



Assessing the Impact of Innovation Processes on Electronic Systems Technology Adoption

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Abstract

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, namely 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 might 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 analyze 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) 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 the TAM, DOI, and TOE models to provide a more holistic understanding of EHRs adoption in the private healthcare sector. It also introduces the concept of time as a critical innovation artefact, highlighting its significance in the adoption process.

Keywords:

Electronic Health Records (EHRs);
Private Healthcare Sector;
Technology-Organization-Environment;
Innovation Processes.

Article History:

Received:	08	May	2024
Revised:	18	September	2024
Accepted:	23	September	2024
Published:	01	October	2024

1- Introduction

In the current competitive landscape, the efficient utilization of technology across all areas of an organization is a critical success factor. Throughout history, the Information and Communication Technology (ICT) sector has been at the forefront of driving innovation in service optimization, enabling seamless communication across the world, and empowering 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, store, manage, and share information related to patient data and their 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].

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DOI: <http://dx.doi.org/10.28991/ESJ-2024-08-05-02>

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Despite the clear benefits of EHRs adoption, there are challenges and barriers that prevent 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 in 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 in 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 in Australian community pharmacies. Taken together, these studies point to barriers and challenges in the adoption of EHRs, however, they fail to address the implications of these issues in terms of innovation. Prior systematic reviews of EHRs adoption have been highlighted, including the effects of technological, organizational, and environmental factors (TOE) on e-health [9], the cost effectiveness of EHR adoption [10], and the adoption of 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, which receive significantly fewer funding allocations than their larger counterparts. Therefore, this specific circumstance has motivated the research team to explore the adoption of EHRs in the 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 an innovation culture within healthcare institutions [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]. The current study aims to address the lack of knowledge on the application of integrated IMs in the private healthcare sector to better inform private healthcare managers and decision makers. We outline in this paper how each innovation model informs adoption success. Later, the discussions shift to expounding on the unique features of innovation to provide a better 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 an 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, which has substantial policy implications for comparable jurisdictions.

2- Theoretical Context of Innovation

2-1-Converging Innovation Research

Extant research has explored the benefits of applying TAM and DOI innovation models (IMs) in various contexts [18-21], TAM and TOE models [22-24], and TOE and DOI models [25-28]. Each IM is unique and can be tailored to explore distinct features of technology adoption [29, 30]. For example, the TOE framework is useful for analyzing 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 warrants 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 the example studies listed have often integrated two IMs side-by-side, only one study, Nabukenya et al. [33], combined the three models relevant to the adoption of EHRs. 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, to the best of our knowledge, no studies have explored the effects of combining IMs on EHRs

technology adoption processes, especially in the Australian private healthcare sector. This is an important oversight because different innovation characteristics are expected to have different effects on user 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								References	Year		
TOE & Innovation Criteria											
Cost	Complexity	Leadership Support	Culture	Financial resources	Regulation	Perceived usefulness	Job relevance	Knowledge	Decision		
	Y	Y				Y		Y		Abdekhoda et al. [22]	2019
	Y	Y				Y				Chatterjee et al. [37]	2021
	Y	Y				Y			Y	Gangwar et al. [38]	2015
						Y		Y		Motsi & Chimbo [39]	2023
Y		Y		Y	Y	Y				Mbwambo & Mandari [23]	2023
	Y					Y	Y	Y	Y	Putzer & Park [40]	2010
Y				Y		Y				Chong et al. [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 & Rostiani [43]	2021
						Y		Y		Awa et al. [44]	2016
	Y	Y								Chong & 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 analyzed here offer distinct yet supportive features for the innovation process. The TOE framework, as defined by Tornatzky & Fleischer [46], delineates 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 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 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 innovation decision to confirmation stage [48].

Moreover, Davis et al. [16] used the Technology Acceptance Model (TAM) to measure the level of information system adoption at the individual level, such as their perceived ease of use and perceived usefulness. A subsequent version of the model referred to as TAM2 developed by Venkatesh & Davis [49] focuses on two main factors that influence technology acceptance: the social influence process (such as subjective norms, voluntariness, and image) and the cognitive instrumental process (such as job relevance, output quality, result demonstrability, and perceived usefulness). When considering all the information, it can be said that while TOE investigates those organizational factors necessary for the adoption process, both DOI and TAM2, in contrast, measure different innovation artefacts such as perceived usefulness, which reflects the real adoption processes, and usage behavior. Figure 1 reflects the discussions.

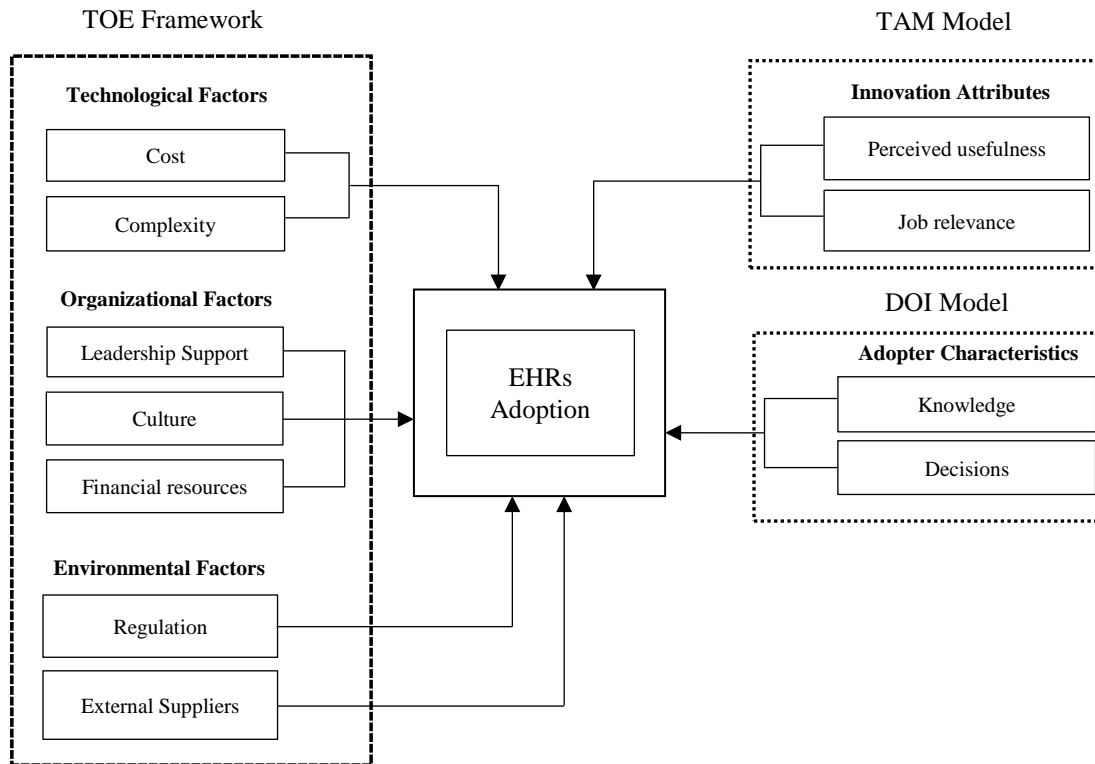


Figure 1. The conceptual research models

Certain commonalities of IMs can be identified. For instance, socioeconomic, compatibility, and complexity aspects in DOI are comparable to the technology measures of TOEs compatibility and complexity [50, 51], such that it is not necessary to measure these factors twice. Similarly, the 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.

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 explore methods for creating greater theoretical insight between TOE, TAM, and DOI models. Based on the above discussions and Figure 1, we propose five ways in which innovation insight might enhance the understanding of the EHRs adoption process; these include: (1) innovation attributes [52, 53], including user knowledge of how to embrace new innovations [54]; (2) technological contexts [39, 53]; (3) organizational 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 technological 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 and practitioners have gained no insight into the manner in which these innovations are implemented.

Job Relevance is also an innovation attribute. Job criteria focus 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 allied health 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 endeavor 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, IT infrastructure maintenance, and external expenses related to suppliers [63, 64], *inter alia*. Accounting for the complexity of technological systems [65] is a central consideration in EHR adoption processes [66], yet, similar to other problems identified, new technology adoption has of more interest 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 contribute to 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 technological infrastructure, staff training, and ongoing support for resolving EHR systemic issues [70, 71], which has been a concern in private health settings [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 have been established in various contexts. For instance, 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. The 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 challenges of IT adoption within the Australian private healthcare setting as follows:

- **Research Question 1:** Which mitigating factors offset the challenges of EHRs adoption within the Australian private healthcare sector?
- **Research Question 2:** Which innovation artefacts are more ubiquitous with respect to the adoption process of electronic healthcare records (EHRs)?

4- Research Methodology

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 in South-East Queensland, Australia, with the organization being referred to as "Allan's Private Hospital" or APH to maintain confidentiality and compliance with 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 provided that the sample reflects the participation of key decision makers. Additionally, scholars have observed that in phenomenological studies involving senior decision-makers, fewer than ten interviews may be adequate [82]. Yardley [83] emphasizes that the rigor of the study relies not solely on the size of the sample but on its ability to provide exhaustive data necessary for thorough analysis.

4-2- Participant Demographics

Table 2 reflects the participants' demographic information. As noted, all participants were relatively senior managers responsible for making decisions related to new hospital innovations. Out of the total participants, three were male and five female, with four being between the ages of 30 and 40 and the other four in the 40-50 age range. The tenure of senior managers was greater than ten years (approximately half), with the tenure of remaining staff between 6-10 years. All participants possessed a university degree, and the responsibility level reflected their senior management roles.

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	<ul style="list-style-type: none"> • Diploma • Bachelor✓ • Master • Doctorate 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Diploma • Bachelor✓ • Master • Doctorate 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Diploma • Bachelor✓ • Master • Doctorate 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Diploma • Bachelor✓ • Master • Doctorate 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Diploma • Bachelor✓ • Master • Doctorate 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Diploma✓ • Bachelor • Master • Doctorate 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Diploma • Bachelor • Master✓ • Doctorate 	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • Diploma • Bachelor✓ • Master • Doctorate 	<ul style="list-style-type: none"> • 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 at APH. The initial round of interviews commenced with the hospital director and the director of the information and communication technology (ICT) department to establish foundational insights. Through purposive sampling techniques [84], the key decision-makers involved in the EHRs planning process were selected. The data 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 influencing factors of EHRs innovation adoption process consistent with research questions 1 and 2.

4-4-Data Analysis

The authors adopted a critical realist approach to analyze health professionals' perceptions of underlying reality, considering cultural and other experience factors. Using the reflexive guidelines advocated by Braun & 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 were evident in these reflexive themes. Thus, critical reflexivity invoked new participant-centered ideas [85, 86], which were subsequently suitable for deriving inferences from the data [87]. The researchers performed iterative processes of data review, coding, theme development, and refinement while carefully reviewing 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, followed by a more manual process of deciding on the reflexive and emergent themes. Drawing on existing literature and as 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 3 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 who had not been trained.
	Decision-making	Improving patient safety underpins a champions user group, which informs 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, recognising that overly complex systems were difficult to use.
Organizational Factors	Leadership support	Leaders responded to staff concerns, and providing relevant resources was vital for support.
	Financial	Participants saw EHRs as just another tool, funded by the executive and board.
	Culture	Managers discussed fixing the culture and not forcing individuals 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	Thematic Findings
Innovation Attributes	<p>Perceived usefulness</p> <p>"... 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).</p> <p>"...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).</p> <p>Perceived ease of use</p> <p>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.</p> <p>"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).</p> <p>"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).</p> <p>Job relevance</p> <p>"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).</p>
Adaptor Characteristics	<p>Knowledge</p> <p>"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).</p> <p>"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).</p> <p>"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).</p> <p>Decision-making</p> <p>"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).</p> <p>"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).</p>
Technological-Related Factors	<p>Cost</p> <p>"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).</p> <p>"Definitely the cost, cost of staff training is huge. And there's an ongoing cost as well" (P2).</p> <p>Complexity</p> <p>".....system complexity level was a main criterion when we made an adoption decision" (P1).</p> <p>"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).</p> <p>" Decision makers may be hesitant to adopt electronic health records if they perceive them as overly complex P4).</p>
Organizational-Related Factors	<p>Leadership Support</p> <p>"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).</p> <p>"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).</p> <p>Financial resources</p> <p>"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).</p> <p>"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).</p> <p>Culture</p> <p>"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).</p> <p>"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).</p> <p>"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).</p>
Environmental-Related Factors	<p>"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).</p> <p>"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).</p> <p>External supplier</p> <p>"...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).</p> <p>"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 it's 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).</p>

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 technological 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, Csonka & Korppi [92] emphasize the importance of EHRs containing patient-specific information, including treatment plans and clinical workflow analysis to meet the 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 consistent with the findings of the current study.

The findings highlight the critical role 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 as part of 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 strategic implementation of projects and achieving organizational goals, requiring careful planning and allocation of resources [97, 98]. Participants also emphasized the importance of preparing the culture for change and innovation to ensure successful adoption and utilization of electronic systems [99]. This result may be attributed to the need of successfully addressing resistance and engaging 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. These factors collectively contribute to the overall success and sustainability of EHR implementation initiatives in healthcare settings. The result of the current study point out the importance of regulatory requirements and 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 management programs and comprehensive training to ensure successful adoption of EHRs. Engaging users throughout the transition is critical for adoption, since buy-in and understanding of benefits are necessary to overcome resistance. Despite the 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 comprehensive comparison 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 prior research have identified constraints and challenges with EHR adoption more generally as noted earlier, our study broadens related literature by matching EHR implementation concerns to their thematic findings relevant to various 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 response to research question 1, and based on the previous discussion, Table 5 presents the mitigating factors that counteract the negative aspects of the EHRs adoption process in our private hospital case study. 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 since they are cost-effective and lead 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. Innovation 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 requires 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 needs 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. <u>Innovation strategy:</u> 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. <u>Innovation strategy:</u> 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. <u>Innovation strategy:</u> 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. <u>Innovation strategy:</u> 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 <u>Innovation strategy:</u> 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. <u>Innovation strategy:</u> 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 <u>Innovation strategy:</u> Management decisions must incorporate all users.

6-2-Answers to Research Questions 2

We have now expanded upon the insights obtained from research question 1 to address the responses to research question 2, which pertains to the adoption process of electronic healthcare records (EHRs) and which innovation artefacts are more prevalent. Earlier in Figure 1, we illustrated how our conceptual model encompasses the TAM2, DOI and the TOE framework. In Table 3, we outlined the relationship between the thematic findings from the data and the dimensions of innovation. In sum, TOE and innovation practices influence EHRs practices both positively and negatively, as previously discussed in the response to research question 1. We previously described the method used to identify innovation artefacts from the data set using critical reflexive analysis (RTA) in accordance with Braun & 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 additional factors emerged from the data.

Table 6 illustrates how a careful review of the data and each innovation theme led to the identification of 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	<p>"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".</p> <p>"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.</p> <p>"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".</p> <p>"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".</p> <p>"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."</p>	<p><u>Supporting Research</u></p> <p>"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 behavior can be regarded as a proxy for behavior [102]. This also applies to time and temporal work as a proxy for behavior [103].</p> <p>"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].</p> <p>[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" [105].</p> <p><u>Contribution to Theory</u></p> <p>Broadening TAM is possible by adding other characteristics such as temporal work and time to measure the impact of technology adoption over time.</p>
	Knowledge, Job relevance and Decision-making	<p>"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"</p> <p>"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".</p> <p>"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"</p> <p>"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".</p> <p>"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".</p> <p>"We were relying on the expertise of vendors to help make decisions around number of unclear aspects"</p> <p>"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".</p> <p>"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".</p>	<p><u>Supporting Research</u></p> <p>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].</p> <p>"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" [103].</p> <p>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].</p> <p><u>Contribution to Theory</u></p> <p>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.</p>
	Leadership support, Complexity and Financial	<p>"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.</p> <p>"Later on, the required skills shift to leadership, managerial control, and workforce empowerment skills".</p> <p>"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?"</p> <p>"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".</p> <p>"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".</p> <p>"Financially of course, it's going to be an expensive journey for anyone".</p> <p>"Further along as we got into training we had very much a regimented structured training process whereby there's an allocation of time to each user group and each process for their training".</p> <p>"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".</p>	<p><u>Supporting Research</u></p> <p>While TAM models have validated how attitude (of both leaders and other users) has influenced actual use behavior 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.</p> <p>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].</p> <p>There are highlighted instances of scheduling training and people's time by pacing the EHRs workflow [108].</p> <p>The readiness of physicians to adopt EMRs is heavily influenced by various factors such as age, experience, computer literacy, organizational culture, and participation [12]. Time is also a contributing factor [12].</p> <p>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].</p> <p><u>Contribution to Theory</u></p> <p>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].</p>

Using Bansal et al.'s [103] definition of temporal work, 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 concept of time as an innovation artefact. We observed from the data how temporal work shaped participants' propensity to collaborate by taking new actions rather than waiting for the ‘right time’ for innovation [106]. We identified instances of scheduling training and individuals' time by pacing the EHR workflow [110].

In terms of perceived usefulness, for instance, participants discussed the importance of involving others in the process of developing the new system over time and the fact that they were on a journey. In perceived ease of use category, participants observed 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, which is indicative of temporal pacing. In terms of knowledge, participants noted the building phase and the necessity of expanding upon our current efforts. Participants did not indicate that the process was concluded at any point. Similarly, in terms of decision making, collecting knowledge as a digital journey, simplifies the stages of implementation, and that vendors would need to be helped with a number of ambiguous guidelines. Consequently, the decision-making processes were time-dependent, since they relied on time as an innovation artefact in bringing about change. For instance, participants acknowledged long-term savings and the expensive process of 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 after the project. Sustained improvements were inferred as a time artefact for temporal pacing, since they 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 monitored or measured, they might create a speed trap [107]. Yet, innovation adoption models are primarily human-focused and determined by individual characteristics, such as users' perceived ease of use and usage behavior, with time or the temporal effect of work is seldom 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 perspectives.

Liu & Miguel-Cruz [105] note 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 behavior 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 discussed, time is an innovation artefact influencing temporal pacing [103]. That is, building on the integrative insights from the three innovation models, 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 and intention to use can be regarded as a proxy for behavior [102], there remains a need to aggregate the effects of factors and compare them across time and applications [104]. Simply measuring some behavioral factors while ignoring others may not be sufficient to determine how innovation practices influence outcomes. Liu & 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 donating time [103]. Without considering time as a temporal artefact, the adoption process could create a speed trap for eager users [107]. Leadership does not necessarily translate into adoption success. The literature notes that technology adoption differs from diffusion [12] such that participants forged ahead without being cognizant of the optimal timing 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 the emphasis on time as an innovation artefact contributes to a broader understanding of the innovation practices that are important to the EHR processes, in addition to the well-known effects of innovation models, as highlighted through 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 technological 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 prioritize which innovation attributes are important for healthcare service providers. We suggest that a greater appreciation of innovation will result in enhanced patient care and decreased healthcare expenses as discussed earlier. Accordingly, managers will need to better align organizational strategy with information systems strategy [111, 112], rather than 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 EHR adoption processes, making a novel 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 such as TAM, individuals' perceptions of technology have changed considerably because of the increase in individual user knowledge. Different versions of TAM 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 were not the main basis for user acceptance in the current study, potentially 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 might explore. The current study is limited in generalizing 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 TOE model, the TAM model, and the Diffusion of Innovation model, to better understand how these models inform innovation adoption practices. This comprehensive analysis identified key factors and insights that enrich the existing literature on EHR adoption practices, particularly in private healthcare institutions. Factors offsetting the challenges of EHR 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 EHR adoption in healthcare organizations. The study emphasized the importance of integrating different innovation models with EHR adoption processes and underscored the significance of temporal pacing and timing as essential elements of innovation in EHR adoption processes, making a novel contribution to both academia and practical application. The results suggest the value of grounding EHR adoption processes on the basis of innovation characteristics, which helps to prioritize 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, S.O. and P.A.M.; methodology, S.O. and P.A.M.; formal analysis, S.O.; data curation, S.O.; writing—original draft preparation, S.O.; writing—review and editing, P.A.M.; visualization, S.O.; supervision, P.A.M.; K.A. and O.A.; project administration, S.O.; funding acquisition, P.A.M. All authors have read and agreed to the published version of the manuscript.

8-2-Data Availability Statement

The data presented in this study are available on request from the corresponding author.

8-3-Funding

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

8-4-Institutional Review Board Statement

Not applicable.

8-5- Informed Consent Statement

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

8-6- Conflicts of Interest

The authors declare that there is no conflict of interest 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.

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