THE DETERMINANTS OF ELECTRONIC HEALTH RECORD ADOPTION AND THE ROLE OF DATA GOVERNANCE AS MEDIATOR IN INDONESIA

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LIST OF ABBREVIATIONS

CP	Competitor Pressure
DG	Data Governance
DHO	District Health Office
DOI	Diffusion of Innovation
EHR	Electronic Health Record
EHRs	Electronic Health Record System
EMR	Electronic Medical Records
FI	Formal-Informal
GDP	Gross Domestic Product
GS	Government Support
HIE	Hospital Information Exchange
HIS	Hospital Information System
HITECH	Health Information Technology for Economic and Clinical Health
IF	Infrastructure
IS	Information System
PHO	The Provincial Health Office
PLS	Partial Least Squares
TA	Technology Availability
TC	Technology Characteristic
TM	Top Management
TOE	Technology-Organisation-Environment
TTF	Task-Technology Fit
USM	Universiti Sains Malaysia
RKE	Rekod Kesihatan Elektronik
SEM	Structural Equation Model
SL	Slack
SZ	Size

LIST OF APPENDICES

PENENTU PENGGUNAAN REKOD KESIHATAN ELEKTRONIK DAN PERANAN TADBIR URUS DATA SEBAGAI PENGANTARA DI INDONESIA

ABSTRAK

Rekod Kesihatan Elektronik (RKE) mempunyai kemungkinan mengubah penyampaian penjagaan kesihatan dengan mempromosikan penjagaan pesakit, mengurangkan kos, hubungan penyepaduan bersama dan teknologi penjagaan kesihatan ekosistem baharu. Terdapat keperluan untuk menangani penentu penting yang menyumbang kepada penggunaan RKE di Indonesia. Kajian ini menyiasat kesan pengantaraan tadbir urus data yang mungkin menjejaskan penggunaan RKE. Objektif utama kajian ini adalah untuk menjelaskan peranan tadbir urus data dalam pengantaraan penggunaan RKE dalam konteks cabaran yang berkaitan dengan penyeragaman dan penyepaduan data merentas hospital awam di Indonesia. Kajian kuantitatif ini meneroka aspek teknologi, organisasi dan persekitaran yang mempengaruhi penggunaan RKE dan menilai kesan tadbir urus data terhadap penggunaan RKE. Gabungan rangka kerja teknologi-organisasi-persekitaran (TOE), teori penyebaran inovasi (DOI), dan rangka kerja tadbir urus data, berdasarkan gabungan rangka-kerja kajian ini mengkaji ciri-ciri teknologi perhubungan (TC), ketersediaan teknologi (TA), organisasi penghubung formal-tidak formal (FI), sokongan pengurusan atasan (TM), kendur (SL), saiz hospital (SZ), tekanan kompetitif (CP), infrastruktur (IF), tadbir urus data (DG) dan penggunaan RKE. Data dikumpul dari hospital awam kawasan Jawa-Bali di Indonesia menggunakan reka bentuk kajian keratan rentas. Daripada 276 borang soal selidik yang diedarkan, hanya 160 jawapan

telah digunakan untuk analisis lanjut menjadikan kadar maklum balas yang sah sebanyak 57,97%. Perisian Partial Least Squares-Structural Equation Modeling (PLS-SEM) (v.4.0.9.0) telah digunakan untuk analisis data. Penemuan itu mendedahkan hubungan positif langsung antara organisasi penghubung formal-tidak formal, kelonggaran, infrastruktur dan tadbir urus data. Walau bagaimanapun, ketersediaan teknologi mempunyai hubungan negatif terhadap tadbir urus data. Sebagai tambahan, penggunaan RKE dipengaruhi oleh tadbir urus data. Kajian ini juga mendapati bahawa tadbir urus data memainkan peranan penting sebagai pengantara antara organisasi penghubung formal-tidak formal, infrastruktur dan sokongan kerajaan. Kajian ini menggariskan kepentingan membangunkan peraturan tadbir urus data yang komprehensif untuk memudahkan penggunaan RKE yang berkesan di Indonesia, yang akhirnya akan mengakibatkan hasil perkhidmatan pesakit yang lebih baik dan kerugian ekonomi. Untuk mengkaji implikasi jangka panjang tadbir urus data terhadap penggunaan RKE dan untuk mewujudkan amalan terbaik untuk pengurusan data dalam sistem penjagaan kesihatan Indonesia, kajian lanjut diperlukan.

THE DETERMINANTS OF ELECTRONIC HEALTH RECORD ADOPTION AND THE ROLE OF DATA GOVERNANCE AS MEDIATOR IN INDONESIA

ABSTRACT

Electronic health records (EHRs) can transform healthcare delivery by promoting patient care, decreasing costs, co-integration relationships, and creating new ecosystem healthcare technology. It is urgent to address significant determinants contributing to EHR adoption in Indonesia; hence, this study investigates the mediation of data governance that may affect the adoption of EHRs. The primary objective of this study is to elucidate the role of data governance in mediating the adoption of Electronic Health Records (EHRs) within the context of challenges associated with data standardisation and integration across public hospitals in Indonesia. This quantitative study explores the technological, organisational, and environmental aspects that influence EHR adoption and evaluates the impact of data governance on EHR adoption. To understand the symbiosis of technology-organisation-environment framework (TOE), diffusion of innovation (DOI) theory, and data governance framework, this study examined the relationship between technology characteristic (TC), technology availability (TA), formal-informal linking organisation (FI), top management support (TM), slack (SL), hospital size (SZ), competitive pressure (CP), infrastructure (IF), data governance (DG), and EHRs adoption. Data were collected from the public hospitals across Jawa-Bali in Indonesia using a cross-sectional study design. Out of the 276 questionnaires distributed, only 160 responses were used for further analysis, making a valid response rate of 57,97%.

Partial Least Squares-Structural Equation Modelling (PLS-SEM) software (v.4.0.9.0) was used for data analysis. The finding revealed a direct positive relationship between formal-informal linking organisation, slack, infrastructure, and data governance. However, technology availability has a negative relationship with data governance. In addition, EHR adoption is influenced by data governance. This study also found that data governance plays a significant mediator between formal-informal linking organisations, infrastructure, and government support. This study underlines the importance of developing comprehensive data governance regulations to facilitate the effective deployment of EHRs in Indonesia, eventually resulting in improved patient outcomes and reduced economic loss. Further study is required to examine the long-term implications of data governance on EHR adoption and to establish best practices for data management in the Indonesian healthcare system.

CHAPTER 1

INTRODUCTION

1.1 Introduction

The background section of this chapter discusses the research challenge and motivation. Additionally, this chapter includes a problem statement that addresses gaps in past research on its impact on technology adoption decision-making. The research objectives and questions section discusses the study's significant research statements. As shown in this chapter, this study is expected to have theoretical, practical, and societal implications. Additionally, this chapter examines the definition of key terms, which includes an explanation of the variables in the study framework and the thesis organisation, which details the thesis's overview.

1.2 Background of Study

The coronavirus discovered in 2019 has changed the habits carried out regularly by individuals and organisations; hence, a "New Normal" appears as many activities carried out onsite are changed to online. Lockdowns closed businesses, schools, public transport, houses of worship, public areas, and quarantined people. Alternatively, people use the Internet to work, care for others, and socialise (L. Liu & Miguel-Cruz, 2022). Technology has become essential in this situation since everyone is trying new norms or shifting from traditional frameworks. Furthermore, the Pandemic has stunted global economies, and public health is one of the sectors that was affected (Al Rahbi, Khan, Gupta, Modgil, & Chiappetta Jabbour, 2020). According to Singhal, Kayyali, Levin, & Greenberg (2020) the benefits of digital transformation, companies in the health sector, including hospitals, have taken the initiative to adopt this digital transformation into their management systems to

improve the quality of health services. In this situation, new requirements surfaced, addressing existing difficulties that were already placing the whole healthcare industry under massive pressure and uncertainty (Secundo, Riad Shams, & Nucci, 2021).

Digital business transformation is no longer arguable, as it has played a significant role across all industries, including healthcare, which benefits the organisation (Iyanna, Kaur, Ractham, Talwar, & Najmul Islam, 2022). During the COVID-19 pandemic, technology significantly enhanced the quality, effectiveness, and outcome of hospital healthcare services (Zarif, 2022). As a consequence of the actual benefits to the business, the current availability of technology has increased the focus on hospitals (Iyanna et al., 2022). Based on the literature, technological developments or adoptions in healthcare to smoothen the operational processes used Internet of Things (Cheung et al., 2019; Secundo et al., 2021), Big Data (El aboudi, Benhlima, & Aboudi, 2018), Blockchain technology (Gaynor, Tuttle-Newhall, Parker, Patel, & Tang, 2020; Ghaleb, Dominic, Fati, Muneer, & Ali, 2021; Palas & Bunduchi, 2021; Vishwakarma, Dangayach, Meena, Gupta, & Luthra, 2022) Artificial intelligence (Yang, Luo, Zhao, & Zhang, 2022), Telemedicine (L. Liu & Miguel-Cruz, 2022), Smartphone-Based Biosensor (Madrid, Ramallo, Barraza, & Chaile, 2022), Electronic Health Record (B. Alanazi, Butler-Henderson, & Alanazi, 2020; B. D. Alanazi, Alhijji, & Alanazi, 2022; Liang et al., 2021).

Digital transformation in healthcare is a crucial aspect of modernising healthcare services, and Indonesia is actively engaging in this process. The country has already implemented digital healthcare systems such as the Indonesia Health Service (IHS) system and various applications like Citizen Health App, Peduli Lindungi, and Halodoc (Hidayat, Zafira, Nurfitriani, & Syahida, 2023). These initiatives aim to enhance access to healthcare facilities and services, which are

especially crucial during events like the COVID-19 pandemic. Efforts to accelerate digital transformation in Indonesia extend beyond healthcare to include programs for Micro, Small, and Medium Enterprises (MSMEs) (Legowo & Sorongan, 2022). The government is focusing on leveraging digital technologies to boost the national economy and drive growth in various sectors, including MSMEs.

Indonesia's digital transformation agenda is multidisciplinary, reflecting a comprehensive approach to integrating digital technologies across different sectors (Verhoef et al., 2021). This approach encompasses various fields, such as computer science, business, and public health, highlighting the country's broad scope of digital transformation initiatives. Moreover, the digital transformation wave in Indonesia is not limited to healthcare but also extends to sectors like aquaculture, public sector organisations, insurance, and even tourism (Magna & Maulana, 2022; Pranita, 2018; Susanto, 2022; Zainudin, Habibullah, Arfiani, & Mumpuni, 2023). These diverse applications of digital technologies underscore the country's commitment to leveraging innovation for economic development and improved service delivery.

Specifically in the healthcare sector, Indonesia is exploring avenues like telemedicine to enhance healthcare services (Wijaya, Octavius, & Hwei, 2022). Indonesia's big population presents significant opportunities for the development and implementation of digital health technologies to cater to the healthcare needs of its citizens effectively. By embracing digital technologies and innovation, Indonesia is poised to enhance service delivery, drive economic growth, and improve the overall well-being of its population.

EHRs have seen significant adoption in Indonesia, focusing on improving healthcare services in Indonesia. Various studies and initiatives have supported the development of EHRs in Indonesia. For instance, the utilisation of Information

Technology systems, including EHR and Clinical Decision Support Systems (CDSS), has been emphasised to enhance the quality of nursing services in large hospitals (Sayam & Sukihananto, 2019). Additionally, there have been proposals for scalable clinical data management toolkits like pyEHR to facilitate the development of EHR systems in countries like Indonesia (Lianas, Frexia, Delussu, Anedda, & Zanetti, 2014). These efforts aim to bring about comprehensive and long-lasting changes in the healthcare landscape by providing a roadmap for e-health projects in Indonesia (Veeraiah, 2024).

EHRs are the most fundamental component of health digital technologies, and their adoption rate in hospitals demonstrates the level of digitalisation of medicine in a society (Liang et al., 2021). Health digital technology encompasses the use of information technology to enhance healthcare delivery, such as through telemedicine and digital health solutions (Kalhori et al., 2021). In addition, technology is used to share society's information, including in the health sector. The availability of health technology in hospitals is crucial for public safety (A. J. Holmgren, Phelan, Jha, & Adler-Milstein, 2021). Therefore, a health technology system, such as EHRs, is required. EHRs can be roughly described as (in electronic format) longitudinal data acquired during normal health care delivery Legally, the information in EHRs is a record of the services provided to patients, which the hospital is permitted to store this information (Esdar, Hüsers, Weiß, Rauch, & Hübner, 2019). According to Hertzum (2021), typically EHRs incorporate demographic, vital statistics, administrative, claims, clinical, and patient-centered information. Patients have access and ownership of their EHRs, and the data can be used by other medical facilities for later treatment purposes. EHRs evolved primarily to improve healthcare quality and record billing information (T. Wang, Wang, & McLeod, 2018). EHRs are also used for observational

studies, safety monitoring, clinical research, and regulation and expected to improve the professionalism and efficiency of hospital administration. Patients and other stakeholders would appreciate the speed and ease of health services (Tarver & Menachemi, 2018).

EHRs offer opportunity to improve patient care, incorporate performance measurements into clinical practice, and allow clinical research (Atasoy, Greenwood, & McCullough, 2019; Coffey et al., 2008; Cook et al., 2021; Esdar et al., 2019; Hansen & James Baroody, 2020; Lite, Gordon, & Stern, 2020; Mathai, McGill, & Toohey, 2020; Özer, Özkan, & Budak, 2020). Based on Secundo et al. (2021) the underlying premise is to view the healthcare ecosystem as a system of collective intellectual ability in which many stakeholders may be coordinated to handle the pandemic-specific management problem. Similarly, as recommended by Singhal, Kayyali, Levin, & Greenberg (2020), future healthcare ecosystems will be focused on patient-centric.

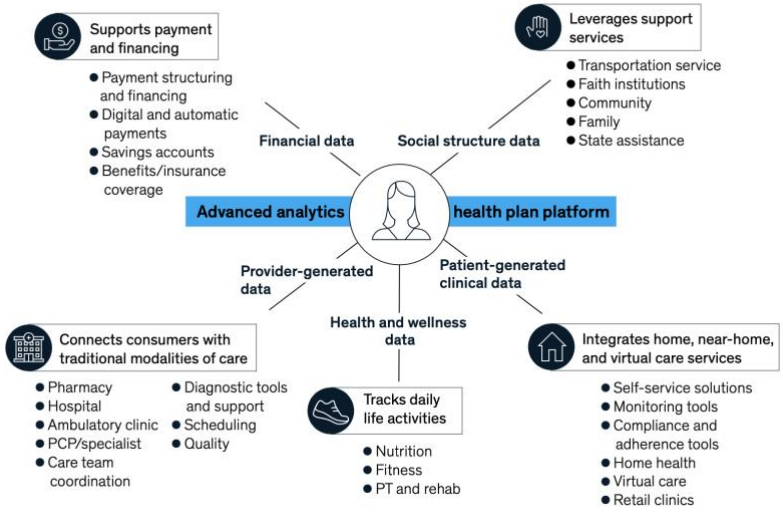

Figure 1.1 Healthcare Ecosystem Technology

Source: McKinsey Report (2020)

Figure 1.1 shows the platform aims to provide a holistic health and wellness hub, leveraging data analytics to facilitate coordinated care across different healthcare services and modalities, while also offering diagnostic, scheduling, and quality support. Blockchain technology has emerged as a promising solution for addressing these challenges diagnostics, health care delivery, and patient well-being are enhanced through a more efficient use of information (B. Alanazi et al., 2020; Malhan, Manuj, Pelton, & Pavur, 2022). EHR is more efficient than paper records because it enhances the accessibility, storage, and retrieval of patient information and automated its gathering and arrangement. Furthermore, according to Mathai et al. (2020) EHRs are considered to be important, highly sensitive, and confidential information in healthcare services since they are regularly exchanged among healthcare professionals when any person or organisation producing, receiving, administering, or paying for this service is in doubt, concerns regarding the security and privacy of health technology in EHRs arise. Due to the importance of EHRs, many countries, including those with high, middle, and low incomes, have exerted considerable effort to build the appropriate environment for fostering health technology development (B. D. Alanazi et al., 2022; Jianxun, Arkorful, & Shuliang, 2021) similarly on global concern, organisations are progressively deploying information systems (IS) to alter business models, support operations, and drive strategic decision-making as part of their digital transformation (H. Li & Yoo, 2022; Steiber, Alänge, Ghosh, & Goncalves, 2020). However, interconnection is raised by the idea of 'new' technology. Due to the timeframe involved, it may be challenging to integrate and cross-access data and use it between multiple systems or even versions (Zarif, 2022).

However, in Indonesia not all health facilities are ready to face the era of disruption 4.0, to streamline the digitisation. Various obstacles related to human

resources, funding sources, business processes, government regulations and regulations, as well as the existence of a data integration system are often challenges during the implementation (Badan Pengkajian dan Penerapan Teknologi, 2020; Hospital Insights Asia, 2019). According to Siregar et al. (2018), numerous barriers to implementing EHR technology have been identified, including the system's complexity, a shortage of competent health informatics personnel, organisational issues, the requirement for coordination between local and national governments, data utilization issues, and data system integration. Local and state health authorities acknowledged a lack of resources for implementing information systems infrastructure, possibly contributing to low adoption rates (Walker, Yeager, Lawrence, & McAlearney, 2021).

In the context of EHRs, how healthcare providers and hospitals record, analyze, and share information concerning patients is constantly changing. (Heath, Appan, & Henry, 2022). Data standardisation faces several obstacles for instance, many healthcare professionals may collect and record data differently, causing a lack of consistency in the wording and codes used to represent patient treatments and diagnoses (Tse, Chow, Ly, Tong, & Tam, 2018). Despite these obstacles, data consistency is essential for the efficiency of EHRs and the advancement of patient care. According to (Benfeldt, Persson, & Madsen, 2020), data governance contributes to organisational goals by promoting desirable behaviour in managing data as a resource, which is incorporated. Data governance may be considered as organisations and their staff establishing, implementing, and monitoring the structures of rules and authority for controlling the appropriate functioning and assuring responsibility for the complete lifecycle of data and algorithms inside and across organisations(Janssen, Brous, Estevez, Barbosa, & Janowski, 2020). Organisations must clearly define roles

and responsibilities to enhance the effectiveness of data standardisation efforts and develop efficient communication and coordination systems. Overall, data standardisation is an organisation-wide collaborative endeavour involving multiple stakeholders.

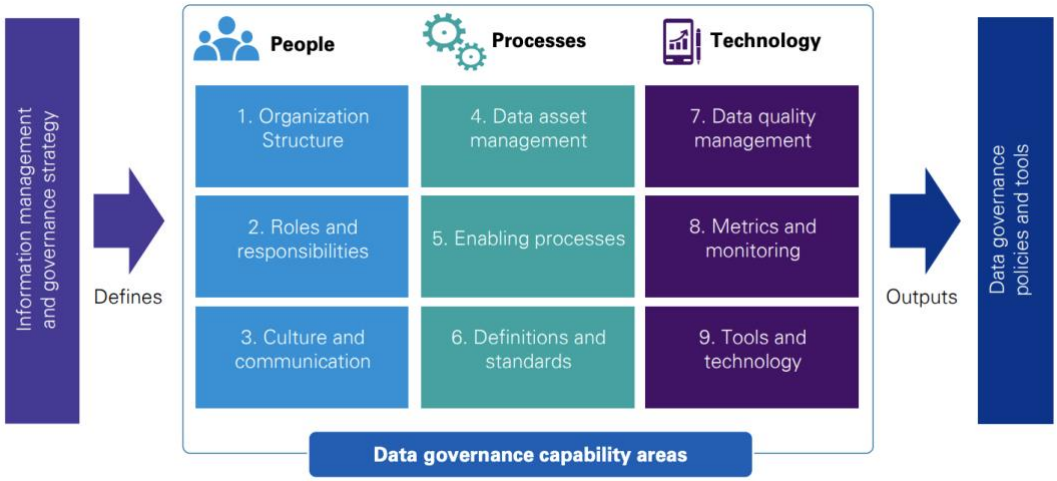

Figure 1.2 Data Governance Capabilities Area

Source : Enterprise Strategy Group (2021)

Referring to L. Lee, Rawstron, Henderson, Applewhite, & Guy (2018) captured in Figure 1.2, truly enable, embed, and constantly improve the critical components of data governance, businesses should embrace a capabilities framework including people, processes, and technology. As organisations adopt additional systems, tools, and services across environments to increase access to more data, the scope of data governance integration intends to expand. Hence, Enterprise Strategy Group (2021) which relates to their organisations' data governance strategies, incorporates data-centric technologies.

1.3 Overview of Healthcare in Indonesia

Indonesia has several sources of gross domestic product (GDP), including mining, plantations, agriculture, medical services, and other areas. Healthcare services,

including as medications, medical technology, medical personnel services, medical travel and transportation, and other health products, are exported by the health industry, contributing to Indonesia's GDP (Connell, 2013; Tri Ratnasari, Gunawan, Qudzi Fauzi, & Fitrisia Septiarini, 2018). Additionally, the health industry contributes to the GDP through medical tourism, i.e. visitors who travel to Indonesia for medical treatment (Ratnasari, Gunawan, Pitchay, & Mohd Salleh, 2022). Medical tourism is an important source of national GDP in Indonesia, especially for tourists from Malaysia, Thailand, Singapore, and other Southeast Asian countries (Malik, 2021). Furthermore, the health industry contributed to the nation's GDP through payments from different countries for advisory services and training provided by competent and professional Indonesian hospital staff (Putra Thama, 2019). However, the health industry is not Indonesia's primary source of GDP, other sectors like as mining, plantations, agriculture, and tourism, as well as the manufacturing and service industries, continue to contribute much more to Indonesia's GDP (Kusumaningrum, 2019; Rahma, 2020).

The Minister of Health develops health policies with input from the ministry and government to establish the sector's strategic direction. Although the Ministry of Health substantially affects healthcare policy formation, Healthcare Indonesia, the Strategic Prioritisation Function, and other ministerial advisory bodies also advise and support the Minister (Ministry of Health, 2017).

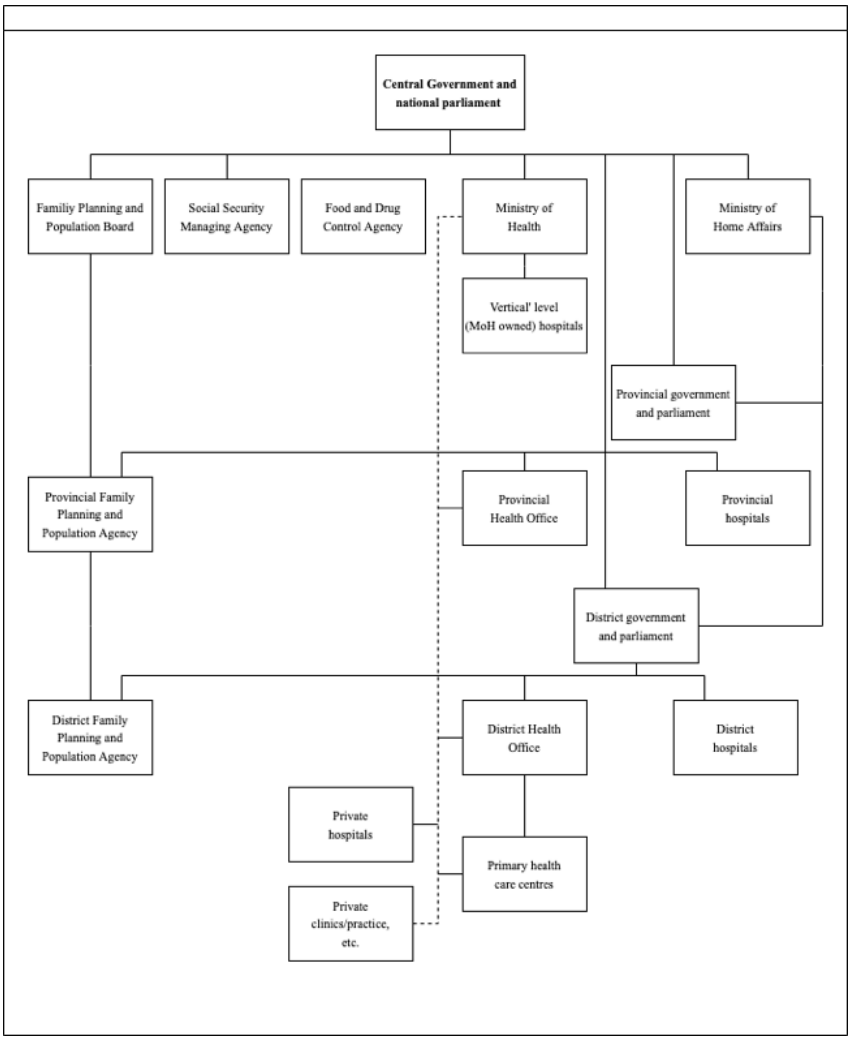

Figure 1.3 Organisation of health system in Indonesia

Source: World Health Organisation (2017)

In Indonesia, the healthcare sector comprised of the public and private. Public sector organisations handle most of the public health provision. In the private healthcare, firms, individuals, and groups of people with religious affiliations own hospitals and primary care clinics. The health sector is something that other public organisations with a national scope are interested in. Regarding the division of local health services between provincial and district/municipality levels. Referring to the *Peraturan Presiden* UU RI No.32 (2004), Provincial governments own provincial hospitals and control healthcare administration through provincial health offices. DHOs also run the primary health centres' networks and their medical services.

However, each hospital level is independent of the health office, and the DHO is independent of the PHO in the decentralized healthcare system. The government and national Parliament oversees the Minister of Health. ‘Vertical' level (MoH-owned) hospitals, Provincial Health Offices, District Health Offices, and Primary Health Care Centres are occasionally overshadowed by health ministers.

Referring to *Peraturan Presiden* UU RI No.40 (2004) this regulation a scheme for general healthcare. This marks the largest overhaul to health services financing after decentralisation and the direct election of the president, governors, regents, and mayors. These recent trends also demonstrate the concerns about social welfare and the need to aid the underprivileged, and all people are rapidly taking centre stage as the main influences on health policy

1. Province Level

   The provincial health office (PHO) is involved in any supporting roles in healthcare, including registration, licensing, accreditation, and certification. Nevertheless, The PHO is not expressly stated as the DHO's reporting or accountability entity.

2. District Level

   Peraturan Presiden UU RI No.38 (2007) states that the DHOs are mandated to organise and implement various health services. The public and private sectors are under the local health authorities' control.

3. Professional and institutional organisations

   National Hospital Association has associations primarily focused on serving central government hospitals, local government hospitals, private hospitals, teaching hospitals, not-for-profit hospitals, and numerous associations of hospitals with religious ties. Local authorities have their own organisations.

4. Non-governmental organisations

   The largest consumer group, the Indonesian Consumer Group, expresses concerns about consumer protection concerning the reliability of healthcare services or the safety of food and drugs. As a result of numerous health challenges, research institutions and advocacy groups also prosper.

5. Development partners

   The health sector may not be the main focus of the World Health Organisations (WHO), but several of these groups have been collaborating with the government to improve the health sector in several ways. Additionally, they collaborate with regional governments, academic institutions, and other businesses on various initiatives to empower communities and build health systems.

Peraturan Presiden UU RI No.32 (2004), decentralisation is the handing over of authority for managing and enforcing governmental obligations from the central government to independent regional administrations. Disappointment quickly replaced the initial exuberance at subnational levels of government, partly due to the quantity of health funding granted in the general allocation budget and the local revenue.

The separation of tasks is further elaborated in Government Regulation *Peraturan Presiden* UU RI No.41 (2007) on Local Government Organisation. Deconcentrating is the transfer of decision from the central government to the governor who serves as its and/or the vertical institutions' representative in each area of responsibility. Assistance tasks are delegated by the province government to the district/municipality, followed by the subdistrict authority and finally the village. The local government oversees making sure that the community has access to resources for health care as well as physical and social health services.

1.3.1 Electronic Health Record in the Healthcare Industry

The pandemic and the revolution of technology have impacted the healthcare industry, currently the implementation of the EHRs has increased in developing countries to improve the quality of service (Adetoyi & Raji, 2020). The adoption of digital technologies, which includes the Internet of Things and Artificial Intelligence, has become a topic of great interest over the last decade, and healthcare sectors across developed countries have already begun to incorporate digital technologies into their service delivery ecosystems (Chakraborty, Bhatt, Chakravorty, & Chakraborty, 2021).

Many healthcare providers still employ paper-based medical records as one of the methods for providing services to patients; hence, manual processes are still required when dealing with patients. The increase from the use of paper-based medical records to EHRs has many advantages, including improving the quality of information, increasing the speed and flexibility of access to medical records, as well as improving the process for making decisions (Jabali, 2017; Severinsen, Silsand, Malm-Nicolaisen, & Pedersen, 2022). Furthermore, adopting EHRs can assist firms in streamlining operating time, overcoming organisational barriers, and operating as an instructional platform (Bushelle-Edghill, Lee Brown, & Dong, 2017). The successful implementation of the EHRs System will contribute to health care quality, increase the capacity of health care system services, and provide flexible services (Hossain, Quaresma, & Rahman, 2019). A convention must be held as a component of the work required to implement EHRs. This is done because it can help enable the use of EHRs in psychiatry, which is highly important for fostering innovation in the use of EHRs in psychiatry and enhancing the quality and efficiency of health care (Levy, Bagley, & Rajkumar, 2018).

One of the objectives of EHRs is to replace the manual recording process on patient health records in order to eliminate patient data inconsistencies and produce accurate data in real-time that is easily accessed by hospitals, clinics, and home care in order to integrate data between healthcare services (Bushelle-Edghill et al., 2017; De Pietro & Francetic, 2018; Hertzum et al., 2021). According to (Gold et al., 2018) accurate EHRs data in documenting patient data in EHRs is utilized in social determinants of health so that it may be observed directly and which cannot be observed by outside parties in real-time. In some cases, real-time data interchange is beneficial for patient action decisions (Hansen & James Baroody, 2020). Hence, based on studied (Liang et al., 2021), discovered that EHRs cross-hospital data sharing and emphasis on clinical intelligent decision making fall into the high level 5 category for implementation EHRs. Real-time information on patient health data is essential since it can provide historical insight on pharmaceuticals that have been supplied and awareness of the disease history of patients.

The Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009 established a national effort to convert healthcare and health technology sharing from a system of paper records kept in silos of file cabinets to mass adoption and usage of "EHRs" (Dunn Lopez et al., 2021). Referring to Henry, J., Pylypchuk, Y. (2016) identify the electronic functions necessary for hospitals to deploy a Basic or Comprehensive EHR system, as determined by a consensus expert panel. Adopting basic EHRs requires establishing each function in at least one hospital unit. However, comprehensive EHRs adoption involves the implementation of each function in all units.

Table 1.1 Comparison Basic VS Comprehensive EHRs

EHR Functions Required	Basic EHR without Clinical Notes	Basic EHR with Clinical Notes	Comprehensive EHR
Electronic Clinical Information			
Patient demographics	v	v	v
Physician notes		v	v
Nursing assessments		v	v
Problem lists	v	v	v
Medication lists	v	v	v
Discharge summaries	v	v	v
Advance directives			v
Computerized Provider Order			
Entry Lab reports			v
Radiology tests			v
Medications	v	v	v
Consultation requests			v
Nursing orders			v
Results Management			
View lab reports	v	v	v
View radiology reports	v	v	v
View radiology images			v
View diagnostic test results	v	v	v
View diagnostic test images			v
View consultant report			v
Decision Support			
Clinical guidelines			v
Clinical reminders			v
Drug allergy results			v
Drug-drug interactions			v
Drug-lab interactions			v
Drug dosing support			v

Source : Krousel-Wood et al. (2018)

The widespread use of EHRs in the healthcare industry allows us to look at how people choose to use new technology in an industry that is significantly regulated and institutionalised (Osop & Sahama, 2018). The statement highlights the significance of EHRs in modern healthcare and emphasizes the opportunity they present for studying technology adoption within a highly regulated and institutionalised industry. In essence, it suggests that adopting EHRs reflects technological advancements and shifts in organisational practices and regulatory compliance within healthcare institutions. Overall, the statement emphasizes the

broader context of EHR adoption, highlighting the interplay between technological innovation, regulatory environment, and institutional dynamics within the healthcare industry. This study aims to provide insights into these complex dynamics and contribute to understanding the factors influencing the adoption of EHRs among public hospitals.

In a prior study by Liang et al. (2021), EHRs adoption in China over the last ten years between 2007 and 2018, the average adoption rate in sampled hospitals in China increased from 18.6 to 85.3 percent, compared to a 9.4 to 96 percent growth in US hospitals between 2008 and 2017. Annual average adoption rates were 6.1 percent in Chinese hospitals and 9.6 percent in US hospitals, respectively. the yearly average number of hospitals adopting EHRs in China was 1500, compared to 534 in the United States, indicating that the former may require more work. Both countries experienced comparable significant challenges when it related to hospital digitization. They fitted this data to the Bass model and analysed the modes of EHRs dissemination in these two nations. They discovered that the number of hospitals that accepted EHRs in China exceeded 16,000, which was 3.3 times that of hospitals that adopted EHRs in the 4814 non-federal US hospitals.

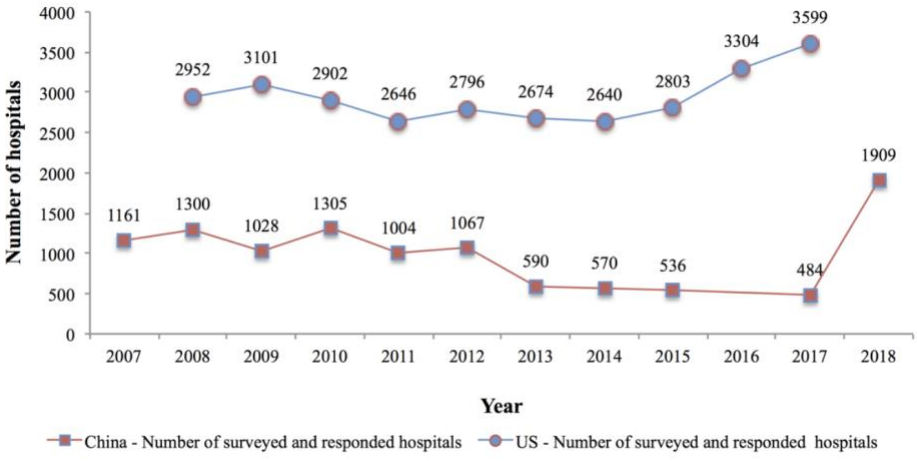

Figure 1.4 Comparison EHRs Implementation China and US

Source: Liang et al. (2021)

Refer to Y.-G. Kim et al. (2017) state that 11.6% of South Korean tertiary teaching and general hospitals had comprehensive EHRs in 2015, with 46.5% having basic systems. EHRs and computerized physician order entry systems were used by 58.1% and 86.0% of hospitals respectively; decision support systems and problem list documentation functions were most frequently missing from comprehensive and essential EHRs systems. Although Korea's EHRs adoption rate has steadily increased over time, its rate is slower than in the US, which may partly account for its disparate rates of adoption - perhaps tied to increased funding from US HITECH Act-linked support accounts for this disparity between the two nations' adoption rates of EHRs adoption rates between countries.

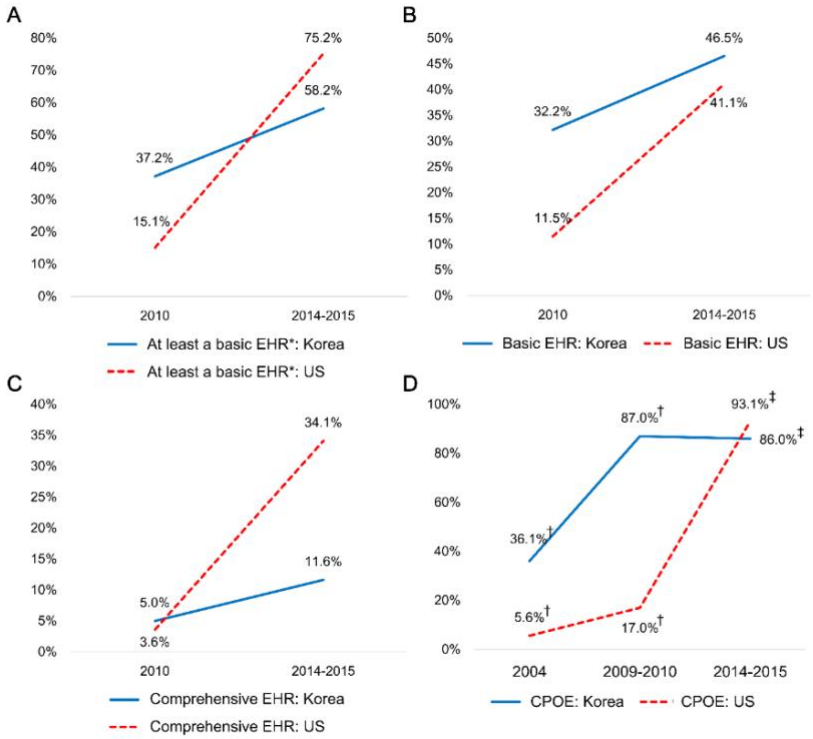

Figure 1.5 Comparison of EHRs Implementation in Korea and the US

Source : Y.-G. Kim et al. (2017)

The Indonesian government has not officially restricted the development of computerised medical/health records. However, the 2008 Electronic Technology Information Law and the 2008 Ministry of Health Regulation No. 269 on the validity

of electronic medical records as legal evidence provide promise for the developing of electronic medical records in Indonesia. The Ministry of Health of the Republic of Indonesia No. 46 of 2017 has endorsed using E-Health; in other words, creating EHRs/EMRs in Indonesia can commence whenever the stipulation is accepted. At the moment, EHRs/EMRs implementation in Indonesia is extremely low due to constraints such as lack of government support, infrastructure readiness, and resources (Pujani, Hardisman, & Nazir, 2019; Yulida, Lazuardi, & Pertiwi, 2021).

The Indonesian government requires that health service facilities (Fasyankes) maintain an electronic patient medical history recording system according to Ministry of Health Regulation 24 of 2022 about medical records (Ministry of Health Indonesia, 2022). This is accomplished because the government is fully conscious of the growth of digital technology in society, which has resulted in the digitization of health services, necessitating the electronic storage of medical records following with the values of data and information security and confidentiality (Rokom, 2022). The government will also allocate a reasonable health budget in 2023 to increase the quality of health services, with information technology systems as a top priority (Indonesia Periksa, 2022). The Indonesian government has taken steps towards adopting of EHRs through the Regulation of the Minister of Health of the Republic of Indonesia Number 24 of 2022. This regulation outlines the implementation of EHRs, activities for organizing these records, and the security and protection of EHRs data (Asyfia, Zaid, Mahendika, & Setyowati, 2023). Furthermore, there has been a significant federal effort in the United States to boost the adoption of EHRs, indicating a global trend towards promoting the use of health information technology (Dunn Lopez et al., 2021).

Indonesia's Minister of Health, Budi Gunadi Sadikin, has shifted the government's focus from pandemic response to improving healthcare quality. The

ministry will allocate a sufficient budget for revitalising healthcare facilities, promotive and preventive programs, and restructuring hospitals to enhance the quality of healthcare for critical illnesses. The ministry will collaborate with regional governments, the Indonesian National Police and the National Defence Forces to maximise the budget. The ministry will also develop the healthcare industry and cooperate with the Ministry of Industry and the Ministry of Education, Culture, Research, and Technology to ensure adequate medical specialist supply.

1.3.2 The issues of Electronic Health Record

According to previous study, mostly government regulatory as barriers refer to the rules and restrictions established by government entities that might inhibit healthcare organisations' adoption and usage of EHRs adoption (Adler-Milstein & Jha, 2017; Bushelle-Edghill et al., 2017; Daley, Krushel, & Chevan, 2020; Esdar et al., 2019; Hansen & James Baroody, 2020; Hu, Qu, Houser, Chen, et al., 2020; Jabali, 2017; Kanakubo & Kharrazi, 2019; Liang et al., 2021; Plantier et al., 2017; Spivak et al., 2021). Several aspects also need to be considered in the adoption of EHRs such as data privacy protection (Esdar et al., 2019; Hu, Qu, Houser, Ding, et al., 2020; Liang et al., 2021) and security standards (Esdar et al., 2019; Levy et al., 2018; Liang et al., 2021; Vest et al., 2019), and lack of finance for the installation of EHR systems are examples of these obstacles (Adler-Milstein & Jha, 2017; Goldstein et al., 2019; A. J. Holmgren et al., 2021; Jabali, 2017; Kanakubo & Kharrazi, 2019; Levy et al., 2018; Liang et al., 2021; Lite et al., 2020; Tarver & Menachemi, 2018). Some government programs, such as the HITECH Act in the United States, have been created to assist in overcoming these obstacles and promoting the broader adoption of EHRs.

The most significant impediment to EHR adoption is the expense of deployment and maintenance (Liou, Lu, Hu, Cheng, & Chuang, 2017). The hospital

can decide to purchase pricey EHRs and technology and EHR implementation requires software, hardware, personnel training, and system integration (Greysen et al., 2020; Kariotis & Harris, 2019; O'Donnell, Kaner, Shaw, & Haighton, 2018; Priestman, Vigne, & Sebire, 2018; Siregar et al., 2018; Vehko et al., 2019). To maximise the potential of these crucial technology resources, the healthcare business must be adequately funded. To increase use, administrators anticipate increased financial commitment. Financial commitment is the most important criterion for EHR adoption in the healthcare industry. Refer to Siregar et al. (2018) explained that numerous barriers exist in the implementation of EHR technology, including the system's complexity, a lack of competent health informatics staff, organisational issues, the requirement for coordination between local and national governments, data utilisation issues, and data interoperability issues.

1.4 Problem Statement

The comprehensive problem of adopting EHRs in Indonesia encounters many obstacles, mainly from an intersection of technological, infrastructure-based, and organisational barriers. In response, the Indonesian Health Ministry has legislated that by December 31, 2023, all healthcare institutions must switch from physical medical records to EHRs (Mulyanto, 2023; Now, 2023). According to Pandamsari (2023) Only 13% of hospitals in Indonesia have optimally adopted of EHRs, Hospitals in Indonesia are clearly struggling to integrate health records and digitalize processes, unfortunately, it is challenging. The core problem that led to the adopting EHRs in Indonesian hospitals is the inefficiency and inadequacy of traditional paper-based record-keeping systems. These systems are cumbersome, error-prone, and inefficient,

leading to numerous challenges in managing patient information, coordinating care, and ensuring timely access to critical medical data.

This rule acts as a supportive regulatory framework for executing health technology transformation, which is one of the pillars of Indonesia's health transformation (Mulyanto, 2023). With this transformation, there is a responsibility to arrange medical information based on the capacities of various institutions. Moreover, administrative difficulties such as a lack of resources and poor training must be addressed for successful EHR adoption.

On the first hand, Indonesia has limited technology infrastructure and interoperability standards, which inhibit the efficient exchange of health data between various healthcare providers. The quality of ICT infrastructure is still limited in Java and Sumatra (Agahari, 2018). The development of metropolitan cities outside Java Island can also help with equitable development and increase Indonesia's economic growth (Pujani et al., 2019). Furthermore, there is an urgent requirement for extensive legislative frameworks to guide the implementation of EHRs, guaranteeing the protection of data, privacy, and the establishment of consistent procedures throughout the healthcare system. The lack of an integrated approach and varying levels of digital capability among healthcare practitioners also complicate the successful adoption of EHRs into current healthcare frameworks (Hospital Insights Asia, 2019). Moreover, the financial limitations provide a substantial barrier, as the expenses linked to the adoption, upkeep, and education of EHRs burden the resources of several healthcare establishments. To address these problems, it is necessary to have a well-coordinated approach incorporating government initiatives, partnerships with the corporate sector, and a strong commitment to establishing a reliable and standardised EHR

infrastructure. This would help improve healthcare delivery and improve the patient experience in Indonesia.

Several developing and developed countries are implementing EHRs to encourage digitalisation in the healthcare industry and encourage the health revolution (Jianxun et al., 2021). Technological changes at this time forced the healthcare industry to develop due to the lack of weak market competition; typically market competition breeds, so the role of technology as a fundamental asset to prepare accurate information to create good services quality (Hossain et al., 2019; Richards, Prybutok, & Ryan, 2012). According to Anand & Fosso Wamba (2013), healthcare ecosystem needs of a transformational change to recover from massive economic loss. Unfortunately, according to Oliver Wyman's Analysis (2018) represented in figure 1.6 an estimated $303 billion-worth of healthcare opportunity cost is lost annually with the sum of economic output lost from diseases and outbound medical tourism has a heavy impact on the economy of Indonesia. However, $130 billions of this opportunity cost could potentially be recovered by addressing unmet healthcare needs.

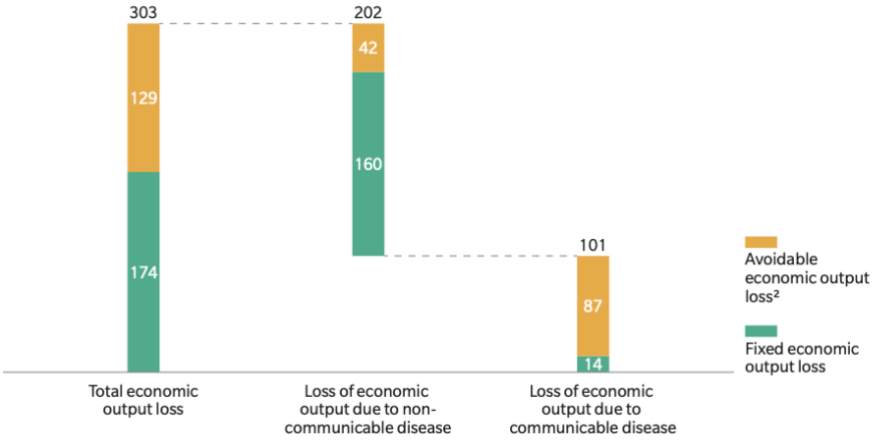

Figure 1.6 Indonesia Economic Output Loss

Source: Oliver Wyman Analysis (2018)

The introduction of health technologies in Indonesia has shown positive performance in the delivery of healthcare services, but they are still undertaken by select higher education institutions, their use is not holistic view within Indonesia, and the government's e-Health policy is unclear (Nugraha & Aknuranda, 2017). Hence, The current problem is that the adoption of the EHRs in Indonesia is very low due to several aspects that must be prepared from the hospital or from supporting aspects (Rahmadiliyani, Putri, & Gunarti, 2019).

Based on McKeering, Norton, & Gulati (2017) showed EHRs adoption and internet penetration, Indonesia was included in the low quadrant for EHRs adoption among South East Asia countries. Instead, guidelines by the Ministry of Health Indonesia (2022) were released to formulate and implement health technology policies. It is also responsible for managing and supervising health services and facilities in Indonesia to ensure they are safe and effective for patients.

Currently, the healthcare industry in Indonesia is massively hiring human resources with IT skills to support daily operations that will be carried out to improve patient service (Hospital Insights Asia, 2019). According to Wang & Hajli (2017a), technology developments lead to changes in healthcare operations, and hospitals must have prepared a competent team of IT personnel to support the hospital's operations. An organisation unwilling to improve human resource competencies will experience difficulties in competitiveness and changing market dynamics as a core business or as a supporter in the healthcare ecosystem (Baloc, Sha, & Panhwar, 2014). Besides that, According to Bain & Company (2020) from “Asia-Pacific Front Line of Healthcare Report 2020,” the availability of high-tech facilities is challenging for Indonesia to support the Indonesia Hospital-centric market. However, the unavailability of infrastructure is an obstacle to implementing EHRs since the infrastructure supports

data exchange and even data storage for the EHRs (Frisina, Munene, Finnie, Oakley, & Ganesan, 2020; Y. Wang & Hajli, 2017). Referring to Iyanna et al. (2022) identifying the availability of current technology at the hospital, such as Internet connectivity, will prevent patients from monitoring the hospital's existing system. Besides the infrastructure issue, the objective of the adoption of the EHRs is the existence of a centralized exchange of information so that there is data management that must be adequately prepared to support exchange data among healthcare providers in Indonesia (Badan Pengkajian dan Penerapan Teknologi, 2020). ICT infrastructure equity in Java is an effort to build information and communication technology infrastructure evenly throughout Indonesia (KOMINFO, 2019).

However, due to the ubiquitous nature of data, when using massive data from multiple sources, the impact of data streams on data quality is uncertain, and there is an understanding of the importance of data quality, which complicates governance (Janssen et al., 2020). Organisations must improve to cope with uncertainty, rapid environmental changes, globalisation, and increasing complexity in executing every activity (Suprapto, 2018; Tepic, 2013).

Furthermore, data is the primary source of interaction and potential outcomes in data collaborations, it is often required to define the problem in terms of accessibility. According to the previous literature, data on implementation represents one of the barriers to implementing EHRs, namely data integration (Atasoy, Chen, & Ganju, 2018; Gold et al., 2018; Hansen & James Baroody, 2020; Hertzum et al., 2021; Liang et al., 2021; Vest et al., 2019), data security (Esdar et al., 2019; Levy et al., 2018; Liang et al., 2021; Vest et al., 2019), data standardisation (Daley et al., 2020; De Pietro & Francetic, 2018; Hansen & James Baroody, 2020; Levy et al., 2018; Poulos, Zhu, & Shah, 2021) data privacy (Esdar et al., 2019; Hu, Qu, Houser, Ding, et al., 2020; Liang