studies have not theorized how the TOE-related effects of electronic healthcare efforts can be broadened or extended on the basis of innovation theory, while innovation use in EHRs has only been discussed more generally [13]. Surprisingly, the context of private healthcare EHRs integrated with innovation theory has not been a high priority in existing studies [14]. Based on an extensive analysis of extant

EHRs and IT-related innovation literature, a significant knowledge gap exists as to how to steer IT-related implementation decisions towards adoption success within private healthcare settings. We posit that EHRs adoption success is unlikely to occur without embracing innovation practices. This is particularly germane for small private hospitals who receive far fewer funding allocations than their larger counterparts. Therefore, This specific circumstance has motivated the research team to explore the adoption of EHRs in Australian private healthcare sector.

Drawing on existing literature, research has yet to definitively determine the specific innovation practices necessary for achieving success in EHRs adoption within the private healthcare sector. Consequently, this study is significant as the successful adoption of EHRs relies on enhancing a culture of innovation within healthcare environments [15]. Furthermore, this research is important in addressing a notable gap in the current scholarly discourse surrounding EHRs adoption, specifically within the private healthcare sector in Australia.

To explore how innovation influences EHRs, the current study draws insight from three leading innovation theories including the Technology, Organization, and Environment (TOE) model, the Technology Acceptance Model (TAM) model [16], and the Diffusion of Innovation (DOI) model [17]. We outline in this paper how each innovation model informs adoption success. Later, the discussions shift to expounding unique features of innovation to provide greater insight about the EHRs implementation process. Our contribution to existing research is thus based on: 1) identifying the mitigating factors that offset the problems of EHRs adoption within the Australian private healthcare sector, 2) establishing which innovation artefacts are more ubiquitous with respect to the EHRs adoption process, and 3) developing a EHRs adoption framework by integrating several innovation models including the Technology, Organization, and Environment (TOE) model, the Technology Acceptance Model (TAM) model [16], and the Diffusion of Innovation (DOI) model [17]. The study provides a holistic understanding of the factors influencing EHRs adoption in the Australian private healthcare sector.

2- Theoretical Context of Innovation

2-1-Converging Innovation Research

Extant research has explored in different contexts the benefits of applying TAM and DOI innovation models (IMs) [18,19,20,21], TAM and TOE models [22,23,24]; and TOE and DOI models [25,26,27,28]. Each IM has a different focus and can be tailored to explore distinct features of technology adoption [29,30]. For example, the TOE framework is useful for analysing intra-firm innovation adoption [31], whereas the DOI and TAM models offer a more targeted exploration of the innovation characteristics influencing technology adoption [32]. For these reasons, the integration of IMs at both the firm and individual level deserve greater prominence in current studies of technology adoption practices.

Table 1 illustrates how several research studies have independently utilized the TOE framework and TAM and DOI models. While example studies listed have often integrated two IMs side-by-side, only one study Nabukenya, Egwar, Drumright, Semwanga, and Kasasa [33] combined the three models relevant to EHRs adoption. Extant research has focused on the national implementation of EHRs and does not include the knowledge and decision-making constructs for DOI models. Some scholars in addition focused on the factors influencing patients' acceptance and usage of consumer e-health innovations[34], while others have focused on identifying the determinants of electronic medical record (EMR) adoption using TOE and TAM [22]. However, no studies to our knowledge have explored the effects of combining IMs on EHRs technology adoption processes especially in Australian private healthcare sector. This is an important oversight because different innovation characteristics are expected to have different effects on users experiences [13]. The justification for integrating these three well-established theoretical IMs follows calls from several scholars to introduce a more comprehensive and complementary understanding of innovation in relation to IT adoption success [31,35,36]. We believe that innovation effectiveness in respect of adopting EHRs within private health will offer new integrative insights for this sector. We next discuss the innovation characteristics of these models.

Table 1: Innovation characteristics

Factors used to test adoption										*Example References*	
TOE & Innovation Criteria											
Cost	**Complexity**	**Leadership Support**	**Culture**	**Financial resources**	**Regulation**	**Perceived usefulness**	**Job relevance**	**Knowledge**	**Decision**		**Year**
	Y	Y				Y		Y		Abdekhoda et al. [22]	2019
	Y	Y				Y				Chatterjee, Rana, Dwivedi, and Baabdullah [37]	2021
	Y	Y				Y			Y	Gangwar, Date, and Ramaswamy [38]	2015
						Y		Y		Motsi and Chimbo [39]	2023
Y		Y		Y	Y	Y				Mbwambo and Mandari [23]	2023
	Y					Y	Y	Y	Y	Putzer and Park [40]	2010
Y				Y		Y				A. Y.-L. Chong, Chan, and Ooi [41]	2012
	Y		Y					Y		Thong [42]	1999
	Y	Y								Wang et al. [36]	2010
	Y	Y						Y		Chiu et al. [25]	2017
Y	Y	Y		Y		Y				Setiyani and Rostiani [43]	2021
						Y		Y		Awa, Ukoha, Emecheta, and Liu [44]	2016
	Y	Y								J. Chong and Olesen [45]	2017
			Y			Y				De Benedictis et al. [24]	2020
	Y					*Y*	*Y*	*Y*		Zhang et al. [34]	2015

2-2-Comparing Innovation Models (IMs)

The IMs analysed here have different yet support features for the innovation process. The TOE framework Tornatzky and Fleischer [46], delineates between three dimensions of an enterprise's context that impact the adoption and implementation of technological innovations: the technological context, the organizational context, and the environmental context. The technological context encompasses both internal and external technologies relevant to the enterprise. The organizational context pertains to descriptive measures about the organization, such as its scope, size, and the availability of internal slack resources. The environmental context represents the arena in which the enterprise operates such as its industry, competitors, and interactions with relevant governments. The diffusion of innovation (DOI) model by comparison explains from a cultural perspective the how, why, and at what rate new ideas and technologies are engaged [47]. The core concept of the theory relates to four factors that impact the diffusion of a new idea: the innovation itself, communication channels, time, and the social system. The communication channel of the model is valuable from a user's perspective since firms can measure the linear effects of their innovation efforts from existing knowledge to the innovation decision, to the confirmation stage [48].

Moreover, the Technology Acceptance Model (TAM) Davis et al. [16], assesses the level of information system adoption at the individual level such as perceived ease of use and perceived usefulness. A subsequent version of the model referred to as TAM2Venkatesh and Davis [49] by comparison addressed the social influence process e.g., subjective norms, voluntariness and image, and the cognitive instrumental process e.g., job relevance, output quality, result demonstrability and perceived usefulness, as key determinants of technology acceptance. Taken together, while TOE investigates those organizational factors necessary for the adoption process, both DOI and TAM2 in contrast measure different innovation artefacts e.g., perceived usefulness reflecting actual adoption processes and usage behaviour, respectively. Figure 1 reflects the discussions. Certain commonalities of IMs can be identified. For instance, socioeconomic, compatibility, and complexity in DOI is similar to the technology measures of TOEs compatibility and complexity [50,51], such that it is not necessary to measure these twice. Similarly, knowledge and decision-making criteria in DOI are similar to the organizational characteristics of TOE. In exploring the integration of IMs, we next problematize innovation within the context of EHRs IT adoption.

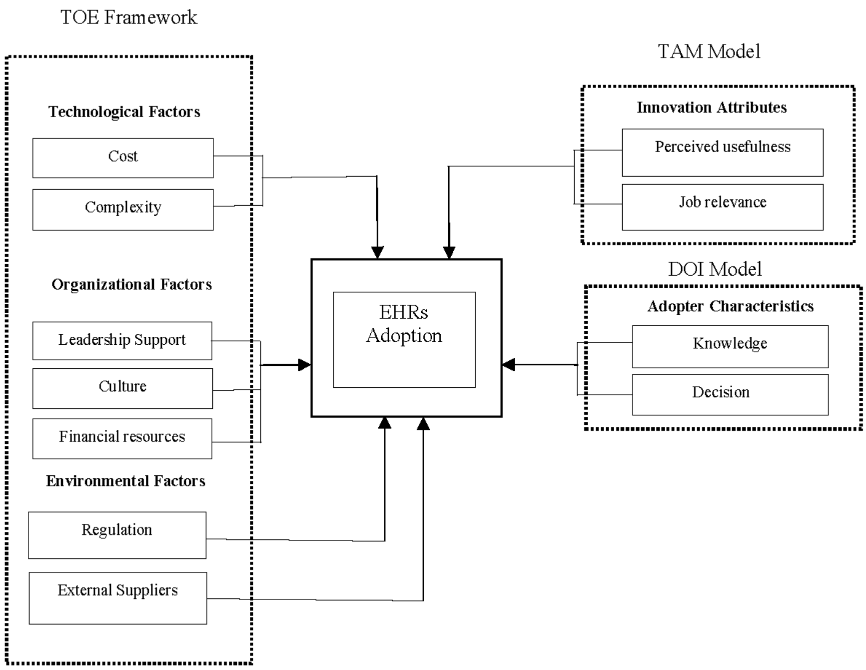


Figure 1. The conceptual research models.

3- Problematizing Innovation in the Context of IT adoption – Developing Research Questions

While the IMs described thus far provide well-known innovation criteria, we now discuss ways for creating greater theoretical insight between TOE, TAM and DOI models. We draw from the above discussions and Figure 1 to suggest five ways that innovation insight informs more clearly the EHRs adoption process including: (1) innovation attributes [52,53], including user knowledge of how to embrace new innovations [54] (2) technological contexts [39,53]; (3) organisational contexts[22,23]; (4) environmental contexts [55,56]; and (5) adopter characteristics [57,58]. We next discuss each of these theoretical insights in informing the research questions for this study.

Innovation attributes refer to measures of individuals' innovation perceptions. Perceived usefulness and job relevance criteria were selected from the TAM model in order to better understand individuals' attitudes and intentions towards adopting new technologies [16]. Perceived usefulness is crucial as healthcare professionals need to perceive technology innovations as valuable tools that help to better facilitate work tasks and improve patient care [59]. If healthcare professionals believe that EHRs will make their jobs easier, more efficient, and ultimately lead to better patient outcomes, they are more likely to adopt and use these systems [60]. Thus far, scholars are practitioners are no wiser about how these technologies are perceived.

Job Relevance similarly is also an innovation attribute. Job criteria focuses on the extent to which individuals perceive a technology as relevant and applicable to their specific job roles and responsibilities [16]. In the healthcare context, job relevance is essential as EHRs systems must align with the tasks and workflows of different healthcare professionals, such as physicians, nurses, and administrative staff [60]. If healthcare workers perceive EHRs as directly relevant to their daily job duties and responsibilities, they are more likely to view the adoption of these systems positively and be motivated to learn how to use them effectively [61].

In the context of technology, the implementation of comprehensive electronic systems across hospitals is a multifaceted endeavour characterized by various technological considerations [62]. The adoption of new technology is expected to offer advantages over existing legacy systems. Researchers have identified numerous factors influencing adoption success. These include overall costs, the upkeep of IT infrastructure, and external expenses related to suppliers[63,64] *inter alia*. Accounting for the complexity of technological systems [65], is a central consideration in EHRs adoption processes [66] yet similar to other problems identified, new technology adoption has been accounted for in contexts other than private healthcare [36; 33; 49].

Within the organizational context, the presence of leadership support is essential for processes of procurement, strategic planning, implementation, and ongoing maintenance of the new system [67]. Inadequate involvement and support from leadership in digital technology solutions can result in the decline of innovative initiatives and solutions [68], despite potential alignment with IT aspirational objectives. Supportive organizational change processes are indicative of leadership's commitment to change and the overall availability of resources [69]. Furthermore, the availability of financial resources significantly impacts EHR adoption within private hospitals. Adequate funding is necessary to invest in technology infrastructure, staff training, and ongoing support for solving EHR systemic issues [70,71], which has been a problem in private health contexts [72].

In the environmental context, regulatory frameworks influence different kinds of technology adoption. To oversee, monitor, and manage the eHealth sharing regime, appropriate administrative and regulatory procedures are in place. The establishment of the National E-Health Transition Authority (NEHTA) in 2005 marked a collaborative effort among the Australian government, state governments, and territories in response to the proliferation of various EHRs systems nationwide. NEHTA's mandate includes setting national standards for the electronic collection and sharing of health information. This responsibility extends to the development of a system for Shared Electronic Health Records (SEHRs), which is built upon the implementation of Unique Healthcare Identifiers (UHIs) [73]. Using external suppliers in the absence of internal expertise may also create internal conflicts [74,75].

In respect of adoption characteristics [57,58], the decision to adopt is influenced by the knowledge of potential adopters and decision-making processes [17]. According to DOI theory, adopter/user knowledge pertains to user awareness, understanding, and the proficiency of individuals' capabilities [54,76]. User knowledge encompasses familiarity with the features, functionalities, and potential benefits of EHRs [77]. Healthcare professionals and administrators need to make informed adoption decisions [78], about the implementation process, training requirements, and potential challenges for effectively integrating these systems into healthcare workflows [79]. The application of integrated IMs within the private healthcare sector to better inform private healthcare managers however is not known which we collectively address in the current study.

Based on the discussions thus far, the following research questions were used to explore the problems of IT adoption within the Australian private healthcare setting as follows:

Research Question 1: Which mitigating factors offset the problems of EHRs adoption within the Australian private healthcare sector?

Research Question 2: Which innovation artefacts are more ubiquitous with respect to the electronic healthcare records (EHRs) adoption process?

4- Research method

4-1-Study Sample and Setting

An exploratory qualitative research design employing a phenomenological approach was utilized to explore the research inquiries. The study was conducted at a private hospital located in South-East Queensland, with the organization being referred to as "Allan's Private Hospital" or APH to maintain confidentiality and adhere to ethical protocols. Interviews were conducted both face-to-face and online, leveraging the recent implementation of an integrated EHRs system at APH. Purposive sampling was employed to select participants for the study. The recommended sample size for phenomenological research varies, with Ellis [80] suggesting a range of 6 to 20 participants, while Boyd [81] proposes 2 to 10 contributors for reaching saturation providing the sample reflects major decision makers participation. Additionally, scholars have noted that in phenomenological studies involving senior decision-makers, fewer than ten interviews may be adequate [82]. As emphasized by Yardley [83], the rigor of the study relies not solely on the size of the sample, but on its ability to provide comprehensive information necessary for thorough analysis.

4-2-Participant Demographics

Table 2 reflects the participant demographic details. As noted, all participants were relatively senior managers responsible for making decisions related to new hospital innovations. Three participants were male and five female with four of the participants identified within the 30-40 age range while another four were located in the 40-50 age range. The tenure of senior managers was greater than 10 years (approximately half) with the tenure of remaining staff between 6-10 years. All participants possessed a university degree while the responsibility level reflected their senior management responsibilities.

Table 2: Participant demographics

NAME	GENDER	AGE	EDUCATION	CURRENT WORK EXPERIENCE	CURRENT RESPONSIBILITY LEVEL
P1	Male	20 to 30 years 30 to 40 years√ 40 to 50 years +50 Years	• Diploma • Bachelor√ • Master • Doctorate	• Less than 1 years • From 1 to 3 years • From 4 to 5 years • From 6 to 10 years√ • More than 10 years	Clinical Informatics Manager
P2	Female	20 to 30 years√ 30 to 40 years 40 to 50 years +50 Years	• Diploma • Bachelor√ • Master • Doctorate	• Less than 1 years • From 1 to 3 years • From 4 to 5 years • From 6 to 10 years√ • More than 10 years	Clinical Educator
P3	Female	20 to 30 years 30 to 40 years√ 40 to 50 years +50 Years	• Diploma • Bachelor√ • Master • Doctorate	• Less than 1 years • From 1 to 3 years • From 4 to 5 years • From 6 to 10 years • More than 10 years√	Nurse Unit Manager
P4	Male	20 to 30 years 30 to 40 years 40 to 50 years√ +50 Years	• Diploma • Bachelor√ • Master • Doctorate	• Less than 1 years • From 1 to 3 years • From 4 to 5 years • From 6 to 10 years • More than 10 years√	ICT Manager
P5	Female	20 to 30 years 30 to 40 years 40 to 50 years√ +50 Years	• Diploma • Bachelor√ • Master • Doctorate	• Less than 1 years • From 1 to 3 years • From 4 to 5 years • From 6 to 10 years • More than 10 years√	Director of Nursing
P6	Female	20 to 30 years 30 to 40 years 40 to 50 years√ +50 Years	• Diploma√ • Bachelor • Master • Doctorate	• Less than 1 years • From 1 to 3 years • From 4 to 5 years • From 6 to 10 years • More than 10 years√	Patient Administration
P7	Female	20 to 30 years√ 30 to 40 years 40 to 50 years +50 Years	• Diploma • Bachelor • Master√ • Doctorate	• Less than 1 years • From 1 to 3 years • From 4 to 5 years • From 6 to 10 years√ • More than 10 years	Patient Administration
P8	Male	20 to 30 years 30 to 40 years√ 40 to 50 years +50 Years	• Diploma • Bachelor√ • Master • Doctorate	• Less than 1 years • From 1 to 3 years • From 4 to 5 years • From 6 to 10 years√ • More than 10 years	Health Information Services Manager

4-3-Data Collection Tool

In this study, semi-structured interviews served as the primary method of data collection, allowing the researcher to engage with participants in their natural environments [72]. Interviews were conducted with department heads representing various specialties within APH. The initial round of interviews commenced with the hospital director and the director of the information and communication technology department to establish foundational insights. Through purposive sampling techniques [84], the key decision-makers involved in the EHRs planning process were selected. The dataset obtained from these interviews yielded valuable insights into many emerging themes. What was noticeable was that the experience of staff was reflected in the participant data collected. Ethical clearance was obtained from the relevant institution following stringent ethical procedures, and interviews were conducted between June and December 2019. Subsequently, the researchers aligned the themes derived from the TOE, TAM and DOI frameworks to effectively capture the influence factors of EHRs innovation adoption process consistent with research question 1 and 2.

4-4-Data analysis

The authors adopted a critical realist approach to analyse health professional perceptions of underlying reality along cultural and experiential considerations. Using the reflexive guidelines advocated by Braun and Clarke [85], an inductive qualitative method enabled the researchers to jointly derive meaning from emergent healthcare participant data through reflexive thematic analysis (RTA). The local environment of APH provided rich examples of hospital culture which was evident in these reflexive themes. Thus, critical reflexivity invoked new participant centered ideas [85,86], which was subsequently suitable for drawing conclusions from the data [87]. The researchers performed iterative processes of data review, coding, theme development and refinement while carefully perusing the recordings and participant transcripts. Semantic surface meanings and descriptions as well as latent approaches to develop rich descriptions were applied to an inductive coding approach. Reflexive themes thus emerged from the data based on the richness of meaning reflected in the dataset [88]. Participant extracts were edited for length and clarity and included within each thematic area.

To source the data, respective interview questions were formed on the basis of the EHRs, and innovation literature discussed previously. All interviews were meticulously recorded, transcribed, and imported into the qualitative data analysis software QSR NVivo 12 as a first step while a second stage involved a more manual process of deciding on the reflexive and emergent themes. Drawing from existing literature and illustrated earlier in (Figure 1) all interview questions were structured around the key literature previously discussed.

Initially, a preliminary coding dictionary was developed based on the semi-structured interview guide, ensuring consistency in coding practices. Subsequently, all coded transcripts and emerging themes were meticulously reviewed, and any new themes were integrated into the coding dictionary. Data discrepancies, such as missing information were addressed collaboratively by the research team, and consensus was reached regarding the interpretation of themes. In building on the idea of reflexive themes, we asked participants to propose a key emerging innovation artefact from their normal responses to interview questions by reflecting on the description they had provided related to each theme and its underpinning dimension. In addition to the questions that were asked of each participant, we also provided a generalized description of the factors for TAM2 and DOI. From this insight, we were able to build a table of the relevant participant data dimension, theme, and description (Table 3). We then discussed the innovation artefact and used a separate coding function to partition the information. We later used Table 2 as a basis to broaden the existing EHRs literature by drawing new innovation insights which are outlined in the discussions section. We next contextualize Table 2 by discussing the study themes relevant to each innovation dimension.

Table 3: Thematic findings relevant to dimensions of innovation

Dimensions	Theme	Description
Innovation Attributes	Perceived usefulness	The new technology is expected to provide APH with a leaner and more efficient system.
	Perceived ease of use	The system is expected to far outweigh the challenging aspects of EHRs adoption.
	Job relevance	Participants expected that the system while improving efficiency might add more work.
Adopter Characteristics	Knowledge	Training teams all over the hospital to use EHRs was acknowledged with some staff benefiting more than others that had not been trained.
	Decision-making	Improving patient safety underpins a champions user group who underpin decisions related to the whole process.
Technology-related factors	Cost	Cost was acknowledged as an 'expensive journey' especially given that APH was small and not connected to a larger parent company.
	Complexity	Decisions were made by senior leaders to try to reduce the complexity of system use through regular training and briefing while overly complex systems were difficult to use.
Organizational Factors	Leadership support	Leaders listened to staff about their concerns, while supply relevant resources were important for support purposes.
	Financial	Participants saw EHRs as just another tool with funding provided by the executive and board.
	Culture	Managers talked about fixing the culture and not forcing people to use EHRs but acknowledged that staff tenure could be an issue related to change acceptance.
Environmental-related Factors	Regulation	APH had to meet strong regulatory standards but expressed concern that the new EHRs may not be compliant with regulations.
	External Suppliers	The importance of external suppliers was noted, and that the vendor needed to ensure through the joint venture that APH met the required regulations and standards.

5- Study findings

This section of the paper presents the key findings from our study. First, we display the participants' responses in Table 4. Following this, we discuss the relevant data dimensions, emerging themes, and their descriptions based on the interview data from participants.

Table 4: Thematic findings.

Themes	Factors/Participants response
Innovation Attributes	***Perceived usefulness*** *".. we're a small not-for-profit. We're not a big city. We don't have the depth that other healthcare groups do. So, we have to differentiate ourselves in the market by doing things better and smarter than everybody else. We have to be a lot leaner, a lot more efficient with what we do. How are we going to achieve that? We're going to achieve it through benefits of an electronic system. So, where it makes absolute business sense to, we're trying to remove any manual processes out of that" (P4).* *"...in relation to change management material. We've actually got already a couple of change management videos on demonstrating all the benefits of the digital change to the hospital. (P1).* ***Perceived ease of use*** *Participants acknowledged that the system would not be easy to use which equates to earlier research that perceived usefulness is often seen in a different light from actually using the system [92].* *"So, unless you start bringing people on the journey that they're going to go to a digital record, and the benefits for doing that. Then even if you do get it to go live, they're not going to use it" (P4).* *"But I definitely say, at the start, it's always going to be challenging, don't get me wrong. With people adopting a new system, learning the new ways, starting out training and processes will take longer than what they're currently doing now. But in the end, it will far outweigh the bad, the benefits will be better (P7).* ***Job relevance*** *"Well, the benefits to staff are you can make some efficiencies with some workflows, and some other workflows it will add more time onto. I guess this is a controversial issue because you can read a paper that says that the EHR saves time, and you can read another paper that says that EHR add time. So, my personal view is that what we know, it doesn't save much time, or it doesn't make things much efficient. In some papers and some research will say it adds 10% more workload onto the nursing staff and medical staff. (P5).*
Adopter Characteristics	***Knowledge*** *"So, we have a key user group. The key users are representatives from each department who have exceptional knowledge of their processes and workflows. So, they've had additional training and they're the key to the train the trainer model. So, they train their end users and they're the go-to people for support. The champion users sit above them, they approve the process and champion the process if you like." (P1).* *"We've done office specific IT training. All our nurses that come through would have had to undertake some sort of basic computer skills in university. So, our nurses should be fine. It's the staff that are not clinical or not nurses that may have an issue though, but overall, our nurses should be okay. "(P5).* *"Sharing knowledge. So being in a building stage, I'm going to go with where we're at, I think that's easiest. We've had to work with teams from all over the hospital, in the building of what we're doing now for our new system" (P2).* ***Decision-making*** *"We do have a medical council and there's stakeholders from each department group who have input, we call them champion users, so they oversee the whole process, so they make decisions about the workflow, what is accepted and what isn't. (P1).* *"So having the clear strategy now that we are moving forward, and we've made the decision to go down that path and we're looking at the options for doing that. Yes, I think that the vision is there, the vision is that we want to improve patient safety. (P2).*
Technology-related factors	***Cost*** *"Financially of course, it's going to be an expensive journey for anyone. We're a standalone hospital. We don't lean on anyone, so whatever profits are made within our organization stay with us. So, we're not connected to any other hospital" (P2).* *"Definitely the cost, cost of staff training is huge. And there's an ongoing cost as well" (P2).* ***Complexity*** *"... ...system complexity level was a main criterion when we made an adoption decision" (P1).* *"A complex EHR system has a huge number of connections I would say like patients, carers, employees and managers so there will be a lot of information and requirements." (P5).* *" Decision makers may be hesitant to adopt electronic health records if they perceive them as overly complex P4).*
Organization-related factors	***Leadership Support*** *"As program administrators our priority is to provide support required for planning and form of a leadership group to handling this complicated program. We also listen to staff requirements and suggestions, which is very important for sustained improvement. For example, staff nurses could tell us about nurses' concerns in department meetings or send an email to the manager" (P4).* *"Current capability, I guess, again, with the right training put in place with all users, all staff that would use the system with the right resources and support from everyone including top management. To help everyone engage with that right attitude to move from one system to another is massive because change is hard for a lot of people. I think then you would be able to be capable to change" (P6).* ***Financial resources*** *"Well, I just think, there's always a clear strategy of what you would hope for, what you would like when you're adopting a system. So, like, things put in place, planning put in place, training, the resources that are available for you. So, everything to be set out correctly and the staff to be prepared, including the vendors outside the organization as well." (P7).* *"How do we fund it? Without going into too much detail, we're a standalone not-for-profit so any money that we make, we reinvest into the business, right? So, this is no different, it's bigger, but it's no different to buying new beds. It's no different to buying new vital sign monitors. It's just another tool. Right? So, the funding comes through executive and board approval. (P4).* ***Culture*** *"So first and foremost, any organization that is looking at an electronic health record, electronic medical record needs to understand, and particularly if they're moving from a paper-based record, they need to prepare the culture of the organization, right? There's no point putting in an electronic system if it's rejected by the people who use it. So, you need to work on the culture that the change aspect of what's coming. For us, we have an aging workforce. You know, we have a lot of people who've been here 20, 30 years, and that's all they've ever known is the paper record." (P4).* *"I'd say we've been okay with innovation without being great. You say innovation for what? Well, let's fix the culture first and what we are doing with technology will work better" (P5).* *"Huge. So that's why I said right at the start, the first thing you need, the very first thing you need to do is fix your culture. You need to make people want to be part of the change. Otherwise, it's just not going to do it. So, the resistance comes from not bringing people along those journeys. (P4).*

Environment-related factors	***Regulation*** *"This is good one. Legal and regulations. I'm going to go with more regulatory stuff because I've got a bit more knowledge around that. Currently in Australia, we are governed by the National Service Standards for health care. So, we followed eight national standards that we have to meet to be accredited to work as a hospital in Australia. So going digital, the same regulatory body is working on digital standards. (P2).* *"To be able to meet those regulations is going to be very challenging. And I think until we get very clear guidelines. They've got suggestions. Can your system do this? This is a great thing if it can. But it doesn't say that you have to do these..." (P2).* ***External supplier*** *"...But part of what we have as a contractual agreement is that any legislative or regulatory changes that enacted either during the project or post project, it's the responsibility of the vendor to make sure that we as an organization meet those standards and those regulations, it's a joint venture. So, we have to identify that the legislation has changed. We have to identify how and what impacts it has on the system. And then we work with the vendor to make those appropriate changes so that we always stay compliant. It also forms part of your accreditation process as a health provider anyway" (P1).* *"Let's be frank. We haven't always had the skills to assess what's good or bad. They could almost tell us anything and as long as its believable, managers nod their heads. I don't think that's a good assessment of innovation which is a problem for us going forward." (P6).*

5-1-Explanation and interpretation of results

The findings indicate that participants emphasize the need for organizations to demonstrate tangible benefits through effective change programs and comprehensive training, which aligns with earlier research [22,59] suggesting that perceived usefulness plays a significant role in new technology adoption. Also ,the findings emphasized the necessity of engaging users throughout the transition to a digital record to ensure its utilization, suggesting that without buy-in and understanding of the benefits, the system might not be adopted effectively. The participants acknowledged the difficulties at the outset, noting that while the adoption and learning phases are challenging and time-consuming, the long-term benefits of the new system will ultimately outweigh these initial obstacles. This highlights the importance of user engagement, training, and effective communication of benefits to overcome resistance and ensure successful adoption of EHRs systems [89]. Job relevance is indeed a critical factor in the acceptance and adoption of new technology systems as highlighted in the study by Ebnehoseini et al., [90]. The need for adaptable and customizable EHRs systems to align with diverse workflows in healthcare settings is essential as discussed in the research by Barrett [91]. Furthermore, the study by Csonka and Korppi [92] emphasizes the importance of EHRs containing patient-specific information, including treatment plans and clinical workflow analysis to meet varying professional needs. The findings of previous studies collectively stress the significance of job relevance and customization in EHRs systems to enhance user acceptance and to facilitate efficient healthcare delivery which is aligned with the findings of the current study.

The findings highlight the critical importance of key users in the adoption of EHRs systems by emphasizing their extensive knowledge of processes and workflows. These key users are decisive in the train-the-trainer model, where they receive additional training to support and educate end-users, thus facilitating smoother transitions [79]. The study also notes the challenges posed by staff resistance due to a lack of awareness and heavy workloads, underscoring the necessity for targeted training and knowledge sharing across the organization [93]. For instance, while nurses are equipped with basic computer skills from their training, non-clinical staff may face greater difficulties and therefore, require more tailored IT training. This aligns with contemporary literature which underscores the need for comprehensive training and support structures to mitigate resistance and enhance user competency in EHRs adoption [94]. Also ,the findings demonstrate that decision-making processes involving clear strategies and inclusive stakeholder engagement as described by Rogers' innovation-decision process[17] are crucial for aligning the EHRs implementation with organizational goals and ensuring its success. The study findings highlights cost and complexity as critical factors influencing the adoption of EHRs in healthcare settings. Participants identified the high initial costs and ongoing expenses, including staff training, as significant concerns [95]. This financial burden is particularly challenging for standalone hospitals that cannot rely on external support. Additionally, the complexity of EHRs systems, encompassing the difficulty of understanding and using the technology, further complicates adoption [65].

Our findings emphasize the critical role of leadership support, financial resources, and organizational culture in driving the adoption and success of EHRs within healthcare organizations. Leadership support is highlighted as essential for fostering innovation, providing resources, and championing EHR initiatives throughout the organization [96]. Adequate financial resources are crucial for the strategic implementation of projects and achieving organizational goals, requiring careful planning and allocation of resources [97,98]. Also the participants stressing the importance of preparing the culture for change and innovation to ensure successful adoption and utilization of electronic systems [99]. This result may be explained by the fact that it is important to address resistance and engage the workforce effectively, emphasizing the need for cultural readiness and change management strategies. These insights underscore the multifaceted nature of organizational readiness in successful EHRs adoption, highlighting the interplay between leadership, financial management, and cultural transformation (Lipinski & Gondwe, 2021). These factors collectively contribute to the overall success and sustainability of EHR implementation efforts within healthcare settings. The result of current study point out the importance of regulatory requirements and the collaborative engagement with external suppliers in the healthcare sector's adoption of digital systems. Participants stress the necessity for compliance with evolving standards, reflecting the stringent mandates imposed by regulatory authorities [100]. This underscores the intricate nature of contractual agreements between healthcare organizations and vendors, where both parties share the responsibility to ensure adherence to changing regulations. Such collaborative efforts are necessary for maintaining accreditation and navigating the complexities of regulatory environments [101].

In conclusion, the findings emphasize the need for organizations to demonstrate tangible benefits through effective change programs and comprehensive training to ensure successful adoption of EHRs. Engaging users throughout the transition is critical for utilization, as buy-in and understanding of benefits are necessary to overcome resistance. Despite initial challenges, participants acknowledged the long-term advantages of EHRs. We next discuss the broader contributions of this research.

6- Discussions

The purpose of this research was to explore how innovation influences the successful adoption of EHRs in the private hospital sector. To achieve this, the authors drew insight from three leading innovation theories including the Technology, Organization, and Environment (TOE) model, the Technology Acceptance Model (TAM) model [16], and the Diffusion of Innovation model [17]. We discussed at length how innovation models inform innovation adoption practices with an overall aim to provide greater insight about the EHRs innovation process illustrated in Figure 1.

The findings of this study have been compared with the results of previous studies, providing a comprehensive analysis of similarities and differences. The comparison highlights key factors and insights derived from the current study, juxtaposed with prior established research outcomes. This thorough comparative is detailed in Table 5 which captures all relevant factors identified through our study. By doing so, it underscores the robustness and validity of our findings within the broader context of existing literature, thereby contributing to a deeper understanding of EHRs adoption in the Australian private healthcare sector. Overall, while previous studies have pointed to the barriers and issues of EHRs adoption more generally as noted earlier, our study broadens related literature by matching EHRs implementation concerns to their thematic findings relevant to the dimensions of innovation.

We now discuss the contributions to existing research by exploring and expanding on the answers to each research question beginning with research question 1.

6-1-Answers to Research Question 1

In answer to research question 1, and based on the previous discussion, Table 5 presents the mitigating factors that counter the negative aspects of the EHRs adoption process in respect of a private healthcare hospital. Based on the findings in Section 5, the '+' sign represents the favorable mitigating factor while the '-'sign represents a more negative factor. For instance, financial resources have a positive impact on EHRs adoption over the long term due to their cost-effectiveness contributing to significant financial savings. In the short term, however, the adverse effect arises from the substantial costs associated with full adoption and migration to EHRs. Health care institutions will accordingly need to be mindful of the negative effects of implementing EHRs. It does not necessarily follow that all negative outcomes are equally offset by positive ones. Innovations strategies here are thus better identified by integrating IMs leading to a strategy for each emerging factor in Table 5. In broadening the existing EHRs literature related to innovation in other contexts [36; 33; 49], innovation strategies do not go far enough if at all within the private healthcare sector. That is, mitigating processes require an innovation strategy to counter the negative effects of trying to implement new innovation. For instance, the complexity of new innovation requires everyone to be involved in the planning processes similar to what is proposed by DOI [76] while perceived usefulness and ease of use require comprehensive training across the whole hospital similar to TAM2 [95]. Moreover, it is one thing to identify which organizational context needs to change [8; 13] but quite another to influence the context by better embedding the perceived usefulness and ease of use of the new innovation [42]. Taken together, APH need to move forward with clear innovation strategies in support of research question 1.

Table 5. Impact of mitigating factors for EHRs adoption

FACTORS	MITIGATING PROCESSES AND OUTCOMES
Financial resources	(+) Over the long term, EHRs demonstrate a favourable outcome due to their cost-effectiveness, contributing to financial savings for organizations.
	(-) Over the short term, the adverse effect arises from the substantial costs associated with full adoption and migration to EHRs.
	<u>Innovation strategy:</u> Adopting EHRs is a worthwhile process over time considering short-term costs.
Complexity	(+) A complex system has more information than a simple one, therefore, it helps managers to make effective decisions which takes planning.
	(-) Decision makers may exhibit a propensity to refrain from the adoption of EHRs if they perceive excessive degrees of complexity.
	<u>Innovation strategy</u>: Involve everyone in the innovation planning process. Research supports increased benefits from social innovation.
Leadership support	(+) Better services would be provided if EHRs are supported by the leadership team.
Culture	(+) Fixing and identifying cultural issues (ease complexities, employ effective communication practices, and provide resources) from EHRs inception leads to mitigating the challenges.

	(-) Changing a culture requires effort and resources. Innovation strategy: Management to identify which aspects of culture need to align with the new innovation e.g., job processes need to adapt to process innovation.
Regulation	(+) The vendor has to ensure that the organization meets the required standards and regulations. (-) lack of clarity and constant change related to regulations. Innovation strategy: Management to insist on external supplier communication such that all users are more familiar with EHRs processes.
Perceived usefulness	(+) Improving and demonstrating the perceived usefulness of EHRs can lead to increased acceptance and adoption among healthcare provider staff. (-) When perceived usefulness is complex, users will be hesitant. Innovation strategy: Better and comprehensive training required for all users across the hospital.
Perceived ease of use	(+) The benefits will be better including the documentation and accuracy of everything. (-) *Decision* makers may be hesitant to adopt EHRs if they perceive them as overly complex. Innovation strategy: Integrate usefulness with ease of use for all users across the hospital.
Job relevance	(+) The benefits to staff will be evident in workflows. (-) More time allocations will be needed in other areas where work tasks change Innovation strategy: Managers and section heads to carefully align existing roles and job requirements with new roles and job requirements from EHRs innovation.
Knowledge	(+) The level of knowledge of employees and decision makers has a positive impact on the successful EHRs implementation (-) Staff at risk of being resistant to implementation because of their lack of knowledge. Innovation strategy: Better and comprehensive training required for all users to increase skills and knowledge.
Decision	(+) The impact of decision is positive when decisions are made by stakeholders and with the participation of a medical council. (-) EHRs decisions will be difficult when not supported by senior leaders Innovation strategy: Management decisions must incorporate all users.

6-2-Answers to Research Questions 2

In building on insights related to research question 1, we now address the answers to research question 2 related to which innovation artefacts are more ubiquitous with respect to the electronic healthcare records (EHRs) adoption process. Earlier in (Figure 1), we illustrated how our conceptual model encompasses both TAM2, DOI and the TOE framework. We outlined in Table 3 how the thematic findings from the data were related to the dimensions of innovation. In sum, TOE and innovation practices influence EHRs practices both positively and negatively as previously discussed in answer to research question 1. Earlier also we outlined how we used critical reflexive analysis (RTA) to identify innovation artefacts from the data set by using Braun and Clarke [85]. The reflexive process consisted of an inductive qualitative approach to establish greater meaning from the data. The procedure led to a number of emerging insights. For instance, in addition to what we know about user satisfaction in relation to innovation, the researchers wanted to determine what other factors emerged from the data.

In Table 6, we now illustrate how a careful review of the data and each innovation theme resulted in identifying how time or temporal factors emerged to play a key role in user adoption of EHRs in addition to the more standard innovation artefacts discussed earlier. That is, we identified that time as an innovation artefact was borne out of integrating the three innovation models which is a new contribution to determining which innovation artefacts are more ubiquitous with respect to the adoption of EHRs within the private healthcare sector.

Table 6: Broadening electronic healthcare literature.

RQ	Emerging Innovation Theme	Example Emerging Innovation Related to Time Artefacts	Prior Research Supporting a Focus on Time & Contribution to Theory
RQ2: How can innovation inform new electronic healthcare records (EHRs) adoption success?	Perceived usefulness and perceived ease of use	*"There must be means in place to mitigate the concerns of the staff, particularly clinicians, about the introduction of this new technology like showing the benefits of the new system* ***over time".*** *"Moving away from current legacy systems, quality improvement projects, improved medication safety, suggests a number of reasons we've communicated as to why we're going* ***on the journey****.* *"So, unless you start* ***bringing people on the journey*** *that they're going to go to a digital record, and the benefits for doing that. Then even if you do get it to go live, they're not going to use it".* *"How can the new system improve patient care and simplify workflows and affirming that this increased burden won't be* ***sustained in the long term****".* *"And then down the* ***track in five years****, if they put it in legislation, do I go, "Oh, well I didn't do that because it wasn't in legislation. How am I going to build it now?" That's going to be interesting."*	Supporting Research "A meta-analytic review of the factors of technology acceptance across theories might not only help put theories into perspective, but it could also make it possible to focus on individual constructs more widely, examining whether attitude, intention or use behaviour can be regarded as a proxy for behaviour (Marikyan, Papagiannidis, and Stewart 2023: p. 2). This also applies to time and temporal work as a proxy for behaviour [103]. "Considering the changes in technology use cases over the past decades, there is a need to aggregate the effects of factors and compare them across time and applications" [104]. [Adoption] "is a complex process in which an individual's beliefs and attitudes are formed over time and lead to a final decision about whether to adopt a technology" (L. Liu and Miguel-Cruz 2022: p. 162). Contribution to Theory Broadening TAM is possible by adding other characteristics such as temporal work and time to measure the impact of technology adoption over time.

Knowledge, Job relevance and Decision-making	*"We've certainly identified where some of the more complex processes are and where those stakeholder groups will find it more difficult to adopt, and some of the strategies to tackle that, including increased training, increased stakeholder engagement. That's how* ***we're moving through those processes"*** *"Sharing knowledge. So being* ***in a building stage****, I'm going to go with where we're at, I think that's easiest. We've had to work with teams from all over the hospital, in* ***the building of what we're doing now*** *for our new system".* *"The types of skills required vary depending on the stage of implementation. In the* ***early stages****, when the product is unclear, there is a need for the skills of scientific or technical specialists. Later on, the* ***required skills shift*** *to leadership, managerial control, and workforce empowerment skills"* *"The project has been* ***pushed out a little bit*** *there will be another round of training but part of the EHR adoption process and change management process".* *"It's probably something we could do better, I would say. But yeah, overall, I think we're okay. I think we're okay. I think we're prepared enough to go on a* ***digital journey".*** *"We were relying on the expertise of vendors to help make decisions around* ***number of unclear aspects"*** *"There has been a heavy focus on what the* ***standards are and also the guidelines*** *and recommendations by the Australian Commission on Safety and Quality in Health Care (ACSQHC) for electronic systems in hospitals. So, we've been looking at all that as well".* *"We planned to* ***simplify the stages of implementation*** *and planned for training during and after implementation as ways to mitigate concerns related to system complication".*	Supporting Research The coexistence of conflicting temporal structures and assumptions among people who need to work together is equally powerful as individual innovation characteristics. In this case, temporal complexity may also be an enabler of interorganizational collaboration [106]. "Time is not simply a structuring device, but can itself become objectified, quantified, commodified, and financialized. In such contexts, people talk about 'saving' time, 'borrowing' time, or 'giving' time" (Bansal et al 2022: p. 12). An individual's beliefs and attitudes are formed over time given the complex adoption process and if not checked or measured, could create a speed trap in the adoption process [107]. Contribution to Theory In relation to knowledge, job relevance, and decision making, participants are hesitant about the digital journey, the degree of regulation, of moving through processes, and pushing the project out. By not focusing on time could create a speed trap. A focus on managing time as an innovation artefact helps to broaden existing innovation literature.
Leadership support, Complexity and Financial	*"As program administrators our priority is to provide support required for planning and form of a leadership group to handling this complicated program. We also listen to staff requirements and suggestions, which is very important for* ***sustained improvement.*** *"****Later on,*** *the required skills shift to leadership, managerial control, and workforce empowerment skills".* *"So first and foremost, any organization that is looking at an electronic health record, electronic medical record needs to understand, they need to* ***prepare the culture of the organization****, right?* *"So, the people that were part of it got pulled in off the floor, they come along on* ***that journey****, but there probably were some efficiencies in appropriately budgeting and resourcing the right skillset".* *"Investing in electronic health records is not just about modernizing our healthcare system; it's also a strategic decision aimed at* ***long-term cost savings.*** *By digitizing patient records and streamlining administrative processes, we anticipate significant reductions in operational* ***costs over time".*** *""Financially of course, it's going to be* ***an expensive journey*** *for anyone".* *"Further along as we got into training we had very much a regimented structured training process*	Supporting Research While TAM models have validated how attitude (of both leaders and other users) has influenced actual use behaviour in prior research of technology adoption and diffusion [12,102,105], our findings suggest that time-based temporal work has not been measured as an influential factor. We noticed from the data how temporal pacing shaped participants propensity to collaborate via creating new actions rather than waiting for the 'right time' for innovation. [106]. There are highlighted instances of scheduling training and people's time by pacing the EHRs workflow [108]. The readiness of physicians to adopt EMRs is heavily influenced by various factors such as age, experience, computer literacy, organizational culture, and participation (Derecho et al. 2024: p. 13). Time is also a contributing factor [12]. The call for longitudinal studies underscores the importance of tracking EMR adoption over time, allowing researchers to discern how user dynamics and relationships among variables evolve [12,109]. Contribution to Theory Extant studies have not theorized how the TOE-related effects of electronic healthcare efforts can be broadened or extended on the basis of innovation theory, while innovation use in EHRs has only been discussed more generally [13].

whereby there's an ***allocation of time to each user group*** *and each process for their training".*

"But part of what we have as a contractual agreement is that any legislative or regulatory changes that enacted ***either during the project or post project,*** *it's the responsibility of the vendor to make sure that we as an organization".*

In adopting the definition of temporal work for this study by Bansal et al (2022: p. 7), we define temporal work or time-based work practices as "individual, collective or organizational effort to influence, sustain or redirect the temporal assumptions or patterns that shape strategic action". In the current study, we noticed many assumption-based statements and patterns in the data that supported the idea of time as an innovation artefact [107]. We observed from the data how temporal work shaped participants propensity to collaborate via creating new actions rather than waiting for the 'right time' for innovation [106]. We highlighted instances of scheduling training and people's time by pacing the EHRs workflow [110].

In perceived usefulness for instance, participants spoke of building the new system over time, and that they were on a journey and that it was important to bring people along on the journey. In perceived ease of use category, participants noted that the burden of use would not be sustained in the long term and were mindful of what that looked like in five years' time. Interestingly, participants spoke of moving through the process, not of completing the process, indicative of temporal pacing. In terms of knowledge, participants noted the building stage and of building on what we are doing now. At no time did participants suggest that the process was complete. Similarly, in terms of decision making, collecting knowledge as a digital journey, simplify the stages of implementation, and that vendors would need to be helped with a number of unclear guidelines. Decision-making aspects were thus time dependent since they relied on time as an innovation artefact in bringing about change. For cost for instance, participants acknowledged long-term savings and the expensive journey for allocating costs over time. Moreover, managers in respect of complexity and leadership support identified the need to allocate time to user groups and that regulatory changes occurred during and posting the project. Sustained improvements was inferred as a time artefact for temporal pacing since improvements would not take place immediately while preparing the culture was an additional time-based artefact given that cultural change evolves over time [103].

6-3-Contributions to Existing Research

Given our focus on time as an emerging artefact, the characteristics of the three innovation models are more circumspect. Scholars note for instance that the adoption process is not a single event [105]. Rather, an individual's beliefs and attitudes are formed over time given the complex adoption process and if not checked or measured, could create a speed trap [107]. Yet, innovation adoption models are primarily individually focused and determined by individual characteristics e.g., users perceived ease of use, usage behaviour, where time or the temporal effect of work is mostly not measured. Moreover, if scholars wanted to measure the time-based or temporal effects of innovation practices on new technology adoption, then this should be divided into the micro and macro perspective.

Liu and Miguel-Cruz (2022: p. 162) notes that the adoption process relates to the micro perspective of change whereas the macro perspective describes how technology use spreads through a population. While TAM models have validated how attitude (of both leaders and other users) has influenced actual use behaviour in prior research of technology adoption and diffusion [12,102,105], our findings suggest that time-based temporal work has not been measured as an influential factor even while as we have discussed, time is an innovation artefact influencing temporal pacing [103]. That is, building on the integrative insights from the three innovation models (Figure 1), innovation practices are mostly measured at the individual level. Time, however, is an emerging innovation artefact pointing to the importance of innovation diffusion from a longitudinal perspective at the organizational level. The innovation adoption model characteristics based on the current research findings could thus be broadened by illustrating how time and temporal work pacing emerge and are equally influential in the adoption process as other characteristics.

In Table 6, supporting research suggests that while user attitude, intention to use can be regarded as a proxy for behaviour [102], there remains a need to aggregate the effects of factors and compare them across time and applications [104]. Simply measuring some behavioural factors and missing others may not be enough to determine how innovation practices influence outcomes. Liu and Miguel-Cruz [105] note that individuals' beliefs and attitudes are formed over time and lead to a final decision about whether to adopt a technology. We note in the supporting literature of Table 6 that temporal complexity may also be an enabler of interorganizational collaboration [106] because of the emphasis on saving, borrowing, and giving time [103]. Without considering time as a temporal artefact, the adoption process could create a speed trap for eager users [107]. Leadership moreover does not necessarily translate into adoption success. The literature notes that technology adoption is different to diffusion [12] such that participants forged ahead without being cognisant of the right time for innovation [106].

The call for longitudinal studies [109] amplifies the need to carefully measure the dynamics and relationships among variables [12]. Taken together, our contributions to theory suggest that by focusing on time as an innovation artefact helps to broaden insight about which innovation practices are important for EHRs processes in addition to the well-known effects of innovation models as highlighted though research question 1. Similarly, broadening both TAM and TOE might be possible by measuring the characteristics of temporal pacing and the impact of time on technology adoption. Given the priority placed on time by participants in the current study suggests it deserves equal prominence with other innovation characteristics as an important innovation artefact.

6-4-Contributions to Practice

The findings of this research have implications for professional practice. Managers will need to note how the positive mitigating factors presented earlier can be offset by negative factors. However, our results suggest the value of grounding EHRs adoption processes on the basis of innovation characteristics helps to prioritise which innovation attributes are important. We suggest that a greater appreciation of innovation will result in enhanced patient healthcare and decreased healthcare expenses as discussed earlier. Accordingly, managers will need to better align organizational strategy with information systems strategy [111,112], by not paying lip service to new innovation adoption. What emerged in the current study was the need for careful planning, stakeholder engagement, lessons learned from previous implementations, and adherence to health safety guidelines. Health organizations should prioritize highlighting the benefits of the electronic system to all stakeholders, emphasizing improved patient care, workflow simplification, and quality improvement initiatives. Moreover, we highlighted how temporal pacing and time are equally important innovation artefacts informing EHRs adoption processes which is a new contribution to both research and practice.

6-5-Implications for Future Research

We note from Marikyan et al. [102] that since the development of the earlier innovation models e.g., TAM, individuals perceptions of technology have changed considerably because of the increase in individual user knowledge. Different versions of TAM however and other innovation models such as TOE however have not changed considerably. In elaborating on our theoretical contribution, individuals' perceptions of the value of technology was not the main basis for user acceptance in the current study quite possibly confirming that individual users have become more comfortable with new technology overall. Future research should look to explore how time influences adoption processes as well as the effects of different temporal pacing objects such as tasks, the flow of tasks, job roles, time resources and end goals. Time as a temporal factor has thus not received adequate investigation which future studies could explore. The current study is limited in generalising the results to other industries given the focus on private healthcare. A broader study across industries including a broader data set would help to confirm the value of innovation tied to electronic healthcare adoption processes.

7- Conclusion

This study employed in-depth interviews of stakeholders from a private healthcare setting to investigate the impact of innovation processes on the adoption of EHRs in the Australian private healthcare sector. The study drew insights from prominent innovation theories such as the Technology, Organization, and Environment (TOE) model, the Technology Acceptance Model (TAM), and the Diffusion of Innovation model, to understand how these models inform innovation adoption practices. This comprehensive analysis provided key factors and insights that enrich the existing literature on EHRs adoption practices, particularly in private healthcare institutions. Factors offsetting the challenges of EHRs adoption in the Australian private healthcare sector were explored, emphasizing the role of mitigating factors in facilitating adoption processes. Innovation attributes such as perceived usefulness and adopter characteristics like knowledge and decision-making were crucial in enhancing the success of EHRs adoption in healthcare organizations. The study identified the importance of integrating different innovation models with EHRs adoption processes and underscored the significance of temporal pacing and timing as essential elements of innovation in EHRs adoption processes, presenting a novel contribution to both academia and practical application. The results suggest the value of grounding EHRs adoption processes on the basis of innovation characteristics helps to prioritise which innovation attributes are important. In practice, the findings suggest that healthcare managers should align their organizational strategies with innovation models, ensuring comprehensive training, stakeholder engagement, and adherence to safety guidelines.

8- Declarations

8-1-Author Contributions

Conceptualization, Ouheda. S., and Murray Peter A.; methodology, Ouheda. S., and Murray Peter A.; formal analysis, Ouheda. S.; data curation, Ouheda. S.; writing—original draft preparation, Ouheda. S.; writing—review and editing, Peter A. Murray.; visualization, Ouheda. S.; supervision, Murray. Peter A.; Alam. K, A and Ali. O.; project administration, Ouheda. S.; funding acquisition, Murray Peter A. All authors have read and agreed to the published version of the manuscript.

8-2-Data Availability Statement

Data available on request due to restrictions privacy and ethical.

8-3-Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

8-4-Acknowledgements

The author wishes to express gratitude and acknowledge the insightful comments of supervision team.

8-5-Institutional Review Board Statement

Not applicable.

8-6-Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

8-7-Conflicts of Interest

The authors declare that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

9- References

[1] Upadhyay, S., & Hu, H.-f. (2022). A qualitative analysis of the impact of electronic health records (EHR) on healthcare quality and safety: Clinicians' lived experiences. *Health Services Insights, 15*, 11786329211070722.

[2] Handler, T., Overhage, M., Taylor, S., & Underwood, C. (2003). EHR definition, attributes and essential requirements. *Healthcare Information and Management Systems Society, 12*.

[3] Kruse, C. S., Stein, A., Thomas, H., & Kaur, H. (2018). The use of electronic health records to support population health: a systematic review of the literature. *Journal of medical systems, 42*, 1-16.

[4] Xie, H., Cebulla, A., Bastani, P., & Balasubramanian, M. (2024). Trends and Patterns in Electronic Health Record Research (1991–2022): A Bibliometric Analysis of Australian Literature. *International journal of environmental research and public health, 21*(3), 361.

[5] Mendelson, D. (2020). National electronic health record systems and consent to processing of health data in the European Union and Australia. *Legal Tech and the New Sharing Economy*, 115-131.

[6] Tomlinson, J. (2019). My Health Record implementation in private specialist practice. *Medical Journal of Australia, 210*, S32-S34.

[7] Hambleton, S. J., & Aloizos AM, J. (2019). Australia's digital health journey. *Medical Journal of Australia, 210*, S5-S6.

[8] Hareem, A., Stupans, I., Park, J. S., Stevens, J. E., & Wang, K. (2024). Electronic health records and e-prescribing in Australia: An exploration of technological utilisation in Australian community pharmacies. *International journal of medical informatics*, 105472.

[9] Faber, S., van Geenhuizen, M., & de Reuver, M. (2017). eHealth adoption factors in medical hospitals: A focus on the Netherlands. *International journal of medical informatics, 100*, 77-89.

[10] Gopidasan, B., Amanullah, S., & Adebowale, A. (2022). Electronic medical records–A review of cost-effectiveness, efficiency, quality of care, and usability. *Journal of Psychiatry Spectrum, 1*(2), 76-79.

[11] Jiang, J., Qi, K., Bai, G., & Schulman, K. (2023). Pre-pandemic assessment: a decade of progress in electronic health record adoption among US hospitals. *Health Affairs Scholar, 1*(5), qxad056.

[12] Derecho, K. C., Cafino, R., Aquino-Cafino, S. L., Isla Jr, A., Esencia, J. A., Lactuan, N. J., . . . Velasco, L. C. P. (2024). Technology adoption of electronic medical records in developing economies: A systematic review on physicians' perspective. *Digital Health, 10*, 20552076231224605.

[13] Shrestha, A., Alawa, J., Ashworth, H., & Essar, M. Y. (2022). Innovation is needed in creating electronic health records for humanitarian crises and displaced populations. *Frontiers in Digital Health, 4*, 939168.

[14] Harahap, N. C., Handayani, P. W., & Hidayanto, A. N. (2022). Barriers and facilitators of personal health record adoption in Indonesia: Health facilities' perspectives. *International journal of medical informatics, 162*, 104750.

[15] Herbert, V. M., & Connors, H. (2016). Integrating an Academic Electronic Health Record:: Challenges and Success Strategies. *CIN: Computers, Informatics, Nursing, 34*(8), 345-354.

[16] Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management science, 35*(8), 982-1003.

[17] Rogers, E. M. (1995). Diffusion of Innovation. 4th. *New York: The Free*.

[18] Hewitt, B. (2009). Using a hybrid technology acceptance model to explore how security measures affect the adoption of electronic health record systems. *AMCIS 2009 Proceedings*, 328.

[19] Lou, A. T., & Li, E. Y. (2017). Integrating innovation diffusion theory and the technology acceptance model: The adoption of blockchain technology from business managers' perspective.

[20] Al-Rahmi, W. M., Yahaya, N., Aldraiweesh, A. A., Alamri, M. M., Aljarboa, N. A., Alturki, U., & Aljeraiwi, A. A. (2019). Integrating technology acceptance model with innovation diffusion theory: An empirical investigation on students' intention to use E-learning systems. *IEEE Access, 7*, 26797-26809.

Min, S., So, K. K. F., & Jeong, M. (2021). Consumer adoption of the Uber mobile application: Insights from diffusion of innovation theory and technology acceptance model. In *Future of tourism marketing* (pp. 2-15): Routledge.

[22] Abdekhoda, M., Dehnad, A., & Zarei, J. (2019). Determinant factors in applying electronic medical records in healthcare. *Eastern Mediterranean Health Journal, 25*(1), 24-33.
[23] Mbwambo, E., & Mandari, H. (2023). Acceptance of Interoperable Electronic Health Record (EHRs) Systems: A Tanzanian e-Health Perspective. *Journal of International Technology and Information Management, 32*(1), 96-121.
[24] De Benedictis, A., Lettieri, E., Gastaldi, L., Masella, C., Urgu, A., & Tartaglini, D. (2020). Electronic Medical Records implementation in hospital: An empirical investigation of individual and organizational determinants. *Plos one, 15*(6), e0234108.
[25] Chiu, C.-Y., Chen, S., & Chen, C.-L. (2017). An integrated perspective of TOE framework and innovation diffusion in broadband mobile applications adoption by enterprises. *International Journal of Management, Economics and Social Sciences (IJMESS), 6*(1), 14-39.
[26] Al-Zoubi, M. I. (2013). Predicting EBusiness adoption through integrating the constructs of the rogers's diffusion of innovation theory combined with technology-organization-environment model. *International journal of advanced computer research, 3*(4), 63.
[27] Amini, M., & Jahanbakhsh Javid, N. (2023). A Multi-Perspective Framework Established on Diffusion of Innovation (DOI) Theory and Technology, Organization and Environment (TOE) Framework Toward Supply Chain Management System Based on Cloud Computing Technology for Small and Medium Enterprises. *Organization and Environment (TOE) Framework Toward Supply Chain Management System Based on Cloud Computing Technology for Small and Medium Enterprises (January 2023). International Journal of Information Technology and Innovation Adoption, 11*, 1217-1234.
Sastararuji, D., Hoonsopon, D., Pitchayadol, P., & Chiwamit, P. (2021). *Cloud Accounting Adoption in Small and Medium Enterprises: An Integrated Conceptual Framework: Five factors of determinant were identified by integrated Technology-Organization-Environment (TOE) framework, Diffusion of Innovation (DOI), Institutional Theory (INT) and extended factors*. Paper presented at the 2021 The 2nd International Conference on Industrial Engineering and Industrial Management.
[29] Al-Mamary, Y. H., Al-nashmi, M., Hassan, Y. A. G., & Shamsuddin, A. (2016). A critical review of models and theories in field of individual acceptance of technology. *International Journal of Hybrid Information Technology, 9*(6), 143-158.
[30] Claycomb, C., Iyer, K., & Germain, R. (2005). Predicting the level of B2B e-commerce in industrial organizations. *Industrial Marketing Management, 34*(3), 221-234.
[31] Oliveira, T., & Martins, M. F. (2011). Literature review of information technology adoption models at firm level. *Electronic Journal of Information Systems Evaluation, 14*(1), pp110-121-pp110-121.
[32] Hameed, M. A., Counsell, S., & Swift, S. (2012). A conceptual model for the process of IT innovation adoption in organizations. *Journal of engineering and technology management, 29*(3), 358-390.
[33] Nabukenya, J., Egwar, A. A., Drumright, L., Semwanga, A. R., & Kasasa, S. (2023). Feasibility and utility of Point-of-Care electronic clinical data capture in Uganda's healthcare system: a qualitative study. *Journal of the American Medical Informatics Association, 30*(5), 932-942.
[34] Zhang, X., Yu, P., Yan, J., & Spil, I. T. A. (2015). Using diffusion of innovation theory to understand the factors impacting patient acceptance and use of consumer e-health innovations: a case study in a primary care clinic. *BMC health services research, 15*(1), 71.
[35] Chong, A. Y.-L., Lin, B., Ooi, K.-B., & Raman, M. (2009). Factors affecting the adoption level of c-commerce: An empirical study. *Journal of computer information systems, 50*(2), 13-22.
[36] Wang, Y.-M., Wang, Y.-S., & Yang, Y.-F. (2010). Understanding the determinants of RFID adoption in the manufacturing industry. *Technological Forecasting and Social Change, 77*(5), 803-815.
[37] Chatterjee, S., Rana, N. P., Dwivedi, Y. K., & Baabdullah, A. M. (2021). Understanding AI adoption in manufacturing and production firms using an integrated TAM-TOE model. *Technological Forecasting and Social Change, 170*, 120880.
[38] Gangwar, H., Date, H., & Ramaswamy, R. (2015). Understanding determinants of cloud computing adoption using an integrated TAM-TOE model. *Journal of Enterprise Information Management, 28*(1), 107-130.
[39] Motsi, L., & Chimbo, B. (2023). Success factors for evidence-based healthcare practice adoption. *South African journal of information management, 25*(1), 1622.
[40] Putzer, G. J., & Park, Y. (2010). The effects of innovation factors on smartphone adoption among nurses in community hospitals. *Perspectives in Health Information Management/AHIMA, American Health Information Management Association, 7*(Winter).
[41] Chong, A. Y.-L., Chan, F. T., & Ooi, K.-B. (2012). Predicting consumer decisions to adopt mobile commerce: Cross country empirical examination between China and Malaysia. *Decision Support Systems, 53*(1), 34-43.
[42] Thong, J. Y. (1999). An integrated model of information systems adoption in small businesses. *Journal of Management Information Systems, 15*(4), 187-214.
[43] Setiyani, L., & Rostiani, Y. (2021). Analysis of E-commerce adoption by SMEs using the technology-organization-environment (TOE) model: A case study in karawang, Indonesia. *International Journal of Science, Technology & Management, 2*(4), 1113-1132.
[44]Awa, H., Ukoha, O., Emecheta, B., & Liu, S. (2016). Using TOE theoretical framework to study the adoption of ERP solution. Cogent Business & Management, 3 (1), 1196571. In.
[45] Chong, J., & Olesen, K. (2017). A technology-organization-environment perspective on eco-effectiveness: A meta-analysis. *Australasian journal of information systems, 21*.
[46]Tornatzky, L., & Fleischer, M. (1990). The process of technology innovation, Lexington, MA. In: Lexington Books.
[47] Rogers, E. M. (1995). Lessons for guidelines from the diffusion of innovations. *The Joint Commission journal on quality improvement, 21*(7), 324-328.
[48] Rogers, E. M., & Williams, D. (1983). Diffusion of. *Innovations (Glencoe, IL: The Free Press, 1962)*.
[49] Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management science, 46*(2), 186-204.
[50] Kruse, C. S., Mileski, M., Dray, G., Johnson, Z., Shaw, C., & Shirodkar, H. (2022). Physician burnout and the electronic health record leading up to and during the first year of COVID-19: systematic review. *Journal of medical Internet research, 24*(3), e36200.
[51] Woldemariam, M. T., & Jimma, W. (2023). Adoption of electronic health record systems to enhance the quality of healthcare in low-income countries: a systematic review. *BMJ health & care informatics, 30*(1).

[52] Emani, S., Yamin, C. K., Peters, E., Karson, A. S., Lipsitz, S. R., Wald, J. S., . . . Bates, D. W. (2012). Patient perceptions of a personal health record: a test of the diffusion of innovation model. *Journal of medical Internet research, 14*(6), e2278.
[53] Perez, G., Popadiuk, S., & Cesar, A. M. R. V. C. (2017). Internal factors that favor the adoption of technological innovation defined by information systems: a study of the electronic health record. *RAI Revista de Administração e Inovação, 14*(1), 67-78.
[54] Saratchandra, M., Shrestha, A., & Murray, P. A. (2022). Building knowledge ambidexterity using cloud computing: Longitudinal case studies of SMEs experiences. *International Journal of Information Management, 67*, 102551.
[55] Neamah, A. F., & Abd Ghani, M. K. (2018). Adoption of E-Health records management model in health sector of Iraq. *Indian Journal of Science and Technology*, 1-20.
Wolverton, C. C., & Lanier, P. A. (2019). Utilizing the Technology-Organization-Environment framework to examine the adoption decision in a healthcare context. In *Handbook of Research on the Evolution of IT and the Rise of E-Society* (pp. 401-423): IGI Global.
[57] Kaushal, R., Bates, D. W., Jenter, C. A., Mills, S. A., Volk, L. A., Burdick, E., . . . Simon, S. R. (2009). Imminent adopters of electronic health records in ambulatory care. *Informatics in Primary Care, 17*(1).
[58] Sadoughi, F., Khodaveisi, T., & Ahmadi, H. (2019). The used theories for the adoption of electronic health record: a systematic literature review. *Health and Technology, 9*, 383-400.
[59] Tubaishat, A. (2018). Perceived usefulness and perceived ease of use of electronic health records among nurses: Application of Technology Acceptance Model. *Informatics for Health and Social Care, 43*(4), 379-389.
[60] Sieck, C. J., Pearl, N., Bright, T. J., & Yen, P.-Y. (2020). A qualitative study of physician perspectives on adaptation to electronic health records. *BMC medical informatics and decision making, 20*(1), 1-8.
[61] Alanazi, B., Butler-Henderson, K., & Alanazi, M. (2020). Perceptions of healthcare professionals about the adoption and use of EHR in Gulf Cooperation Council countries: a systematic review. *BMJ health & care informatics, 27*(1).
[62] Boonstra, A., Versluis, A., & Vos, J. F. (2014). Implementing electronic health records in hospitals: a systematic literature review. *BMC health services research, 14*(1), 1-24.
[63] Ajami, S., & Bagheri-Tadi, T. (2013). Barriers for adopting electronic health records (EHRs) by physicians. *Acta Informatica Medica, 21*(2), 129.
[64] Larrison, C. R., Xiang, X., Gustafson, M., Lardiere, M. R., & Jordan, N. (2018). Implementation of electronic health records among community mental health agencies. *The journal of behavioral health services & research, 45*(1), 133-142.
[65] Rogers, E. M. (2002). Diffusion of preventive innovations. *Addictive behaviors, 27*(6), 989-993.
[66] Liu, C.-F. (2011). Key factors influencing the intention of telecare adoption: An institutional perspective. *Telemedicine and e-Health, 17*(4), 288-293.
[67] Scott, J. T., Rundall, T. G., Vogt, T. M., & Hsu, J. (2005). Kaiser Permanente's experience of implementing an electronic medical record: a qualitative study. *Bmj, 331*(7528), 1313-1316.
[68] Singh, S. K., Del Giudice, M., Tarba, S. Y., & De Bernardi, P. (2019). Top management team shared leadership, market-oriented culture, innovation capability, and firm performance. *IEEE Transactions on Engineering Management*.
[69] Low, C., Chen, Y., & Wu, M. (2011). Understanding the determinants of cloud computing adoption. *Industrial management & data systems*.
[70] Cohen, M. F. (2016). Impact of the HITECH financial incentives on EHR adoption in small, physician-owned practices. *International journal of medical informatics, 94*, 143-154.
[71] Alzghaibi, H., Mughal, Y. H., Alkhamees, M., Alasqah, I., Alhlayl, A. S., Alwheeb, M. H., & Alrehiely, M. (2022). The impact financial resources on implementation of large-scale electronic health records in the Saudi Arabia's primary healthcare centers: Mixed methods. *Frontiers in Public Health, 10*, 1037675.
[72] Adhabi, E., & Anozie, C. B. (2017). Literature review for the type of interview in qualitative research. *International Journal of Education, 9*(3), 86-97.
[73] Gajanayake, R., Lane, B., Iannella, T., & Sahama, T. (2012). Legal issues related to Accountable-eHealth systems in Australia.
[74] Ghobakhloo, M., Hong, T. S., Sabouri, M. S., & Zulkifli, N. (2012). Strategies for successful information technology adoption in small and medium-sized enterprises. *Information, 3*(1), 36-67.
[75] Da Silva, V. L., Kovaleski, J. L., & Pagani, R. N. (2019). Technology transfer in the supply chain oriented to industry 4.0: a literature review. *Technology Analysis & Strategic Management, 31*(5), 546-562.
[76] Pereira de Souza, V., Baroni, R., Choo, C. W., Castro, J. M. d., & Barbosa, R. R. (2021). Knowledge management in health care: an integrative and result-driven clinical staff management model. *Journal of knowledge management, 25*(5), 1241-1262.
[77] Alqahtani, A., Aljarullah, A. J., Crowder, R., & Wills, G. (2017). Barriers to the adoption of EHR systems in the Kingdom of Saudi Arabia: an exploratory study using a systematic literature review. *Journal of Health Informatics in Developing Countries, 11*(2).
[78] Shahmoradi, L., Safadari, R., & Jimma, W. (2017). Knowledge management implementation and the tools utilized in healthcare for evidence-based decision making: a systematic review. *Ethiopian journal of health sciences, 27*(5), 541-558.
[79] Oo, H. M., Htun, Y. M., Win, T. T., Han, Z. M., Zaw, T., & Tun, K. M. (2021). Information and communication technology literacy, knowledge and readiness for electronic medical record system adoption among health professionals in a tertiary hospital, Myanmar: A cross-sectional study. *Plos one, 16*(7), e0253691.
[80] Ellis, P. (2016). The language of research (part 8): Phenomenological research. *Wounds UK, 12*(1), 128-129.
[81] Boyd, C. O. (2001). Philosophical Foundations of qualitative research. *Nursing research: A qualitative perspective*(14), 14, pp.65-90.
[82] Moser, A., & Korstjens, I. (2018). Series: Practical guidance to qualitative research. Part 3: Sampling, data collection and analysis. *European journal of general practice, 24*(1), 9-18.
[83] Yardley, L. (2000). Dilemmas in qualitative health research. *Psychology and health, 15*(2), 215-228.
[84] Phillips-Pula, L., Strunk, J., & Pickler, R. H. (2011). Understanding phenomenological approaches to data analysis. *Journal of Pediatric Health Care, 25*(1), 67-71.
[85] Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology, 3*(2), 77-101.
[86] Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic analysis: Striving to meet the trustworthiness criteria. *International journal of qualitative methods, 16*(1), 1609406917733847.
[87] Delios, A., Welch, C., Nielsen, B., Aguinis, H., & Brewster, C. (2023). Reconsidering, refashioning, and reconceptualizing research methodology in international business. *Journal of World Business, 58*(6), 101488.

Creswell, J. W., & Poth, C. N. (2016). *Qualitative inquiry and research design: Choosing among five approaches*: Sage publications.
[89] Kalayou, M. H., Endehabtu, B. F., Guadie, H. A., Abebaw, Z., Dessie, K., Awol, S. M., . . . Tilahun, B. (2021). Physicians' attitude towards electronic medical record systems: an input for future implementers. *BioMed research international, 2021*.
[90] Ebnehoseini, Z., Tara, M., Tabesh, H., Dindar, F. H., & Hasibian, S. (2020). Understanding key factors affecting on hospital electronic health record (EHR) adoption. *Journal of family medicine and primary care, 9*(8), 4348-4352.
[91] Barrett, A. K. (2018). Technological appropriations as workarounds: Integrating electronic health records and adaptive structuration theory research. *Information Technology & People, 31*(2), 368-387.
[92] Csonka, P., & Korppi, M. (2022). Electronic health record databases provide a platform for intervention studies. *Acta Paediatrica, 111*(6).
[93] Britiller, M. C., Amponin, A. M., & Pring, C. C. (2023). Effectiveness and Challenges: The Current Situation of Electronic Health Records (EHRs) to Improve Health Care Outcomes. *South East Asia Nursing Research, 5*(1), 1-18.
[94] Tsai, C. H., Eghdam, A., Davoody, N., Wright, G., Flowerday, S., & Koch, S. (2020). Effects of electronic health record implementation and barriers to adoption and use: a scoping review and qualitative analysis of the content. *Life, 10*(12), 327.
[95] Jimma, B. L., & Enyew, D. B. (2022). Barriers to the acceptance of electronic medical records from the perspective of physicians and nurses: A scoping review. *Informatics in Medicine Unlocked, 31*, 100991.
[96] Payne, P. R., Pressler, T. R., Sarkar, I. N., & Lussier, Y. (2013). People, organizational, and leadership factors impacting informatics support for clinical and translational research. *BMC medical informatics and decision making, 13*, 1-12.
[97] Deriel, E., Puttkammer, N., Hyppolite, N., Diallo, J., Wagner, S., Honoré, J., . . . Duval, N. (2018). Success factors for implementing and sustaining a mature electronic medical record in a low-resource setting: a case study of iSanté in Haiti. *Health policy and planning, 33*(2), 237-246.
[98] Babawarun, O., Okolo, C. A., Arowoogun, J. O., Adeniyi, A. O., & Chidi, R. (2024). Healthcare managerial challenges in rural and underserved areas: A Review. *World Journal of Biology Pharmacy and Health Sciences, 17*(2), 323-330.
[99] Yoo, S., Lim, K., Jung, S. Y., Lee, K., Lee, D., Kim, S., . . . Hwang, H. (2022). Examining the adoption and implementation of behavioral electronic health records by healthcare professionals based on the clinical adoption framework. *BMC medical informatics and decision making, 22*(1), 210.
[100] Jianxun, C., Arkorful, V. E., & Shuliang, Z. (2021). Electronic health records adoption: Do institutional pressures and organizational culture matter? *Technology in Society, 65*, 101531.
Bharadwaj, M. S. (2024). Regulatory Insights in Digital Health. In *Multi-Sector Analysis of the Digital Healthcare Industry* (pp. 164-197): IGI Global.
[102] Marikyan, D., Papagiannidis, S., & Stewart, G. (2023). Technology acceptance research: Meta-analysis. *Journal of Information Science*, 01655515231191177.
[103] Bansal, P., Reinecke, J., Suddaby, R., & Langley, A. (2022). Temporal work: The strategic organization of time. *Strategic Organization, 20*(1), 6-19.
[104] Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS quarterly*, 425-478.
Liu, L., & Miguel-Cruz, A. (2022). *Technology adoption and diffusion in healthcare at onset of COVID-19 and beyond.* Paper presented at the Healthcare Management Forum.
[106] Jarvenpaa, S. L., & Välikangas, L. (2022). Toward temporally complex collaboration in an interorganizational research network. *Strategic Organization, 20*(1), 110-134.
[107] Orlikowski, W. J., & Yates, J. (2002). It's about time: Temporal structuring in organizations. *Organization science, 13*(6), 684-700.
Jagannath, S., Sarcevic, A., Young, V., & Myers, S. (2019). *Temporal rhythms and patterns of electronic documentation in time-critical medical work.* Paper presented at the Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems.
[109] Al-Adwan, A. S. (2015). copy rights. *Int. J. Healthcare Technology and Management, 15*(2), 89-111.
[110] Blagoev, B., & Schreyögg, G. (2019). Why do extreme work hours persist? Temporal uncoupling as a new way of seeing. *Academy of Management Journal, 62*(6), 1818-1847.
[111] Nambisan, S. (2013). Information technology and product/service innovation: A brief assessment and some suggestions for future research. *Journal of the Association for Information Systems, 14*(4), 1.
[112] Handayani, P. W., Hidayanto, A. N., Pinem, A. A., Hapsari, I. C., Sandhyaduhita, P. I., & Budi, I. (2017). Acceptance model of a hospital information system. *International journal of medical informatics, 99*, 11-28.

5.3. Links and implications for Paper 3 to Papers 1 and 2

Paper 3 builds upon the foundational insights provided in Papers 1 and 2 by integrating a temporal perspective into the analysis of EHRs adoption. While Paper 1 established the essential technological, organizational, and environmental factors influencing EHRs implementation and Paper 2 highlighted the alignment challenges between innovation stages and organizational capabilities, Paper 3 extends this framework by introducing the concept of time as a critical element in understanding EHRs adoption. This temporal dimension adds depth to the analysis by considering how the timing and pacing of innovation affect adoption outcomes. The combined insights from all three papers underscore the necessity of a multi-faceted approach to EHRs adoption, incorporating both static and dynamic factors. Thru bridging the gap between technological innovation models and practical adoption strategies, Paper 3 provides a more comprehensive understanding of EHRs implementation challenges and offers actionable recommendations for healthcare managers. The integration of time into the adoption framework not only enhances the theoretical contributions of Paper 1 and Paper 2 but also informs practical strategies for overcoming barriers and improving EHRs adoption processes in the Australian private healthcare sector.

CHAPTER 6 DISCUSSION AND CONCLUSION

6.1. Introduction

This research presented an in-depth understanding of the perceptions of healthcare specialists' concerning the adoption of EHRs within the Australian private healthcare sector. The perspectives and experiences of the participants were considered in respect of the three main areas of investigation concerning relevant technological, organisational, and environmental factors. The research explored *what* kinds of barriers exist in relation to the adoption of new EHRs, *how* different processes of innovation can be matched to knowledge stocks by taking into consideration a number of innovation phases, *what* features of innovation models are more germane within the context of adopting EHRs, and *how* innovation processes influence clinical best practice by presenting a new framework for integrating innovation, knowledge, and learning. The research questions were addressed in respect of the three embedded studies discussed in Chapters 3, 4 and 5, and are now represented as follows:

RQ 1: Which emerging TOE factors and underlying EHRs digital issues best inform the EHRs digital adoption process within Australian hospitals?

RQ2: What are the integrating features for adopting EHRs medical processes and clinical measures within the private healthcare sector in the light of TOE barriers and existing healthcare policy settings?

RQ3: How can TOE and innovation theory related to the private hospital context be broadened when innovation, knowledge, and learning capabilities are better integrated?

RQ4: Which mitigating factors offset the problems of EHRs adoption within the Australian private healthcare sector? And

RQ5: Which innovation artefacts are more ubiquitous with respect to the electronic healthcare records (EHRs) adoption process?

6.2. Discussion of key findings

To understand the range of adoption issues within the Australian private healthcare sector, the first paper used a systematic literature review to identify the factors which influenced the adoption of EHRs. This enabled the development of a conceptual adoption framework of the barriers to adoption (Figure 3 in Chapter 3). The framework was then used as a basis to inform the research papers presented in Chapters 4 and 5. The second paper explored how the technology, organization, and environment (TOE) contexts were impacted by innovation, knowledge stocks and learning flows, with respect to health policy frameworks (Chapter 4). The third paper (Chapter 5) by contrast explored how different innovation models such as the Technology Acceptance Model (TAM), the Diffusion of Innovation (DOI) model, and the Technology-Organization-Environment (TOE) framework, could be integrated in ways that influenced user acceptance and satisfaction. The study found that individuals' perceptions of the value of technology was not the main basis for user acceptance and that time or temporal pacing emerged as a critical artefact for innovation tasks, the flow of tasks, job roles, time resources and end goals. Collectively, the three studies closed gaps related to a) informing the barriers to EHRs adoption and implementation, b) highlighting how EHRs innovation was associated with knowledge stocks and learning flows, and c) evaluating study findings in relation to different models of innovation capability and emerging capability.

6.2.1. Factors influencing the adoption of EHRs in the Australian environment

In Chapter 3, an extensive review of the extant literature was conducted to explore the barriers to technology adoption. The next sections 6.2.1.1, 6.2.1.2 and 6.2.1.3 summarise the findings which were discussed in depth in Chapters 3.

6.2.1.1. A Dominant Influence of Organizational Factors

Contrary to popular assumptions, empirical evidence indicates that organizational factors play a key role in the adoption of EHR systems (Kabukye et al., 2020, De Benedictis et al., 2020). Out of these, the most prominent were cultural issues highlighting how shared values, beliefs, and norms, influence individuals' perceptions of innovation and the level of interaction. Technology readiness underscored the importance of organizational preparedness in embracing digital transformations (Kruszyńska-Fischbach et al., 2022). Moreover, employees' knowledge and competencies in respect of adequate training, skill development, and support mechanisms highlighted the significance of human capital investments (Mousa and Othman, 2020). Overall, the compilation of these factors suggested that the adoption of EHRs is not only a technological challenge but a multifaceted organizational endeavour that requires a comprehensive and integrated approach. By focusing on these key organizational aspects, healthcare managers can improve operational efficiencies and achieve better patient care outcomes.

6.2.1.2. Maximizing EHRs Adoption and Diffusion for Healthcare Providers

Acknowledging which organizational factors shape EHRs adoption processes holds profound implications for healthcare providers seeking to optimize and maximize new innovation benefits. The results of the thesis found that by assessing and better managing a range of organizational dynamics e.g., clinical best practice and learning flows, health organizations can significantly improve healthcare outcomes, reduce costs, and enhance care coordination (De Benedictis et al., 2020). A strategic alignment of organizational culture with technological objectives can mitigate resistance to change and facilitate smooth integration processes (Jung et al., 2021). Investments in technology readiness initiatives, infrastructure upgrades, interoperability enhancements, and cybersecurity measures are imperative to ensure the efficacy and sustainability of EHRs implementation resulting in more efficient real-time patient monitoring and data analytics (Wilbawa et al., 2024).

Equally critical is the prioritization of employee training and development programs aimed at enhancing digital literacy and fostering a culture of innovation and adaptability. Training programs must be continuous and tailored to the evolving needs of the healthcare workforce, ensuring that all staff—from clinicians to administrative personnel—are competent in using EHR systems effectively (Gold et al., 2021). This approach not only enhances the functionality of EHR systems but also empowers the workforce to use these tools to deliver higher quality care. Furthermore, advancing a conducive organizational environment that is supportive of EHRs adoption is essential. This involves not only the technological aspect but also the human and cultural elements within the organization (Kruszyńska-Fischbach et al., 2022). Engaging with staff at all levels to solicit feedback, identify potential issues, and to develop collaborative solutions can lead to more effective implementation and utilization of EHR systems . This participatory approach helps to align the system functionalities with the actual needs of users (as discussed in paper 2 Chapter 4), thereby increasing the likelihood of successful adoption and integration into daily practice (Tapuria et al., 2021).

Additionally, healthcare leaders must address the psychological and cultural aspects of technology adoption. Change management strategies that include clear communication, setting realistic expectations, and providing ample support during the transition period are vital. By addressing fears and resistance head-on, leaders can cultivate a more receptive environment that views technology as an enabler of better patient outcomes rather than a burden (Basulo-Ribeiro and Teixeira, 2024). Effective leadership can champion the cause of digital transformation, model positive behaviour and allocate resources judiciously to support the necessary changes. Leaders can also play a fundamental role in bridging the gap between clinical and IT departments, fostering a collaborative culture that integrates technological solutions with clinical practice (yahya Al Abbas et al., 2023). Finally, measuring the impact of EHRs on healthcare delivery and outcomes is crucial for ongoing improvement. This involves regular audits, performance reviews, and feedback mechanisms to ascertain both the benefits and challenges of EHRs usage. Such assessments can provide actionable insights that drive further refinements in EHR strategies, ensuring that they continue to meet the evolving needs of healthcare providers and patients alike.

In conclusion, the successful adoption of EHR systems in healthcare settings is heavily influenced by a multitude of organizational factors. By strategically managing these dynamics, healthcare providers can unlock the transformative potential of EHRs, leading to more efficient operations, better patient outcomes, and a more sustainable healthcare system.

6.2.1.3. Challenges and Future Directions

Despite the compelling evidence highlighting the priority of organizational factors in EHRs adoption, several challenges and areas for future research deserve consideration. Firstly, the complex interplay between organizational dynamics and technological factors necessitates a more nuanced understanding of the underlying mechanisms driving adoption processes. Future studies should adopt interdisciplinary approaches that integrate insights from organizational behaviour, information systems, and healthcare management to unravel the interconnecting themes of the EHRs adoption phenomena. Additionally, the contextual specificity of organizational factors underscores the need for tailored strategies that account for the unique characteristics and needs of diverse healthcare settings. And these may be different from one hospital to another. Furthermore, longitudinal studies are warranted to assess the long-term impact of organizational interventions on EHRs utilization and performance outcomes particularly related to (as paper 2 alludes) to the temporal pacing issues of adoption. By addressing these challenges and advancing knowledge in this domain, researchers can contribute to the development of evidence-based practices that facilitate the widespread adoption and effective utilization of EHR systems , ultimately advancing the quality and efficiency of healthcare delivery on a larger scale.

In conclusion, while technological factors are often described as the primary drivers of EHRs adoption, empirical evidence suggests that organizational factors exert a more significant influence. Culture, technology readiness, and employees' knowledge emerge as fundamental determinants shaping adoption patterns within healthcare facilities. By strategically managing these organizational dynamics, healthcare providers can enhance EHRs adoption and diffusion, leading to improved outcomes, reduced costs, and enhanced care coordination. However, addressing the challenges inherent in navigating the complex interplay between organizational and technological factors requires concerted research efforts and interdisciplinary collaborations. Through advancing knowledge in this domain, stakeholders can unlock the transformative potential of EHR systems , thereby maximising positive change within the healthcare landscape.

6.2.2. Developing Innovation and Knowledge Capabilities for Assessing EHRs Adoption

The primary objective of chapter 4 paper 2 was to determine the obstacles and difficulties hindering the implementation of EHRs innovation in the private healthcare sector in Australia. A secondary goal was to expand scholarly comprehension concerning how various contexts related to technology, organization, and environment could be impacted by different stages of innovation, knowledge stocks and learning flows. Notably, a common thread across all obstacles (Technology-Organization-Environment) was the lack of readiness within the private healthcare sector to adapt to the new innovation process. This was particularly germane with the lack of inclusive capability that should prioritize high knowledge stocks and high learning flows. When this was not evident, the study found that clinical best practices could be compromised on the basis of existing resource stocks.

Moreover, the lack of awareness in respect of Knowledge Stocks and Learning Flows leads to an improvised nature of the innovation process. One of the study findings is that it was not good enough nor desirable to have static and minimized capability evident by low knowledge stocks and learning flows. Whilst this might reflect that fact that the healthcare sector is highly institutionalized, it does little to foster a change culture that is highly receptive to new innovation adoption.

Paper 2 noted that the stages of innovation in one setting might not precisely align with a similar adoption process in another context (Gao and Sunyaev, 2019). One potential approach involves initially pinpointing the clinical metrics that most accurately embody the values and objectives of the healthcare environment in question. Following this, leaders should identify the Technology-Organization-Environment barriers impeding the attainment of these clinical measures. Subsequently, evaluating how Knowledge Stocks and Learning Flows intersect with the stages of innovation becomes critical. The analytical process followed therefore in paper 2 can be replicated in future studies. Without this comprehensive assessment, we believe that leaders and managers may lack the necessary resources and capabilities to effectively introduce new IT innovations.

6.2.3. The influence of various innovation artifacts in EHRs adoption

The adoption of EHRs represents a significant advancement in healthcare systems worldwide, promising improved efficiency, accuracy, and accessibility of patient data (Mathai et al., 2022). However, the adoption process of EHRs is multifaceted and influenced by various innovation artifacts which paper 3 discusses in detail. Building upon insights derived from research (Chapter 5, question 1), which focused on the factors influencing EHRs adoption, the analysis explored in detail the innovation artifacts most ubiquitous in the EHRs adoption process. To contextualize the exploration, the discussions illustrated a conceptual model that integrated the Technology Acceptance Model (TAM2), Diffusion of Innovation (DOI), and the Technological, Organizational, and Environmental (TOE) framework. This integrated model provided a comprehensive lens through which to examine the complexities of EHRs adoption.

Through thematic analysis, as illustrated in Chapter 5, Table 5, the discussions identified key dimensions of innovation and their relationship to EHRs adoption. These dimensions encompassed both positive and negative influences stemming from the TOE framework and innovation practices as discussed in response to Chapter 5, research question 1. However, the analysis went beyond established models to uncover additional innovation artifacts that significantly impacted EHRs adoption. Employing Braun and Clarke's reflexive thematic analysis (RTA), a critical examination of the data was undertaken to identify emerging insights beyond conventional innovation frameworks. This approach allowed the researcher to unveil the innovation artifacts previously overlooked, shedding light on their role in the adoption process. Notably, the analysis revealed the emergence of temporal factors as a crucial innovation artifact, transcending traditional models.

In Chapter 5, Table 6, we present our findings regarding the influence of temporal factors on EHRs adoption. Contrary to the prevalent focus on technological, organizational, and environmental determinants, the study highlighted the critical role of time in shaping adoption dynamics within the private healthcare sector. Time as an innovation artifact encapsulates the temporal aspects inherent in the adoption journey including implementation timelines, transition periods, and temporal constraints. The integration of temporal considerations into our analysis represents a novel contribution to understanding EHRs adoption. By synthesizing insights from TAM2, DOI, and the TOE framework, we uncovered the temporal dimension as a fundamental driver of adoption behaviour. This newfound perspective expands the repertoire of innovation artifacts, providing a more nuanced understanding of the adoption process.

Furthermore, our analysis explains the interconnectedness of temporal factors with existing determinants of EHRs adoption. Temporal considerations intersect with technological advancements, organizational readiness, and environmental dynamics, shaping the overall adoption landscape. For example, time constraints may amplify organizational challenges or impede technological integration, underscoring the intricate interplay between temporal artifacts and other influencing factors. The recognition of time as a pervasive innovation artifact underscores the dynamic nature of EHRs adoption. In essence, temporal factors permeate every stage of the adoption process, from initial awareness and decision-making to implementation and post-adoption evaluation. As such, stakeholders must prioritize temporal considerations alongside traditional determinants to optimize EHRs adoption outcomes. Moreover, the findings hold implications for policymakers, healthcare providers, and technology vendors involved in EHRs implementation. By acknowledging the temporal dimension and its implications, stakeholders can develop more robust strategies tailored to the temporal realities of the adoption context. This may entail flexible implementation timelines, adaptive organizational structures, and proactive mitigation of temporal barriers.

To conclude, the analysis in paper 3 Chapter 5 reveals the innovation artifacts most ubiquitous in the EHRs adoption process, with a particular focus on temporal factors. By integrating insights from multiple frameworks and employing reflexive thematic analysis, the findings extend scholarly understanding of the EHRs adoption process beyond traditional paradigms.

6.3. Thesis recommendations

Based on the findings in this thesis, there are several important recommendations that can be made for policymakers, researchers, and healthcare professionals. EHRs offer a promising alternative to traditional paper-based systems, addressing many challenges associated with data security and patient privacy. Although EHRs are generally more resilient against theft and physical damage than legacy systems, the level of data protection varies among healthcare providers due to discrepancies in IT infrastructure across institutions. This variance in infrastructure can influence the degree to which healthcare providers can guarantee data privacy, especially in settings with differing technological resources and administrative practices. Nonetheless, EHRs contribute significantly to care quality by providing a consistent, centralized platform, enhancing connectivity among hospital departments and facilitating a seamless information flow that improves patient care.

The accessibility of digital EHRs enables quicker administrative processes and fosters a more positive user perception of electronic records while also reducing human error in hospital administration. However, financial constraints remain a substantial barrier, particularly for smaller hospitals that face more pronounced difficulties in securing the funds needed for EHR adoption. The financial demands of EHR implementation extend beyond initial setup costs to encompass long-term expenses, including system monitoring, upgrades, maintenance, and support services. This complexity underscores the need for healthcare administrators to carefully assess the financial and resource commitments required for successful, sustainable EHR adoption.

Effective EHR implementation must also account for varied technological infrastructures, organizational cultures, and existing data management practices across hospitals. By addressing these factors, leaders can ensure that the transition to EHRs aligns with the organization’s capabilities and strategic vision. Implementing EHRs successfully requires not only well-defined goals but also strong managerial commitment and adequate resources, particularly for staff training and change management. Organizational buy-in and workforce training are crucial, as they mitigate role uncertainty, boost job satisfaction, and cultivate a positive attitude toward the transition. Likewise, overcoming resistance from staff who are accustomed to legacy systems is essential, as a shared commitment to digital transformation is a key indicator of successful EHR integration.

To ensure a streamlined adoption process, healthcare organizations should carefully select EHR vendors and assess potential systems for compatibility, ease of use, and cost-effectiveness. It is also essential to integrate temporal considerations within EHR adoption strategies, accounting for factors like flexible timelines, adaptive implementation processes, and proactive management of temporal constraints. An early alignment of priorities, strategies, and technical requirements fosters a smoother transition, positioning healthcare providers to realize the full potential of EHRs for improving patient outcomes and operational efficiency.

6.4. Contribution of the thesis

In Chapter 3, this study adds to the existing knowledge by exploring key elements that impact the adoption of EHRs. Specifically, this investigation focused on factors influencing the adoption process within the Australian private healthcare sector, a topic that has not been previously studied. Consequently, the findings provide a fresh and unique contribution for both researchers and practitioners. Chapter 3 also identifies two categories of factors: those that facilitate and support the adoption process, and those that hinder it. The categorization of 136 factors relevant to EHRs adoption within the Australian private healthcare sector significantly enriches the understanding of which crucial elements need to be considered in the adoption process. The factors identified in Chapter 3 validate and support prior studies of the advantages and barriers of EHRs adoption.

In chapter 4, the thesis expands the existing body of knowledge concerning EHRs by emphasizing the significance of learning flows and knowledge stocks and matching these to innovation capability. By employing a cross-theory approach, Chapter 4 addresses recent calls from scholars to explore digital IT innovation and adoption in specific contexts (Saratchandra et al., 2022). The chapter also explored how to align an organization's existing innovation capabilities with a desired level of innovation. This alignment is crucial for health organizations to efficiently accomplish their clinical objectives. Chapter 4 also discussed how health organizations can employ various policy mechanisms to enhance collective innovation capabilities (refer to Figure 2 in Chapter 4).

Extending extant research from the present study more generally relates to:

- The necessity in pinpointing the clinical measures or indicators specifically associated with a particular healthcare provider’s service.
- The need to evaluate the obstacles and constraints hindering the adoption of EHRs innovation that prevent clinical measures from being achieved.
- The necessity of understanding how learning flows and knowledge stocks inform the phases of IT innovation, consequently helping to address a range of TOE concerns.

- The significance of developing a set of policy levers that enhance organizational innovation capability.

Therefore, by integrating insights from prior studies, the theoretical framework depicted in Figure 2 Chapter 4 and summarized in Table IV Chapter 4, represents a cross theory approach for broadening the extant literature. The findings provide valuable insights for private healthcare institutions, potentially expanding the understanding of IT innovation adoption across various healthcare settings.

The findings of Chapter 5 hold significant implications for professional practice. Managers must consider how positive mitigating factors identified earlier might be countered by negative influences. Nonetheless, our findings suggest that anchoring Electronic Health Records (EHRs) adoption processes on the foundation of innovation characteristics assists in prioritizing essential innovation attributes. We propose that a deeper understanding of innovation will lead to improved patient healthcare and reduced healthcare costs, as previously discussed. Consequently, managers should aim to align organizational strategy more effectively with information systems strategy, avoiding mere lip service to new innovation adoption. The study of paper 3 in Chapter 5 highlights the importance of careful planning, stakeholder engagement, drawing lessons from previous implementations, and adhering to health safety guidelines. Healthcare organizations should prioritize communicating the benefits of electronic systems to stakeholders, emphasizing enhancements in patient care, streamlining of workflows, and quality improvement initiatives. Additionally, we underscore the significance of temporal pacing and time as crucial innovation elements guiding EHR adoption processes, which represents a novel contribution to both research and practice.

Regarding the implications for future research, and taken together, the findings suggest that individuals' perceptions of technology have evolved considerably since the development of earlier innovation models such as TAM, possibly due to increased user knowledge. However, different versions of TAM and other innovation models like TOE have not undergone substantial changes. In elaborating on the thesis theoretical contributions, individuals' perceptions of technology's value were not the primary determinant of user acceptance in this study, suggesting that users may have become more comfortable with new technology overall. The findings of the thesis indicate that the impact of time-based temporal work has not been adequately measured as a significant factor, despite earlier discussions highlighting time as an innovation artefact that affects temporal pacing. Specifically, drawing from the integrative insights of three innovation models, innovation practices are often measured at the individual level. However, time is emerging as an important innovation artefact, underscoring the significance of innovation diffusion from a longitudinal perspective at the organizational level. Consequently, the characteristics of the innovation adoption model, based on the research in this thesis, could be expanded to show how time and temporal work pacing emerge and are as influential in the adoption process as other characteristics.

The current study's generalizability to other industries is limited due to its focus on private healthcare. A broader study across industries with a more extensive dataset would help confirm the value of innovation tied to electronic healthcare adoption processes.

6.5. Thesis limitations and avenues for future research

The current study's potential limitations stem from variations in social, cultural, economic, regional, legal, and other contextual factors within hospital sectors across different countries. The focus of investigation in this thesis specifically examined the outcomes of EHRs IT innovation within a single hospital, which may restrict the applicability of the findings to other settings. Also, despite the numerous advantages derived from qualitative research and the valuable insights garnered from the collected data, employing alternative methodologies like grounded theory could have been advantageous in identifying additional factors and achieving a more profound comprehension. Furthermore, integrating quantitative techniques could have offered insights into EHRs adoption rates, enabled statistical assessments, and revealed correlations among various factors.

Future studies might employ a comprehensive methodology to examine the barriers and enabling factors that influence EHRs adoption in both private and public healthcare settings. This should consider various factors such as hospital ownership, location, size, and accreditation level to ensure broader applicability of conclusions. Research could extend this by employing an expanded mixed methodology encompassing multiple organizations, diverse professional groups, and new technologies. Future research should also explore the role of relationship building and collaboration between system users (e.g., hospitals and clinics) and system suppliers in the context of EHR adoption. Specifically, studies could examine how these collaborative efforts influence the ongoing functionality and reliability of EHR systems, including technical support, system updates, and the incorporation of user-friendly features. Further investigation into how fostering strong partnerships between stakeholders can enhance the adoption process and address challenges related to system implementation would contribute valuable insights to both EHR adoption theory and practical applications in healthcare setting. Moreover, Future research could explore the cost-effectiveness of EHR systems in hospitals and clinics of varying sizes, assessing their suitability across different organizational contexts. Investigating whether smaller healthcare institutions can adopt EHRs without excessive financial burden would provide important insights into scalability and economic feasibility. Additionally, research could examine how the unique needs of different healthcare settings influence the effectiveness and adaptability of EHR systems, contributing to a more nuanced understanding of their implementation in diverse environments

6.6. Conclusion

In conclusion, the adoption of EHRs brings transformative benefits to the healthcare sector. EHRs improve patient care by enhancing accuracy in diagnosis and treatment through comprehensive, real-time access to patient information. They streamline clinical workflows, reduce redundancy, and improve communication among healthcare providers, ultimately leading to better coordinated and more efficient care(Derecho et al., 2024). The implementation of EHRs also supports data-driven decision-making, offering valuable insights that drive patient-centered outcomes and support preventive care measures(Woldemariam and Jimma, 2023).

Beyond the specific advantages of EHRs, the broader impact of information technology (IT) on healthcare underscores a move toward more integrated, responsive, and data-driven systems. IT advancements, including telemedicine, health information exchanges, and data analytics, further enhance healthcare delivery by providing tools that facilitate remote care, predictive analytics, and personalized medicine(Woldemariam and Jimma, 2023). Collectively, these technologies create a robust framework that not only supports operational efficiency but also fosters a more proactive approach to healthcare that anticipates patient needs and improves overall public health outcomes(Yilma et al., 2023).

Information technology can bring several benefits to the healthcare system. Digital innovation such as EHRs contribute to improving the quality of care and patients' health by using various tools for representing, visualizing, and accessing medical records. This thesis focused on factors that influence the adoption of EHRs in Australia. The discussions noted earlier that EHRs are a computerized system that provides a digital method to collect, store and share a patient's health data. Each chapter discussed in addition the findings and contributions to research by broadening the current literature in terms of what scholars and practitioners know about the EHRs adoption process. Taken together, the findings of the thesis are expected to make a major contribution to health administrators, policy experts, health leaders, practising health experts, and government departments of the most important and pervasive features of adopting digital electronic healthcare records.

REFERENCES

AJAMI, S. & BAGHERI-TADI, T. 2013. Barriers for adopting electronic health records (EHRs) by physicians. *Acta Informatica Medica,* 21**,** 129.

AJZEN, I. 1991. The Theory of Planned Behaviour. Organizational Behaviour and Human Decision Processes *Volume,* 8**,** 179-211.

AL-ASWAD, A. M., BROWNSELL, S., PALMER, R. & NICHOL, J. P. 2013. A review paper of the current status of electronic health records adoption worldwide: the gap between developed and developing countries. *Journal of Health Informatics in Developing Countries,* 7.

AL-GAHTANI, S. S. & KING, M. 1999. Attitudes, satisfaction and usage: factors contributing to each in the acceptance of information technology. *Behaviour & Information Technology,* 18**,** 277-297.

ALI, O., MURRAY, P. A., MUHAMMED, S., DWIVEDI, Y. K. & RASHITI, S. 2022. Evaluating Organizational Level IT Innovation Adoption Factors among Global Firms. *Journal of Innovation & Knowledge,* 7**,** 100213.

ALSYOUF, A., ISHAK, A. K., LUTFI, A., ALHAZMI, F. N. & AL-OKAILY, M. 2022. The role of personality and top management support in continuance intention to use electronic health record systems among nurses. *International journal of environmental research and public health,* 19**,** 11125.

AMMENWERTH, E., DUFTSCHMID, G., AL-HAMDAN, Z., BAWADI, H., CHEUNG, N. T., CHO, K.-H., GOLDFARB, G., GÜLKESEN, K. H., HAREL, N. & KIMURA, M. 2020. International comparison of six basic eHealth indicators across 14 countries: an eHealth benchmarking study. *Methods of Information in Medicine,* 59**,** e46-e63.

ANDARGOLI, A. E. 2021. e-Health in Australia: A synthesis of thirty years of e-Health initiatives. *Telematics and Informatics,* 56**,** 101478.

BASULO-RIBEIRO, J. & TEIXEIRA, L. 2024. The Future of Healthcare with Industry 5.0: Preliminary Interview-Based Qualitative Analysis. *Future Internet,* 16**,** 68.

BAUER, J. C., JOHN, E., WOOD, C. L., PLASS, D. & RICHARDSON, D. 2020. Data entry automation improves cost, quality, performance, and job satisfaction in a hospital nursing unit. *JONA: The Journal of Nursing Administration,* 50**,** 34-39.

BERNAT, J. L. 2013. Ethical and quality pitfalls in electronic health records. *Neurology,* 80**,** 1057-1061.

BHATTACHERJEE, A. 1998. Managerial influences on intraorganizational information technology use: A Principal-agent model. *Decision Sciences,* 29**,** 139-162.

BLACK, A. D., CAR, J., PAGLIARI, C., ANANDAN, C., CRESSWELL, K., BOKUN, T., MCKINSTRY, B., PROCTER, R., MAJEED, A. & SHEIKH, A. 2011. The impact of eHealth on the quality and safety of health care: a systematic overview. *PLoS medicine,* 8**,** e1000387.

BURTON-JONES, A., AKHLAGHPOUR, S., AYRE, S., BARDE, P., STAIB, A. & SULLIVAN, C. 2020. Changing the conversation on evaluating digital transformation in healthcare: Insights from an institutional analysis. *Information and Organization,* 30**,** 100255.

CHEN, Q., WANG, C.-H. & HUANG, S.-Z. 2021. Effects of organizational innovation and technological innovation capabilities on firm performance: evidence from firms in China's Pearl River Delta. *Inside the Changing Business of China.* Routledge.

COHEN, M. F. 2016. Impact of the HITECH financial incentives on EHR adoption in small, physician-owned practices. *International Journal of Medical Informatics,* 94**,** 143-154.

CRESSWELL, K., SHEIKH, A., FRANKLIN, B. D., KRASUSKA, M., THE NGUYEN, H., HINDER, S., LANE, W., MOZAFFAR, H., MASON, K. & EASON, S. 2021. Interorganizational knowledge sharing to establish digital health learning ecosystems: qualitative evaluation of a national digital health transformation program in England. *Journal of medical Internet research,* 23**,** e23372.

DAHLEEZ, K. A., BADER, I. & ABORAMADAN, M. 2020. E-health system characteristics, medical performance and healthcare quality at UNRWA-Palestine health centers. *Journal of Enterprise Information Management*.

DAVIS, F. D. 1989. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS quarterly***,** 319-340.

DAVIS, F. D., BAGOZZI, R. P. & WARSHAW, P. R. 1989. User acceptance of computer technology: a comparison of two theoretical models. *Management science,* 35**,** 982-1003.
DE BENEDICTIS, A., LETTIERI, E., GASTALDI, L., MASELLA, C., URGU, A. & TARTAGLINI, D. 2020. Electronic Medical Records implementation in hospital: An empirical investigation of individual and organizational determinants. *PloS one,* 15**,** e0234108.
DERECHO, K. C., CAFINO, R., AQUINO-CAFINO, S. L., ISLA JR, A., ESENCIA, J. A., LACTUAN, N. J., MARANDA, J. A. G. & VELASCO, L. C. P. 2024. Technology adoption of electronic medical records in developing economies: A systematic review on physicians' perspective. *Digital Health,* 10**,** 20552076231224605.
EBNEHOSEINI, Z., TARA, M., TABESH, H., DINDAR, F. H. & HASIBIAN, S. 2020. Understanding key factors affecting on hospital electronic health record (EHR) adoption. *Journal of family medicine and primary care,* 9**,** 4348-4352.
ERSTAD, T. L. 2003. Analyzing computer-based patient records: A review of literature. *Journal of Healthcare Information Management,* 17**,** 51-57.
FICHMAN, R. G. & KEMERER, C. F. 1997. The assimilation of software process innovations: An organizational learning perspective. *Management science,* 43**,** 1345-1363.
FRAMBACH, R. T. & SCHILLEWAERT, N. 2002. Organizational innovation adoption: A multi-level framework of determinants and opportunities for future research. *Journal of business research,* 55**,** 163-176.
FRASER, H. S., BLAYA, J., CHOI, S. S., BONILLA, C. & JAZAYERI, D. Evaluating the impact and costs of deploying an electronic medical record system to support TB treatment in Peru. AMIA Annual Symposium Proceedings, 2006. American Medical Informatics Association, 264.
FRASER, H. S., JAZAYERI, D., NEVIL, P., KARACAOGLU, Y., FARMER, P. E., LYON, E., FAWZI, M. K. C. S., LEANDRE, F., CHOI, S. S. & MUKHERJEE, J. S. 2004. An information system and medical record to support HIV treatment in rural Haiti. *Bmj,* 329**,** 1142-1146.
GOLD, R., BUNCE, A., DAVIS, J. V., NELSON, J. C., COWBURN, S., OAKLEY, J., CARNEY, S., HORBERG, M. A., DEARING, J. W. & MELGAR, G. 2021. "I didn't know you could do that": A Pilot Assessment of EHR Optimization Training. *ACI open,* 5**,** e27-e35.
GRANT, K. 2012. What can Canada learn from New Zealand, Denmark and the United Kingdom about Electronic Health Record (EHR) adoption? Increasing adoption, health system benefits, and the transformation of patient care.
GUI, X., CHEN, Y., ZHOU, X., REYNOLDS, T. L., ZHENG, K. & HANAUER, D. A. 2020. Physician champions' perspectives and practices on electronic health records implementation: challenges and strategies. *JAMIA open,* 3**,** 53-61.
GUNTER, T. D. & TERRY, N. P. 2005. The emergence of national electronic health record architectures in the United States and Australia: models, costs, and questions. *Journal of medical Internet research,* 7.
HANDLER, T., OVERHAGE, M., TAYLOR, S. & UNDERWOOD, C. 2003. EHR definition, attributes and essential requirements. *Healthcare Information and Management Systems Society,* 12.
HÄYRINEN, K., SARANTO, K. & NYKÄNEN, P. 2008. Definition, structure, content, use and impacts of electronic health records: a review of the research literature. *International journal of medical informatics,* 77**,** 291-304.

HOEKSMA, J. 2002. IT strategy lies in ruins as only five trusts hit April EPR targets. *Health Services Journal,* 5797**,** 4-5.
HOSSAIN, A., QUARESMA, R. & RAHMAN, H. 2019. Investigating factors influencing the physicians' adoption of electronic health record (EHR) in healthcare system of Bangladesh: An empirical study. *International Journal of Information Management,* 44**,** 76-87.
HUDA, M. Q., HIDAYAH, N. A., KHUDZAEVA, E., LUBIS, A. B. & SUJOKO, I. IT Adoption and Implementation on Pre-Implementation Phase: the Case of State Islamic University in Indonesia. 2021 9th International Conference on Cyber and IT Service Management (CITSM), 2021. IEEE, 1-5.
JIANG, J., QI, K., BAI, G. & SCHULMAN, K. 2023. Pre-pandemic assessment: a decade of progress in electronic health record adoption among US hospitals. *Health Affairs Scholar,* 1**,** qxad056.
JOUKES, E., DE KEIZER, N. F., DE BRUIJNE, M. C., ABU-HANNA, A. & CORNET, R. 2019. Impact of electronic versus paper-based recording before EHR implementation on health care professionals' perceptions of EHR use, data quality, and data reuse. *Applied clinical informatics,* 10**,** 199-209.
JUNG, S. Y., HWANG, H., LEE, K., LEE, D., YOO, S., LIM, K., LEE, H.-Y. & KIM, E. 2021. User perspectives on barriers and facilitators to the implementation of electronic health records in behavioral hospitals: qualitative study. *JMIR formative research,* 5**,** e18764.
KABUKYE, J. K., DE KEIZER, N. & CORNET, R. 2020. Assessment of organizational readiness to implement an electronic health record system in a low-resource settings cancer hospital: A cross-sectional survey. *PloS one,* 15**,** e0234711.
KIM, J., OHSFELDT, R. L., GAMM, L. D., RADCLIFF, T. A. & JIANG, L. 2017. Hospital characteristics are associated with readiness to attain stage 2 meaningful use of electronic health records. *The Journal of rural health,* 33**,** 275-283.
KITCHENHAM, B. 2004. Procedures for performing systematic reviews. *Keele, UK, Keele University,* 33**,** 1-26.
KRUSZYŃSKA-FISCHBACH, A., SYSKO-ROMAŃCZUK, S., NAPIÓRKOWSKI, T. M., NAPIÓRKOWSKA, A. & KOZAKIEWICZ, D. 2022. Organizational e-health readiness: How to prepare the primary healthcare providers' services for digital transformation. *International Journal of Environmental Research and Public Health,* 19**,** 3973.
LABKOFF, S. E. & YASNOFF, W. A. 2007. A framework for systematic evaluation of health information infrastructure progress in communities. *Journal of Biomedical Informatics,* 40**,** 100-105.
LEWICKA, D. 2011. Creating Innovative Attitudes in an Organisation–Comparative Analysis of Tools Applied in IBM Poland and ZPAS Group. *Journal of Asia Pacific Business Innovation and Technology Management,* 1**,** p1-12.
LEWIS, W., AGARWAL, R. & SAMBAMURTHY, V. 2003. Sources of influence on beliefs about information technology use: An empirical study of knowledge workers. *MIS quarterly***,** 657-678.
LUDWICK, D. A. & DOUCETTE, J. 2009. Adopting electronic medical records in primary care: lessons learned from health information systems implementation experience in seven countries. *International journal of medical informatics,* 78**,** 22-31.

MALIK, S., CHADHAR, M., VATANASAKDAKUL, S. & CHETTY, M. 2021. Factors affecting the organizational adoption of blockchain technology: Extending the technology–organization–environment (TOE) framework in the Australian context. *Sustainability,* 13**,** 9404.
MATHAI, N., MCGILL, T. & TOOHEY, D. 2022. Factors influencing consumer adoption of electronic health records. *Journal of Computer Information Systems,* 62**,** 267-277.
MILLER, R. A., GARDNER, R. M., JOHNSON, K. B. & HRIPCSAK, G. 2005. Clinical decision support and electronic prescribing systems: a time for responsible thought and action. *Journal of the American Medical Informatics Association,* 12**,** 403-409.
MORTON, M. E. 2008. Use and acceptance of an electronic health record: factors affecting physician attitudes.
MOSSIALOS, M., WENZL, R. & OSBORN, D. 2015. *International Profiles of Health Care Systems* [Online]. The Commonwealth Fund. Available: https://www.commonwealthfund.org/publications/fund-reports/2016/jan/international-profiles-health-care-systems-2015 [Accessed 15 January 2016 2016].
MOUSA, S. K. & OTHMAN, M. 2020. The impact of green human resource management practices on sustainable performance in healthcare organisations: A conceptual framework. *Journal of cleaner production,* 243**,** 118595.
NAJAFTORKAMAN, M. 2016. *Facilitators and Barriers to User Adoption of Electronic Health Record Systems.* Griffith University, Gold Coast.
NEHTA, A. 2016. Evolution of eHealth in Australia: Achievements, lessons, and opportunities. National E-Health Transition Authority Ltd Sydney.
NO-AUTHER 2002. Delivering 21st Century IT Support for the NHS. National Strategic Programme,
https://webarchive.nationalarchives.gov.uk/ukgwa/20130107105354/http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_4067112.pdf
Department of Health.
ODERKIRK, J. 2017. Readiness of electronic health record systems to contribute to national health information and research (Working Paper No. 99). OECD Health Working Papers, OECD Publishing, Paris. http://dx. doi. org/10 ….
OLIVEIRA, T. & MARTINS, M. F. Information technology adoption models at firm level: review of literature. The European conference on information systems management, 2010. Academic Conferences International Limited, 312.
OLIVEIRA, T. & MARTINS, M. F. 2011. Literature review of information technology adoption models at firm level. *Electronic journal of information systems evaluation,* 14**,** pp110-121-pp110-121.
OZAIR, F. F., JAMSHED, N., SHARMA, A. & AGGARWAL, P. 2015. Ethical issues in electronic health records: a general overview. *Perspectives in clinical research,* 6**,** 73.
PARK, Y.-T. & HAN, D. 2017. Current status of electronic medical record systems in hospitals and clinics in Korea. *Healthcare informatics research,* 23**,** 189.
PICHLAK, M. 2016. The innovation adoption process: A multidimensional approach. *Journal of Management & Organization,* 22**,** 476-494.

PRIETO, I. M. & REVILLA, E. 2006. Assessing the impact of learning capability on business performance: empirical evidence from Spain. *Management learning,* 37**,** 499-522.

PROTTI, D., BOWDEN, T. & JOHANSEN, I. 2008. Adoption of information technology in primary care physician offices in New Zealand and Denmark, Part 3: Medical record environment comparisons. *Journal of Innovation in Health Informatics,* 16**,** 285-290.

ROGERS, E. M. 2002. Diffusion of preventive innovations. *Addictive behaviors,* 27**,** 989-993.

ROTICH, J. K., HANNAN, T. J., SMITH, F. E., BII, J., ODERO, W. W., VU, N., MAMLIN, B. W., MAMLIN, J. J., EINTERZ, R. M. & TIERNEY, W. M. 2003. Installing and implementing a computer-based patient record system in sub-Saharan Africa: the Mosoriot Medical Record System. *Journal of the American Medical Informatics Association,* 10**,** 295-303.

RUDIN, R. S., FRIEDBERG, M. W., SHEKELLE, P., SHAH, N. & BATES, D. W. 2020. Getting value from electronic health records: Research needed to improve practice. *Annals of Internal Medicine,* 172**,** S130-S136.

SALAHSHOUR RAD, M., NILASHI, M. & MOHAMED DAHLAN, H. 2018. Information technology adoption: a review of the literature and classification. *Universal Access in the Information Society,* 17**,** 361-390.

SAMBAMURTHY, V. & CHIN, W. W. 1994. The effects of group attitudes toward alternative GDSS designs on the decision-making performance of computer-supported groups. *Decision sciences,* 25**,** 215-241.

SEQUIST, T. D., CULLEN, T., HAYS, H., TAUALII, M. M., SIMON, S. R. & BATES, D. W. 2007. Implementation and use of an electronic health record within the Indian Health Service. *Journal of the American Medical Informatics Association,* 14**,** 191-197.

SHARMA, M. & AGGARWAL, H. 2016. EHR Adoption in India: Potential and the Challenges. *Indian Journal of Science and Technology,* 9.

SIECK, C. J., PEARL, N., BRIGHT, T. J. & YEN, P.-Y. 2020. A qualitative study of physician perspectives on adaptation to electronic health records. *BMC medical informatics and decision making,* 20**,** 1-8.

SPIRANOVIC, C., MATTHEWS, A., SCANLAN, J. & KIRKBY, K. C. 2016. Increasing knowledge of mental illness through secondary research of electronic health records: opportunities and challenges. *Advances in Mental Health,* 14**,** 14-25.

STANDING, C. & CRIPPS, H. 2015. Critical success factors in the implementation of electronic health records: A two-case comparison. *Systems Research and Behavioral Science,* 32**,** 75-85.

TAPURIA, A., PORAT, T., KALRA, D., DSOUZA, G., XIAOHUI, S. & CURCIN, V. 2021. Impact of patient access to their electronic health record: systematic review. *Informatics for Health and Social Care,* 46**,** 194-206.

TEOH, S. Y., SINGH, M. & CHONG, J. 2013. An overview of E-health development in Australia. *User-Driven Healthcare: Concepts, Methodologies, Tools, and Applications***,** 901-917.

TORNATZKY, L. G., FLEISCHER, M. & CHAKRABARTI, A. K. 1990. *Processes of technological innovation*, Lexington books.

TREASURY, Q. 2017. Population change in Queensland resource regions. *Quensland Government Statistician's Office. Retirado em novembro,* 2**,** 2020.

TSAI, C. H., EGHDAM, A., DAVOODY, N., WRIGHT, G., FLOWERDAY, S. & KOCH, S. 2020. Effects of electronic health record implementation and

barriers to adoption and use: a scoping review and qualitative analysis of the content. *Life,* 10**,** 327.
TSIAMPALIS, T. & PANAGIOTAKOS, D. 2023. Methodological issues of the electronic health records' use in the context of epidemiological investigations, in light of missing data: a review of the recent literature. *BMC Medical Research Methodology,* 23**,** 180.
UPADHYAY, S. & HU, H.-F. 2022. A qualitative analysis of the impact of electronic health records (EHR) on healthcare quality and safety: Clinicians' lived experiences. *Health Services Insights,* 15**,** 11786329211070722.
VENKATESH, V. 2000. Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Information systems research,* 11**,** 342-365.
WANLESS, D. 2002. Securing our future health: taking a long-term view. Citeseer.
WOLDEMARIAM, M. T. & JIMMA, W. 2023. Adoption of electronic health record systems to enhance the quality of healthcare in low-income countries: a systematic review. *BMJ Health & Care Informatics,* 30.
WRIGHT, D., BAKER, D., BUYS, L., CUTHILL, M., MAYERE, S. & SUSILAWATI, C. 2017. Co-futuring narratives for Toowoomba-A regional Australian community. *Journal of Futures Studies,* 22**,** 19-38.
YAHYA AL ABBAS, A., NOORAN, A. S., ALQAOUD, A. S., AL MUBTI, S. A. S., ALZAMANAN, M. A. & ALYAMI, F. M. D. 2023. Synergy In Healthcare: Bridging Devices, Social Services, And Hospital Management: A Critical Review. *Journal of Survey in Fisheries Sciences,* 10**,** 155-160.
YILMA, T. M., TILAHUN, B., MAMUYE, A., KERIE, H., NURHUSSIEN, F., ZEMEN, E., MEBRATU, A., ABEBAW, T., GEBEYEHU, H. & ABAY, S. 2023. Organizational and health professional readiness for the implementation of electronic medical record system: an implication for the current EMR implementation in northwest Ethiopia. *BMJ Health & Care Informatics,* 30.