AN EVALUATION OF THE USER PERFORMANCE IMPACT: HEALTH INFORMATION SYSTEM USE IN KUWAIT PUBLIC HOSPITALS

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LIST OF ABBREVIATIONS

AVE	Average Variance Extracted
CMV	Common Method Variance
CR	Composite Reliability
EM	Expectation Maximization
ER	Emergency
HIM	Health Information Management
HIS	Health Information System
HTMT	Heterotrait-Monotrait Ratio
ICT	Information Communication Technology
IS	Information System
IT	Information Technology
PLS	Partial Least Squares
SEM	Structural Equation Modelling
SPSS	Statistical Package for the Social Sciences
TTF	Task Technology Fit
VIF	Variance Inflation Factor

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PENILAIAN IMPAK PRESTASI PENGGUNA: PENGGUNAAN SISTEM MAKLUMAT KESIHATAN DI HOSPITAL AWAM KUWAIT

ABSTRAK

Penggunaan Sistem Maklumat Kesihatan (HIS) dalam sektor penjagaan kesihatan berkembang pesat di banyak negara maju dan negara membangun. Namun begitu, pertumbuhan yang luar biasa tersebut dalam pelaksanaan Teknologi Maklumat dan Komunikasi di sektor penjagaan kesihatan mampu memberi tahap kerumitan dalam pelaksanaannya menjadi berkembang tinggi serta mewujudkan kesukaran terhadap organisasi penjagaan kesihatan. Kerajaan Kuwait telah membelanjakan sejumlah peruntukan yang besar untuk melaksanakan HIS di kalangan kemudahan penjagaan kesihatan dan ia perlu memastikan bahawa HISs mengekalkan matlamat mereka dari segi memenuhi keperluan-keperluan pengguna, meningkatkan kualiti, dan prestasi kerja. Malah, telah diperhatikan bahawa terdapat kekurangan terhadap kajian penilaian dan penyelidikan mengenai pelaksanaan HIS di Kuwait (Alhuwail, 2020). Oleh itu, tujuan penyelidikan ini adalah untuk menilai prestasi pengguna HIS kerana ia adalah penting untuk menentukan kejayaan IS, dengan menentukan factor yang mempengaruhinya. Untuk berbuat demikian, penyelidikan ini telah dibangunkan dengan menggunakan Model Kejayaan Sistem Maklumat DeLone dan McLean sebagai teori asas yang bersepadu dengan teori Pemautan Teknologi Tugas, Kepercayaan, dan Rintangan Pengguna. Kajian ini menggunakan pendekatan kuantitatif. Data dikumpulkan melalui soal selidik keratan rentas berstruktur sendiri yang diedarkan di kalangan pengguna HIS di tiga buah hospital awam. Kaedah persampelan purposif telah diikuti untuk menentukan sampel kajian. Kajian mendapati

bahawa kualiti sistem, kualiti maklumat dan kualiti perkhidmatan mempunyai kesan positif terhadap kepercayaan bersama-sama dengan TTF. Manakala kepercayaan memberi kesan negatif terhadap rintangan pengguna, yang seterusnya memberi kesan negatif terhadap penggunaanNYA. Didapati juga bahawa kualiti maklumat, kualiti sistem dan kualiti perkhidmatan memberi impak positif kepada TTF, yang seterusnya memberi kesan kepada penggunaan HIS dan prestasi pengguna. Kajian membuktikan bahawa ciri individu mempunyai kesan positif terhadap TTF, tetapi ciri tugas didapati tidak mempengaruhi TTF. Selain itu, kajian menunjukkan bahawa TTF dan kepuasan pengguna mempunyai kesan positif terhadap prestasi pengguna. Adalah disyorkan bahawa faktor yang mempengaruhi yang diketengahkan harus diambil kira oleh pihak pengurusan, perancang, pembangun sistem dan pembuat keputusan ke arah penambahbaikan

AN EVALUATION OF THE USER PERFORMANCE IMPACT: HEALTH INFORMATION SYSTEM USE IN KUWAIT PUBLIC HOSPITALS

ABSTRACT

In many developed and developing nations, health information systems (HIS) are increasing rapidly in the healthcare industry. Despite the great development in the application of information and communication technologies (ICT) in the healthcare sector, implementation complexity is increasing, posing challenges for healthcare organizations. Kuwait Government has spent significant investments in implementing HIS among healthcare facilities, and it must be ensured that the systems are maintaining their goals of meeting the users' needs and requirements and increasing work quality and performance. Certainly, it has been noted that there aren't enough evaluation studies and research on HIS adoption in Kuwait. (Alhuwail, 2020). Therefore, this research aims to assess HIS user performance as it is important to determine the IS success by determining its influencing factors. To do so, the basic theory for this study was the DeLone and McLean Information System Success Model, integrated with Task Technology Fit theory, Trust, and User resistance. A cross-sectional, self-structured questionnaire was used to collect data. According to the study, trust and TTF are positively impacted by the system, information, and service quality. Whereas trust negatively affects user resistance, which negatively affects HIS use. It was also found that information, system, and service quality positively impact TTF, which consequently affects both HIS use and user performance. Furthermore, the study proved that individual characteristics positively impact TTF, but task characteristics did not influence TTF. The research also showed that TTF and user satisfaction positively impact user performance. It is recommended that the

highlighted influencing factors be considered by management, planners, system developers, and decision-makers for improvement.

1.1   Introduction

The emerging role of Information Technology (IT) in the healthcare domain is undeniable. IT offers many great opportunities in terms of refining and redefining healthcare systems in general. A summary of the research is presented in this first chapter, with a complete description of its goal, followed by the research background, problem, objectives, research questions, study importance, definitions of important words, and general structure. The main aim of this research is to assess the implemented health information systems of public hospitals in Kuwait. Three public hospitals were selected to conduct the study. The health information system (HIS) is a tool for gathering, processing, retrieving, and sending clinical, financial, and administrative data (Bouraghi et al., 2022)

In the previous decade, information technology has been widely used in practically every part of life, including the healthcare industry. As a result, there were tremendous beneficial engagements and technology developments in the healthcare field. The HISs are considered innovations in healthcare organizations that have changed performance values by improving healthcare delivery and services. The goal of HIS as a branch of medical informatics is to enhance the quality of health procedures and provide developments for future administration (Alhuwail, 2021).

In healthcare facilities, timely and accurate information and data availability are big decision-making issues. The necessary data must be efficiently acquired, processed, stored, retrieved, and transmitted to make successful judgments. The HIS has the feature to proceed with the data handling process so that useful information

can be extracted for decision-making, health planning, and allocation of resources to provide quality service (Wager et al., 2017). The HISs were found to have many benefits, such as providing accurate, complete, understandable, and reliable information; increasing access to information; reducing task time, and reducing costs. It also enhances individual and organizational performance and facilitates interactions among providers as part of care transmissions (Esmaeilzadeh, 2022).

Although the recognized advantages of HIS, its adoption is associated with many challenges related to internal and external factors. Challenges may include, but are not limited to, issues related to system usability, data exchange policy, financial investments, and end-user resistance to the system. Detailed focus on the barriers and challenges associated with HIS implementation are discussed later in Chapter 2.

It is worth noting that HIS implementation is a socio-technical process, i.e., it is not considered a technical project only but rather a project that involves the information system itself, the end-users, and the healthcare organization (Sligo et al., 2017). As a result, many HIS implementation efforts are likely to fail. Hospitals must, therefore, carefully evaluate the HIS to ensure that it satisfies the organization's and end users' operational goals, which must be included in the deployment process to guarantee that their demands are addressed. In addition, managers must have a strong degree of involvement and digital literacy that allow them to appropriately enhance the quality of the HIS.

This study intends to examine the impact of Kuwait's established HIS on user performance from the viewpoint of its users. The word HIS will be used to refer to medical records, electronic health records, healthcare information systems, and health information technology throughout this study.

1.2   Background of the Research

Kuwait is one nation that offers its inhabitants a high degree of health development and services through 94 primary healthcare clinics, 81 diabetes clinics, six general public hospitals (one in each health zone), and nine specialty public hospitals. Kuwait has general hospitals, which cover practically all medical specialties, and specialized hospitals, which focus on a single specialty (for example, an orthopedic hospital, ophthalmology hospital, etc.). Additionally, Kuwait has 12 hospitals in the private sector and three hospitals that are owned by oil firms that provide healthcare (Division Health and Vital statistics, 2019).

The Ministry of Health initiated a project for shifting towards IT-based healthcare information systems around the country. The first step was installing an electronic medical records system at primary care facilities in 2003. Later in 2006, the implementation of HIS was initiated by three general public hospitals. Patient health records are currently digitized at a few hospitals, but there is no link between them, and the rest of the hospitals still use a manual method.

The targeted healthcare organizations of this study are three public hospitals in Kuwait that use the same HIS in parallel with the manual approach. These hospitals would be referred to as "Hospital A, Hospital B, and Hospital C". The remaining public hospitals use different HISs in parallel with the manual approach or only the manual one. The reason for choosing these hospitals is due to the long period of HIS implementation so that a judgment could be taken towards system outcomes. In addition, these hospitals are located in heavily populated areas that serve many patients, which brought the need to provide and facilitate high-quality services to those

populations by using efficient HIS. Table 1.1 shows the attributes of the selected hospitals (Division Health and Vital statistics, 2019).

Table 1.1

Attributes of the selected hospitals

	Hospital A	Hospital B	Hospital C
Year of establishment	1982	1980	1981
Year of HIS implementation	2006	2006	2006
Employee size	3826	4321	3787
Number of patient visits per year	825,533	1,474,000	1,226,236
Number of Beds	725	868	785

As stated earlier, by 2006, the Ministry of Health started the project of HIS implementation in "Hospital A", "Hospital B", and "Hospital C" with an initial vision and goals, followed by system adoption after a few months. The implementation project was created to offer a collection of components allowing healthcare professionals and other users to improve their work processes, thereby raising the standard of hospital services. The main goal of the adopted HIS project was to use a standardized, integrated electronic health record system, which leads to increased efficiency and improved quality of patient healthcare. Other goals include improving patient safety by ensuring data accuracy, accessing the needed information easily, eliminating paper use, enhancing employees' performance, improving the quality of services, saving time on tasks' performance, supporting decision-making, and saving costs.

The implemented HIS has many important properties, including providing ease of use and development of electronic health records, serving all medical specialties

and hospital management, supporting Arabic and English languages, supporting interoperability with other systems, providing security and confidentiality of information, and the ability to modify and upgrade. In addition, the system has unified core modules with the opportunity to add more specific modules based on specific requests of healthcare management decision-makers. Technical support is provided by the HIS team, who is also responsible for training users, providing workshops, solving any related problems, providing the needed modifications, and ensuring proper system performance.

However, when the project was first initiated, the plan was to use the manual system in parallel with the electronic system as an initial phase until a final decision of full electronic use was released. A review with the project management revealed that 20% of the clinical tasks were automated when the HIS was first adopted, and recently, 80% of the tasks have been electronically operated in the selected hospitals, as reported in the statistical report of the Ministry of Health (Division Health and Vital statistics, 2019). This reveals a delay in the implementation process.

Given the above, despite the huge investments, the HIS in Kuwait public hospitals is still not fully operating by end users. Some tasks are still being performed manually, although the electronic system has been adopted. Additionally, the non-clinical functions of the system are still not fully implemented or functioning as it aimed to. This indicates a delay in the country's health vision 2035, which aims to implement e-health projects in all healthcare facilities.

Using both systems in parallel leads to increased workloads on users by duplicating the performed tasks, which decreases their satisfaction with the new system and consequently increases their resistance. In addition, higher costs are

required to operate both systems, which contradicts the goal of HIS implementation (McDonald, 1997). Accordingly, it might be thought that the implemented system is not effective or successful in meeting the desired goals of implementation.

1.3   Research Problem

As discussed in section 1.1, the Ministry of Health in Kuwait has invested much in the past 16 years to establish ICT infrastructure and implement HIS in public sector hospitals. In 2017, the investments were estimated to be around 100,000 Kuwaiti Dinar. It was stated that the increasing rate of costs is 12% of the total investments each year (Division Health and Vital statistics, 2019). This is likely due to widespread conviction that the HIS may improve service delivery to customers, including internal users like physicians, nurses, administrators, and managers, and external users like patients.

Because HIS deployment necessitates a significant investment in supplying hardware, software, training, maintenance, and communication infrastructure, the number of investments will steadily rise to sustain HIS implementation in all healthcare institutions. This brings the need to ensure that the system maintains the goals of meeting the users' needs and requirements, increasing work quality, and improving users' performance.

Thus, investigating user performance impact is important because improved user performance indicates that HIS implementation is a successful and worthwhile investment (DeLone & McLean, 2016). Although the user performance impact is a determining factor of information system (IS) success (Dalle et al., 2020), it is a rarely described outcome in the literature (Tam et al., 2019). User performance impact can be demonstrated by higher individual productivity, improved job performance,

increased effectiveness and efficiency of work, time savings, eliminate repetition, enhanced access to information, improved quality and security of patient care, and improved problem identification skills (Zaineldeen et al., 2020).

However, it should be noted that if the system fails to match the user's needs or fails to increase user performance impact even after successful adoption, it may result in unfavorable costs or wasted effort. In this regard, Goodhue and Thompson (1995), in their model Task Technology Fit (TTF), highlighted the importance of fit among the user needs and the IS functionality in increasing users' performance. TTF is the compatibility of work needs, individual talents, and the technology's functioning and interface (Goodhue, 1997). When users perceive a mismatch between the system's limited functionality and work requirements, their performance suffers (Malakoane et al., 2020). Failure to recognize users' needs during IS implementation may generate user resistance and system failure (Lee et al., 2021). Unfortunately, TTF theory was found to have less application in the HIS field (Valaei et al., 2019).

On the other hand, it was discovered that trust was crucial in the HIS setting and might influence user performance in a positive way (Asmri et al., 2020). In the case of this study, a lack of sufficient user trust in the system may influence users to execute activities manually or inefficiently, which is a system failure. This highlights the necessity to examine the function of trust in the context of HIS and identify its causes. Creating a culture of trust among system users helps them see the value of HIS and inspires them to utilize it (Dhagarra et al., 2020).

Furthermore, trust is vital since it mitigates the feelings of danger and uncertainty that come with trying new things (Chouk & Mani, 2022). The absence of trust might lead to user resistance, which is one of the most difficult aspects of

implementing large-scale information systems. As a result, resistance and subsequent dishonest use under forced settings are important factors that influence user performance impact (Ilie & Turel, 2020). Therefore, among the key issues associated with HIS implementation failure, user resistance is one of the most remarkable factors related to user performance impact (Heath et al., 2022). According to Goodhue and Thompson (1995), failing to comprehend user resistance can lead to worse user performance and major difficulties. It has been noticed that user resistance has little attention in IT research (Klein et al., 2022) and in healthcare settings in specific (Asiedu et al., 2018; Cho et al., 2021).

In addition to the problems mentioned above, it has been noted that clinical and administrative operations are concurrently conducted manually and electronically in the chosen facilities. This dual use of manual and electronic systems is believed to increase time and effort consumption, which results in user resistance. Besides, it allows the user to perform tasks manually, leading to lower user performance impact.

Unfortunately, there aren't enough evaluation studies and research on HIS adoption in Kuwait (Alhuwail, 2020), which decreases the ability to monitor, guide, evaluate, and improve HIS implementation in the country. Without the assessment studies in Kuwait concerning HIS, it is impossible to investigate whether the implemented HIS successfully increases user performance impact and enhances healthcare services.

1.4   Research Objectives

This study aims to evaluate the user performance impact of the implemented HIS in "Hospital A", "Hospital B", and "Hospital C" and its influencing factors as an attempt to assess whether the HIS is achieving the final goals and outcomes, which

shape healthcare quality. In addition, the research focuses on evaluating user performance impact to ensure that heavy investments in HIS implementation in Kuwait public hospitals will not be wasteful. Furthermore, understanding how information systems affect users' performance impact is beneficial because it may aid in creating new techniques for employing information systems and analyzing their effects on the organization and users.

Moreover, the study aims to evaluate the crucial factors influencing the impact of HIS users' performance. The assessment is based on the perspectives of the HIS users, mainly in the light of IS success dimensions of DeLone and McLean model, TTF theory, integrated with trust and user resistance constructs. Since users are the ones who utilize the system, their opinions are crucial for evaluating the efficacy of HIS applications (Nursyamsiet al., 2020).

The research objectives are formulated as below:

1. To investigate the influence of system quality on trust.

2. To investigate the influence of information quality on trust.

3. To investigate the influence of service quality on trust.

4. To investigate the influence of trust on HIS use.

5. To investigate the influence of trust on user resistance to HIS use.

6. To investigate the influence of HIS use on user satisfaction.

7. To investigate the influence of user satisfaction on user performance impact.

8. To investigate the influence of system quality as technology characteristics on TTF.

9. To investigate the influence of information quality as technology characteristics on TTF.

10. To investigate the influence of service quality as technology characteristics on TTF.

11. To investigate the influence of task characteristics on TTF.

12. To investigate the influence of individual characteristics on TTF.

13. To investigate the influence of TTF on HIS use.

14. To investigate the influence of TTF on user performance impact.

15. To investigate the influence of user resistance on HIS use.

1.5 Research Questions

1. Does system quality influence trust toward HIS use?

2. Does information quality influence trust towards HIS use?

3. Does service quality influence trust towards HIS use?

4. Does trust influence HIS use?

5. What is the relationship between trust and user resistance to HIS use?

6. Does HIS use influence user satisfaction?

7. Does user satisfaction influence user performance impact?

8. Does system quality as technology characteristics influence TTF?

9. Does information quality as technology characteristics influence TTF?

10. Does service quality as technology characteristics influence TTF?

11. Do task characteristics affect TTF?

12. Do individual characteristics affect TTF?

13. Does TTF influence HIS use?

14. Does TTF influence user performance impact?

15.   Does user resistance influence HIS use?

1.6   Significance of the Study

This study aims to be a great effort to assess the implementation of HIS in Kuwait public hospitals. The study aims to investigate user performance impact and its influencing factors to assess HIS implementation success in Kuwait public hospitals and to compare these findings to those of other studies undertaken in industrialized and developing nations. It also contributes to the limited information on the deployment and execution of HISs in underdeveloped nations, particularly Kuwait.

1.6.1   Theoretical Contribution

This study will be useful from a theoretical and practical perspective. First, the study extends and validates a research model by including the TTF model, trust, and user resistance in the DeLone and McLean model. As a result, examining their impact on HIS use, user satisfaction, and user performance impact, those constructs' significance in HIS settings is highlighted. It is anticipated that the study would add to the body of knowledge regarding the factors influencing HIS users' performance, particularly in Kuwait. As far as we know, the Kuwaiti healthcare industry hasn't yet looked at how the implementation of HIS has affected user performance.

1.6.2   Practical Implication

The conclusions of this study should be considered by governments, hospital administrators, senior management teams, and HIS developers who influence HIS implementation projects as a practical contribution to effective policy formation and execution. The framework produced in this study may be utilized as a reference for

analyzing and evaluating the aspects that will help them make decisions, in addition to forecasting the probable effects that will lead to improvements in the HIS implementation process. More significantly, the study is expected to aid leaders in improving trust among HIS users, which is critical for effective implementation.

In addition, the study clarifies to the managers the possibility of developing user attitudes of resistance after the implementation. Recommendations will be presented and discussed by considering the causes of resistance to avoid its occurrence.

However, since the study is based on evidence collected from the selected hospitals, it forms a solid basis for providing solutions and recommendations generated from the available information better to administer the needed development at public healthcare facilities. More importantly, the study will provide evidence of whether the implemented HIS in Kuwait public hospitals is fulfilling its goals and worth the budget, time, and effort invested.

The significance of this research derives from the fact that such systems still have a low adoption rate in Kuwait and must be properly investigated to see whether they live up to expectations and are cost-effective. For example, the HIS adoption rate in 2006, 2013, 2016, and 2018 was 19%, 25%, 31%, and 43%, respectively (Division Health and Vital statistics, 2019). Indeed, the study may be influential in motivating top management for real change. However, the novelty of this study presented in integrating trust with the D&M model in healthcare settings, integrating user resistance with the D&M model in healthcare settings, and investigating the relationship between trust and user resistance in healthcare settings.

1.7　Definitions of Key Terms

DeLone and McLean information system success model: a framework for evaluating the efficiency of information systems that proposed six independent criteria, including information quality, system quality, service quality, system utilisation, user satisfaction, and net benefit (DeLone & McLean, 2003).

Health information: any information generated or obtained, whether orally or in writing, and regardless of format, by a healthcare practitioner, health plan, public health agency, employer, life insurance, school, or healthcare clearinghouse It has to do with a person's past, present, or future physical or mental health or condition, the provision of healthcare to that person, or the past, present, or future payment for such treatments (Wager et al., 2017).

Health information system: is a tool for gathering, processing, storing, retrieving, and transmitting clinical, financial, and administrative data (Bouraghi et al., 2022).

Health information system implementation: a set of procedures that converts a software system from a business concept to a fully functional HIS, typically taking the place of an earlier or legacy system with limited functionality and capabilities (Balgrosky, 2019).

Individual characteristics: the qualities of system users that may impact or affect how the system is used (Goodhue & Thompson, 1995).

Information quality: the qualities of the system's intended goals (DeLone & McLean, 2016).

Information system evaluation: a central activity by which the achieved results of a particular technology are assessed over time to suggest new strategies and seek best practices (Abdulkareem & Ramli, 2021).

Public hospital: a government-owned hospital that is fully funded by the government to support healthcare operations. This hospital offers patients free medical care in some nations, with government funding covering costs and employees ("*Public Hospital*," 2019).

Service quality: The degree of assistance given to system users by the information system organization and IT support personnel (DeLone & McLean, 2016).

System quality: Ease of use, system flexibility, system dependability, and ease of learning, along with system qualities of intuitiveness, complexity, and reaction speed, are all desired properties of an information system (DeLone & McLean, 2016).

Task characteristics: the actions that an individual carries out to turn inputs into outputs (Rahi et al., 2020).

Task technology fit: The compatibility of work needs, individual talents, and the technology's functioning and interface (Goodhue, 1997).

Trust: In uncertain and risky circumstances, the readiness to rely on and be subject to an IS (Mayer et al., 1995; Wang & Emurian, 2005).

TTF Theory: Goodhue and Thompson (1995) built a model as a theoretical framework for information systems research that examines aspects like task fit and performance (Omotayo & Haliru, 2020).

Use: The extent workers and consumers use an information system's capabilities (DeLone & McLean, 2016).

User resistance: the behave that shields individuals from the repercussions of real or envisioned change (Zander, 1950).

User satisfaction: user perceptions of the product's use, including both short- and long-term metrics (DeLone & McLean, 2016).

User performance impact: the extent to which a technology application improves work quality by helping employees complete jobs quickly, gain control over it, reduce errors, and perform more efficiently (Aldholay et al., 2019).

1.8   Organization of the Chapters

There are five sections to this study. Chapter 1 described the study, along with some background information, goals, and objectives of the investigation. A synopsis of the research topic, research questions, and the study's contribution is also included. Chapter 2 summarizes the HIS, explores pertinent literature, and examines the theoretical framework employed in this investigation. The research approach is covered in Chapter 3. It contains details on the target audience, the sample and sampling procedures, the unit of analysis, the research and questionnaire design, data collecting, statistical testing, and analysis. Chapter 4 presents the statistical analysis based on the questionnaire. Finally, in Chapter 5, the study's results are addressed along with the theories and literature on the subject before the overall conclusion and suggestions for additional research.

CHAPTER 2

LITERATURE REVIEW

2.1   Introduction

This chapter provides the HIS, which serves as the study context's background. Following is a discussion of the literature review and empirical information about the use of HISs. Following that, an overview of IT adoption theories is explored, leading to the conceptual model's construction. Finally, the study's research structure and hypotheses are presented.

2.2   Background of HIS

As information systems have been embedded in almost all work fields, its implementation within the healthcare sector is our concern in this research. The medical business has been evolving for about two decades, thanks to the introduction of HISs that provide complete converged medical treatment in developed and developing nations (Heath et al., 2022). HISs are crucial for obtaining universal health care on a global scale. Therefore, it is necessary to define the phrase "health information" to grasp and comprehend the information that will be covered in this research paper.

Health information is defined under the Health Insurance Portability and Accountability Act (HIPPA), which federal legislation provides precautions to prevent the unauthorized disclosure of people's health information "any information, whether oral or recorded in any form or medium, that is created or received by a healthcare provider, health plan, public health authority, employer, life insurer, school or university, or healthcare clearinghouse. It relates to the past, present, or future physical

or mental health or condition of an individual, the provision of healthcare to an individual, or the past, present, or future payment for the provision of healthcare to an individual" (Wager et al., 2017). Health data is handled using HIS, a complete, integrated, and specialized information system created to manage hospitals and other healthcare facilities' administrative, financial, and clinical components (Bouraghi et al., 2022). The HIS was designed to enhance data management, such as data gathering, analysis, storage, and network transfer, all used to deliver timely and high-quality data for organizational decision-making. As a result, it improves patient coordination, management, and safety in healthcare (Lin et al., 2022).

The two categories into which HISs are divided based on their purpose and the kind of data they hold are administrative and clinical information systems. An administrative information system, as it is called, provides administrative functions and is mainly related to the management of the healthcare organization. In contrast, healthcare providers and clinicians use a clinical information system because it deals with clinical and health-related information concerning a patient's diagnosis, treatment, and monitoring (Khobi et al., 2020).

2.3   History of HIS

The development of HISs has been linked to computer technologies. The development of HIS and technology in the 1960s and the growth of computerization happened simultaneously. The first healthcare computer applications were developed by very few organizations that could afford to hire expensive mainframe programmers and purchase the necessary hardware. Early software programs mostly served accounting and financial goals, with only a few examples of specialized clinical research apps developed by these organizations' data processing sections. Because

finance departments handled budgets and accounting information, early HIS was primarily used to assist hospital finance and accounting departments.

Things began to shift in the 1970s with the introduction of air-cooled minicomputers. In addition, hospital financial software programs were provided and supported by companies. These were the early stages of HIS and technological development, allowing vendors to create specialized systems that allowed local hospitals and institutions to share the usage of mainframe computers with larger hospitals. Clinical systems, such as clinical laboratory and pharmacy systems, were created as a result, but administrative systems were only found in major institutions due to the massive size of mainframe computers, which required large storage facilities.

The minicomputer was created in the 1980s, drastically altering how HISs were utilized. Because they were more compact, generated less heat, were more economical, and could be maintained more easily because they could be cooled with less expensive air conditioning instead of water, minicomputers fiercely competed against the expensive, water-cooled mainframes of the 1960s and 1970s. In addition, these minicomputers replaced the systems engineers and other highly trained personnel needed for mainframe maintenance, which was more efficient and less expensive to purchase and run. But to run and maintain them, they also required smaller and less expensive personnel. As a result, the cost of automation decreased due to this trend, benefiting hospitals, major clinics, and even sizable medical practices. The outcome was the development of therapeutic applications and increased adoption of traditional financial accounting systems (Balgrosky, 2019).

The advent and widespread usage of the Internet in the 1990s provided several benefits in making information more accessible to healthcare practitioners, customers, and patients. The introduction of local area networks made sharing information among personal computers feasible.

By the beginning of the new millennium, the priority in the healthcare field was to maintain healthcare quality and patient safety. As a result, several studies have been published emphasizing the relevance of information technology implementation in avoiding and lowering various problems, including medical mistakes, drug-drug interactions, and lost medical data. Furthermore, hospitals invest in and create software for financial, patient accounting, and order communication systems (Balgrosky, 2019). In 2009, more concerns were directed at improving healthcare through adopting and using electronic health records (EHR) and other health information technology. Moreover, concerns were also required to engage patients in the technology adoption by allowing them to access their EHR through portals. In addition, other advances have been developed since that time, such as cloud computing, Telehealth, Telemedicine, and mobile applications that have the advantage of monitoring and tracking a wide range of health data (Wager et al., 2017). Figure 2.1 highlights the key events that arise each time on the evolution and development of HIS, which are discussed above.

1960-70s	1980s	1990s	2000s	2010-present
• Support accounting and financial departments • Mainframe computing • Designed primarily in house in large hospitals	• Need for clinical and administrative applications • Advent of minicomputer	• widespread of internet and local area network helped health information sharing. • Continued growth of clinical applications	• Necessity of patient safety • inhouse development of financial, patient accounting, and order communications systems	• EHR incentive programs and meaningful use • Population health management • Cloud computing • Mobile applications

Figure 2.1 *Evolution and development of Healthcare Information Systems (1960s to today)*

(Wager et al., 2017)

2.4   HIS Implementation

The HIS implementation is the set of actions that transforms a software system from a business plan to a fully functional HIS, typically replacing an earlier system with constrained functionality and capabilities. Even the most advanced and well-funded businesses have difficulties when implementing new technologies. For effective system deployment, a disciplined procedure supports a precisely carried out comprehensive project plan. In addition to installing new software on brand-new hardware, new operating systems, programming languages, storage, and other infrastructure, implementation also entails training end users on how to use the new system, activating it stably and predictably, and migrating all processes and users to the new system. The new system is also examined and tested when adopting HIS to ensure it is operating as intended (Bouraghi et al., 2022).

Implementing HIS mainly relies on the top management to follow the ideal methods of its application. HIS implementation is a long process requiring careful attention to every procedure. Before deploying a new HIS, managers should design a strategic plan to align the HIS and technologies with the strategic orientations and prevent serious implications such as data quality declines and expensive maintenance costs, especially for information processing software. A good HIS strategy demands that an organization's anticipated future state be defined in 5, 10, 15, or 20 years. A balanced, actionable portfolio of systems that support and enable the organization's operational, clinical, administrative, and connectivity needs is produced from the HIS strategic plan (Balgrosky, 2019).

Successful HIS implementation requires managers to introduce the new system with clear policies and procedures about when, where, and how the system is used.

Hence, the users become ready to adopt and participate in the system development. It also requires understanding the organizational, technical, and human issues to succeed (Tangcharoensathien et al., 2020). Previous studies show that communicating with consumers about the system's advantages helps create expectations for it. In addition, users need a clear understanding of how the new technology will benefit them or their work (Yusif et al., 2020).

In addition, preparing individuals who specialize in the health information technology field is highly recommended during the initial phase of implementation. For example, the chief clinical information officer (CCIO) is an important member who must be assigned carefully. CCIO should have excellent technical expertise, develop effective communication with other departments, and have the necessary leadership skills (Lehmann et al., 2022). Another important point is preparing a professional IT staff with technical and interpersonal skills to communicate effectively with employees and managers in other departments, deal with changes, and develop IT applications that support organizational needs. Indeed, a lack of IT expertise results in failure to overcome the technical problems related to the implementation, which impedes making effective and meaningful decisions (Yusif et al., 2020).

However, healthcare administrators and managers must understand that moving to an electronic HIS is a systematic process that must be handled from various perspectives, including therapeutically, administratively, culturally, and organizationally. Not only must the transition involve the process changes that come with using a new tool, but it must also include technical procedural training and the resulting changes in personnel responsibilities (Sarathchandra & Rathnayake, 2019). In addition, due to the organizational complexity, HIS implementation is a complex

process (Ebnehoseiniet al., 2020). Thus, the transition requires a strong management commitment and motivation.

As a result of the foregoing, it is determined that technology adoption alone is insufficient to ensure that the desired advantages are realized in terms of effectiveness and efficiency. There are other essential issues to be considered by the planners and managers to guarantee an effective implementation of health information technologies, which include human, technical, and organizational issues. Successful implementation of HIS requires defining many aspects and measures in a well-planned program (Sheykhotayefeh et al., 2017). In their study, Grossi et al. (2021) recommend that the health sector adheres to tried-and-true methods for creating, developing, and testing such systems. National or international standards authorities may establish these standards.

2.5   Advantages of HIS Adoption

Many benefits and advantages have been recognized after the evolution of HISs, specifically in increasing healthcare productivity that benefits both patients and healthcare providers. In fact, throughout the literature, it has been noticed that the most frequently common benefit of HIS implementation is enhancing evidence-based decision-making and improving health services (Khobi et al., 2020). In addition, reducing medical errors and mistakes such as incorrect dosage selections and drug-drug or drug-allergy interaction is another recognizable benefit of HIS.

Another advantage of using the HIS is that it reduces illegible handwriting, which makes it difficult to comprehend written notes, which is important for public health decision-making and system development.

Moreover, one of the most highly acknowledged benefits of HIS adoption in hospitals is the time saving for the healthcare providers and patients because of the instant access to the needed data and information and the immediate view of the diagnostic images and laboratory results. Thus, healthcare providers can easily decide on the best patient healthcare.

As more explorative studies have been conducted to highlight the HIS benefits, in their study, Zhao et al. (2020) mentioned that HIS implementation is expected to reduce expenses associated with records keeping, facilitate and enhance the automated sharing of information among providers, compared with the paper-based system that is associate with many problems such as difficulty in records storage, limited information exchange due to lack of time and space and waste of paper records. Accordingly, long-term saving will have a great positive impact on the economy of the healthcare organization.

In general, a properly installed and operated HIS in a healthcare organization results in maintaining accurate, complete, and structured clinical data documentation; generating and summarizing data and information; providing direct access to updated patients' records, eliminating medical errors, supporting right decision making, increasing staff productivity, increasing patient care productivity, enhancing patient care quality, saving time, and lowering costs.

2.6   Success factors of HIS implementation

As many healthcare organizations have developed and implemented HIS to increase the quality and efficiency of work, some of those systems successfully met the goals, while others failed and need improvements. HIS implementation success results from many factors. In their study, Sarathchandra and Rathnayake (2019) found

that various technical, cultural, and organizational issues impact HIS implementation success. It has been recognized that HIS implementation is a socio-technical process; i.e., it is not a technical matter only but also involves human and organizational issues, and any problems in these areas may cause the failure of IS implementation even when the technology itself is successful (Khobi et al., 2020). Following is the explanation of managerial, technical and human success factors.

2.6.1 Managerial factors

Undoubtedly, the implementation process itself requires effective management to be successful. Because of their assistance during and after the implementation, top management plays a significant role in information technology implementation initiatives. Prior studies have identified it as critical for information system implementation initiatives.

A plethora of IS studies have validated the critical role of top management in IS project success and examined its impact on IT implementation outcomes. Effective management has the responsibility of establishing a strategic plan, initiating organizational goals, ensuring the plans and goals are achieved as expected, establishing policies that ensure the objectives of information systems are met, defining the IS project with a clear vision, allocating financial, material and human resources, providing directions and action plans during and after the acquisition of IT system to solve problems, making effective and useful decisions, preparing a good IS a team, providing IS infrastructure support, involving users in the implementation process, setting priorities, budgeting, and defining key performance indicators (Yusif et al., 2020)