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Assimilating Healthcare Information Systems in a Malaysian Hospital

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Abstract:

The importance of information systems/information technology (IS/IT) to healthcare organisations is being recognised today as paramount and critical in order to realise superior healthcare delivery. Successful assimilation of IS/IT, which is the central focus of this study, then becomes a key consideration in ensuring that IS/IT is appropriately and systematically deployed into a healthcare organisation. The key findings from this research indicate that there are people, process, technology and environment elements that should be considered as facilitators to the healthcare information systems (HIS) assimilation process, as well as barriers that the healthcare organisation should overcome throughout the entire assimilation process or at specific stages. This research, therefore, is not only topical but especially beneficial to management and administrators in the web of healthcare players as they grapple with trying to successfully assimilate HIS into their respective organisations.

Keywords: healthcare information systems, initiation, adoption, assimilation

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I. INTRODUCTION

The assimilation and use of information systems and information technology (IS/IT) have an important role in enhancing a firm's performance [Devaraj and Kohli, 2003]. Assimilation as defined by Cooper and Zmud [1990] refers to the extent to which information technologies are being used within the key processes and activities in organisations [Setia, Setia, Krishnan and Sambamurthy, 2011]. The assimilation process can be described through a series of stages beginning from the organisation's initial evaluation of a potential system to its formal adoption and ending with a well-accepted deployment of the system to a point where it becomes an important part of organisation's business processes [Fichman, 2000]. The final stage in which the system becomes part of the business processes is called routinization [Zhu, Kraemer and Xu, 2006].

The emergence of studies on the adoption of healthcare information systems (HIS), electronic medical record (EMR) and electronic health record (EHR) has increased tremendously throughout the last decade [Ford, Menachemi, Huerta and Yu, 2010; Heathfield, Pitty and Hanka, 1998; Ludwick and Doucette, 2009; Venkatraman, Bala, Venkatesh and Bates 2008]. Nevertheless, a study specifically focusing on the assimilation of IS/IT in healthcare contexts, specifically the assimilation of healthcare information systems (HIS) throughout an entire hospital, has to date been quite limited. The focus on HIS assimilation must be highlighted as the importance of HIS in healthcare organisations today is recognised as a key enabler to facilitate the delivery of superior healthcare outcomes [Wickramasinghe and Schaffer, 2010]. To address this apparent void in the literature, this study focuses on a Malaysian public hospital equipped with a healthcare information system (HIS) as an exemplar case study for an exploratory research to uncover the critical issues relating to the assimilation of HIS. Specifically, the case study serves to explore the major technology innovation assimilation issues that many hospitals are facing during their acquisition and deployment of HIS [Setia et al., 2011; Chin, 2007; Thakur, Hsu and Fontenot, 2012; Reardon and Davidson, 2007].

Although the term *HIS* may sometimes be used interchangeably for hospital information system or healthcare information system [Ozkan, Byakal and Sincan, 2008], this study defines HIS as a healthcare information system that integrates computer systems throughout the hospital and which was developed to enhance the clinical and administrative function of a hospital [Kim, Lee and Kim, 2002]. The HIS applications were also developed to communicate with the relevant medical departments at the Health Ministry especially with regard to human resources, finance and procurement considerations.

Malaysia is an example of a developing country that is progressing in its e-health initiative by having the healthcare IS/IT placed under the government's vision 2020 plan [Mohan and Raja Yaacob, 2004; Sibte, Abidi, Goh and Yusoff, 1998]. There are 3,616 government health facilities, but only eighteen public hospitals are equipped with HIS since the Telehealth initiative was launched more than a decade ago [Li, 2010]. Patients with critical cases usually are referred to these eighteen HIS-equipped hospitals due to the resource availability in terms of expertise and equipment. This indicates the criticality of IS/IT efficiency in these facilities, especially in supporting the enormous amount of critical cases daily for patients seeking treatment from all over the nation. It is also especially important for the HIS equipped public hospitals to perform efficiently whilst providing excellent services to the public, as the revenues from general taxation were used to subsidize health services, namely, in purchasing the systems and state-of-the-art equipments [Chee and Barraclough, 2007].

The HIS-equipped public hospital is taken as an exemplar case study since it complies with the definition of being a hospital that has gone through the full series of assimilation stages. The hospital was built to have an organisation-wide use of the information system; therefore, all hospital personnel were considered potential interview participants. The hospital staff interviewed were asked about their experiences with using the HIS, including any problems and issues throughout system deployment. Primary focus was given to hospital staff members who have been in the hospital throughout the acquisition and deployment stage in order to obtain their views and experiences during each assimilation stage.

Through the development of a focused theory on diffusion innovation [Rogers, 1983] leading to innovation assimilation [Fichman, 2000], technology-organisation-environment (TOE) [Tornatzky and Fleischer, 1990] and resource-based view of the firm [Grant, 1991; Ross, Beath and Goodhue, 1996; Bharadwaj, 2000], it was possible to provide a technology assimilation model for information technology (IT) managers, hospital chief information officers

and IT executives involved in acquiring or deploying HIS. Combination of these theories was tailored specifically to the technology implemented in this healthcare setting, aimed at delivering better healthcare services.

II. BACKGROUND AND CONCEPTUAL FRAMEWORK

Innovation can be defined as an idea, practice, technology or entity that is considered to be new by an individual, a group, or any other units of adoption [Rogers, 2003]. With innovation comes the processes' initial discussion and idea for innovation generation, introduction of the idea for innovation, evaluation of the idea for innovation through the identification of needs and priorities of this new innovation. Rogers' and Kincaid's [1981] work is considered groundbreaking with regard to technology innovation and diffusion; therefore, most studies that focus on the diffusion of innovation with respect to technology begin with Rogers. Given this, the present study also draws heavily upon the work of Rogers [2003, 1983] as there is a clear need for more research to be done on the IT innovation assimilation area grounded through the diffusion of innovation theory (theories) in investigating the failure or rejection of innovation usage amongst a population in a particular context such as the healthcare industry. The diffusion of innovation model by Rogers [1983] has been extended [Moore and Benbasat, 1991] and has created an insightful role in moulding the concepts, terminologies and scope of the innovation field. Nevertheless, the extended models are not always suitable for different innovations at different adoption contexts [Fichman, 2000].

In a more recent diffusion of innovation article by Rogers [2003], it was suggested that innovations in the non-profit sector often encounter huge diffusion difficulties especially with innovations that could provide benefit to the public. Hence a study that explores innovation issues is worth undertaking [Mcgrath and Zell, 2001]. A study that examines the organisation, people and technological level focusing on how technology can be sustained throughout the innovation assimilation stages is also deemed important. This study serves to fill a key void in the existing literature through the exploration of "how" and "why" people in the organisation reject or refuse to make use of a specific innovation after the acquisition process, which can ultimately cause discontinuance of the innovation [Greenhalgh, Robert, Bate, Macfarlane and Kyriakidou, 2004]. There are also a lack of theories being developed for a specific type of technology and for a particular adoption context such as the healthcare organisation due to the lack of generic theory of technology innovation [Fichman, 2000]. These factors together provide the motivation for this research in developing a technology innovation assimilation model for hospitals to successfully assimilate their healthcare information systems (HIS). Successfully assimilating HIS is seen also as having a possible impact on decreasing technology, organisation, environment and process issues pertaining to acquisition and deployment. As a result, successful assimilation of HIS would realize the objective of assisting work processes of the medical professionals to the benefit of the community at large. This study focuses on answering, *How would a systematic focus on assimilation facilitates sustained use of healthcare information systems (HIS)? Why is assimilation of HIS important? and Why are HIS generally poor with regard to sustained use?*

Hence, this study explores the HIS assimilation issues and, through analysis of results, develops an HIS assimilation model. This model will be recommended for use as a guide to successfully integrate information systems in hospitals towards the assimilation of HIS.

In finding out elements that could influence healthcare innovation assimilation, organisation innovation elements identified from various theoretical frameworks such as technology–organisation–environment (TOE) [Tornatzky and Fleischer, 1990] and resource-based view of the firm [Ross et al., 1996; Bharadwaj, 2000; Grant, 1991; Huang, Ou, Chen and Lin, 2006; Khatri, 2006; Grant, 1995] in combination with the diffusion of innovation [Rogers, 1983, 2003] have been identified to be relevant. Technological readiness involves infrastructure, relevant systems, hardware and technical expertise which are considered important factors for successful IS/IT adoption [Kwon and Zmud, 1987; Armstrong and Sambamurthy, 1999]. Based on the studies done by Grant [1995], Ross et al. [1996], Bhadrawaj [2000] and Huang et al. [2006], the identification of resources for this research will include all three of the common resources (IS/IT Infrastructure, human IS/IT resources, IS/IT enabled intangibles) in the conceptual framework. These resources are deemed significant. Hence, exploring how they are being utilized and how they can be leveraged in sustaining the use of HIS is relevant to this study. Another concept that is specifically relevant to managing information technology is IT governance. Many organisations including the healthcare industry are adopting the IT governance concept in having organisational mechanisms such as committees, policies, procedures and best practices in place to ensure IS/IT strategies are formed, priorities are set, standards are developed and projects are managed according to organisational goals and objectives [Cater-Steel and Tan, 2005; Wager, Lee and Glaser, 2005].

The organisation context highlights the importance of firm size and managerial obstacles in a healthcare industry assimilating technology. Firm size concept is incorporated in this framework due to its importance for innovation diffusion [Rogers, 2003] and to distinguish between activities that are carried out between large and small firms in each of the assimilation stages according to their resource advantages [Zhu et al., 2006]. The managerial obstacles are also considered an important concept as the success of innovation implementation will rely not only on the



innovation itself and the behaviour of the adopters but also the strength and support provided by the management [Greenhalgh et al., 2008; Zmud, 1984; Attewell, 1992; Yetton, Sharma and Southon, 1999]. The managerial skills and efficiency of the management in handling change could determine the effectiveness of the innovation assimilation and thus lead to sustained use of HIS. Regulatory element in the environment context is an important concept to consider especially in hospitals where the federal government has a centralized control over the country's health policy through its constitutional powers. Hence, the healthcare organisations are required to conform to any regulatory changes and implementation [Chee and Barraclough, 2007] as the government's regulatory influences would have an impact on the HIS assimilation in a hospital. These impacts might involve elements such as support and funding provided for technology adoption [Chee and Barraclough, 2007].

Information Systems in the Malaysian Healthcare Context

The Malaysian healthcare system comprises of the Ministry of Health as the main healthcare provider with public hospitals, general practitioners as well as private healthcare facilities [Kumar, Krupinski and Abdullah, 2008]. There are more than 200 private hospitals and approximately 5,000 general practitioners excluding those operated by the Non-profit Government Organisations (NGO), hence it is rather predictable that personal health data is scattered and unorganized [Li, 2010]. To overcome this issue there are several projects developed by the Malaysian government with the aim of promoting and maintaining the wellness of Malaysians and to provide greater access to healthcare information. Such projects include the National Telehealth Policy [Kumar et al., 2008]. This project comprises of four exciting initiatives for IS/IT such as Teleconsultation/Telemedicine, Mass Customised/ Personalised Health Information and Education (MCPHIE), Lifetime Health Plan (LHP) and Continuing Medical Education (CME) [Kumar et al., 2008; Li, 2010]. This project was launched as the government foresees the need to transform the Malaysian healthcare system in order to overcome the challenges of rising healthcare costs, changing patterns of disease, rural-urban migration, increased life expectancy and increased expectations of consumers [Mohan and Raja Yaacob, 2004]. Among the four initiatives, teleradiology is seen as the most evolving branch under telemedicine. Teleradiology uses computers and telecommunication networks in exchanging images and data from one location to another for specialist consultation [Bulgiba, 2004; Kumar et al., 2008]. Using teleradiology has enabled Malaysia to open its first paperless and filmless hospital in 1999 with the establishment of a Total Hospital Information Systems (THIS) [Kumar et al., 2008].

The Total Hospital Information System (THIS) is a computerized hospital information system aimed at providing a paperless and filmless environment [Selayang-Hospital, 2010]. The central objective of having THIS is to provide an integrated care delivery system capable of information sharing, automation of work processes, greater efficiency, better storage of data and use of data for relevant medical statistical or research purposes. Further, the THIS was also aimed at providing easy access of data, data sharing among providers while improving patient safety in the management of illness, better record management and security, as well as improving workflow through the reengineering of work processes [Kumar et al., 2008].

The THIS project was first launched in Malaysia in late 1999 as a direct result of the Prime Minister's vision for Malaysia becoming a developed country by the year 2020 [Kumar et al., 2008; Salleh, 2003]. This vision included various IS/IT initiatives that included a healthcare information technology reformation. It was the aim of Malaysia to be the first in the world to have a single HIS which covers all aspects of hospital's operation, both clinical and non-clinical. The development of THIS was made from a mix-and-match product of multiple vendors integrated into a complete HIS for the hospital. Two of the vendors involved with the THIS development and implementation were CERNER and SIEMENS. A group of enthusiastic medical professionals, including heads of departments, specialists and medical administrators, sought relevant information from worldwide sources through a series of meetings, discussions and visits to hospitals in order to gain insight into the specifications for a hospital with an efficient and effective information system [Salleh, 2006].

An efficient and effective hospital information system basically covers all aspects of the clinical processes as well as management and administrative functions in areas of administration, finance, office automation and communications. The functions of THIS included appointments and scheduling of patients, patient registration, admission, discharge and transfer, as well as the management of clinical data documentation. This includes administration, patient monitoring and charting, diagnosis documentation and outcome documentation. THIS was also developed to cater for ordering tasks and tests, ordering drugs and supplies, entering results of procedures and tests, viewing results and referring patients.

Waiting time, identified as one of the major issues in a non-computerized hospital, was targeted for improvement by a fully computerized hospital, as was the reduction in patient admission waiting time [Salleh, 2006; Wee and Jomo, 2007]. The computerization of the hospital information system was also aimed at reducing length of patient stay, reduction of patient discharge processing time, faster processing time in viewing x-rays, gaining efficiency in

scheduling patients' appointment, and reducing the time of viewing and retrieving of the patient's record [Salleh, 2003].

The THIS has been designed to provide numerous values to the healthcare community and indirectly provide benefits to the patients. These benefits include knowledge transfer and knowledge management with technology, which allows junior medical doctors to learn from specialists using the tools provided to them anytime and anywhere [Li, 2010]. The patterns of standard treatment and diagnosis for common illness can be generated from the data stored in the system. The system also provides better patient safety in terms of storage of their medical records which eliminates the issue of missing data and patient's medical records. To further enhance the reliability of the system, security mechanisms were incorporated in addressing accessibility issues through the use of passwords and controlled logins [Salleh, 2003, 2006].

Issues with Malaysia's Healthcare Information System

There are several issues with the information systems implementation in Malaysia, driven by an inadequacy of skilled human resources to operate and maintain the technology. Lack of in-house technology, insufficient experience in the use of IS/IT in healthcare, and the attitudes of some healthcare staff also contribute to the issues to be resolved [Bulgiba, 2004]. Hospitals implementing the HIS are having integration issues with multiple vendors implementing different versions of HIS in different hospitals, which also creates issues with lack of expertise [Li, 2010; Merican and Yon, 2002; Mohd and Syed Mohamad, 2005]. It has also been highlighted by Bulgiba [2004] that there should be one body that ensures that the standards are set and followed by the implementing hospitals. However, this would result only in computerised hospitals and not the achievement of the ultimate HIS on a national scale [Bulgiba, 2004]. The implementation of the Malaysian IS/IT in healthcare requires a realistic assessment, especially in producing very clear policy, a committed leadership, an efficient implementation program, and the right technology frameworks which recognize that the technology is an enabler and not the ultimate solution [Kumar et al., 2008]. Projects with similar initiatives have been undertaken elsewhere in the world and have proved to be successful. In Malaysia's case, even though the technology is available, the selected technology may not be organisationally, socially or even politically possible [Kumar et al., 2008].

Implications to This Study

Successfully assimilating HIS is said to be particularly useful in solving healthcare organisations' problems in adopting and institutionalizing HIS [Nemeth, Feifer, Stuart and Ornstein, 2008]. Therefore, it is necessary to explore the possibility that assimilating HIS using a systematic approach would actually result in the sustained use of HIS in the healthcare facility. The clinical and non-clinical medical professional's daily activities being aligned with the objective of the HIS applications should also be explored. It is also anticipated that the level of enthusiasm amongst healthcare professionals would also be sustained throughout the assimilation process as the HIS is being institutionalized as part of the healthcare organisation's business processes. The conceptual framework for this study is depicted in Figure 1.

This conceptual model is developed to present a theoretical basis to answer the research question, *How would a systematic focus on assimilation facilitate hospitals in sustaining the use of HIS?* It also identifies the assimilation stages and different components of technology, organisation and environment which act as facilitators to the success of the HIS innovation assimilation which then leads to HIS. This model is derived from a combination of previous work done by Huang et al. [2006] and Zhu et al. [2006] and is consistent with the classic conceptual work of Tornatzky and Fleischer [1990], Rogers [1983], Thompson [1965], Zmud [1982], and Grover and Goslar [1993].

Assimilation in this research refers to the series of stages that the healthcare organisation has to undergo from the initial evaluation of the potential system to be acquired to the formal adoption and finally to the deployment of the system after which it becomes part of the healthcare organisation's business processes. This research argues that new technology such as the HIS is introduced into a healthcare organisation with great enthusiasm and rapid acquisition but nevertheless fails to be thoroughly deployed and sustained its use amongst healthcare professionals. As suggested by Fichman and Kemerer [1999], the widespread acquisition of an innovation will not necessarily be followed by a widespread deployment and full utilization by the acquiring organisation. An assimilation gap exists between the rate of acquisition and deployment, where certain barriers are claimed to have slowed the innovation diffusion process and caused a negative impact on deployment when compared to the acquisition [Fichman and Kemerer, 1999].

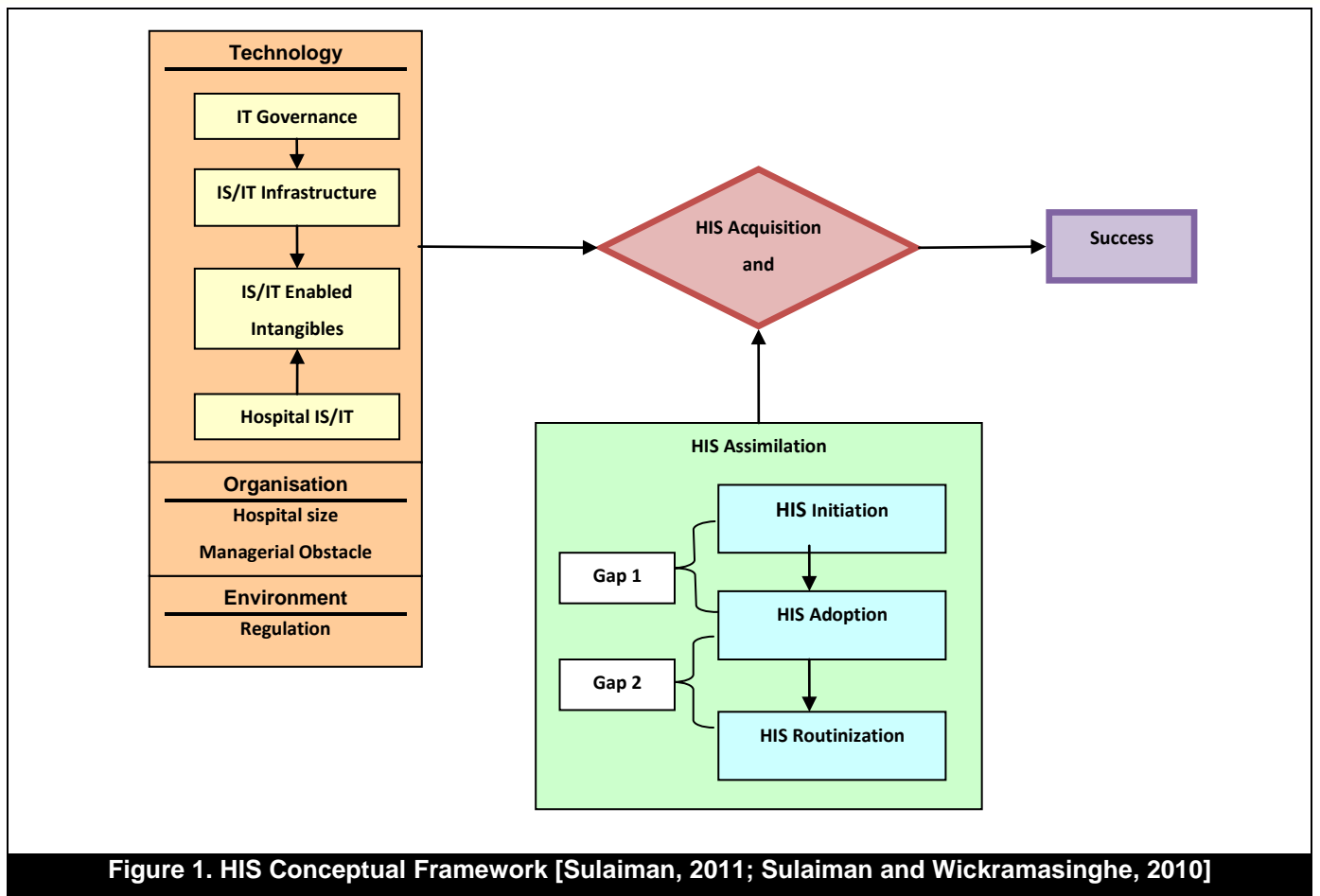


Figure 1. HIS Conceptual Framework [Sulaiman, 2011; Sulaiman and Wickramasinghe, 2010]

The conceptual model evolved from this research deals with successfully assimilating and sustaining the use of HIS where success is deemed to be achieved when the new innovation becomes a norm in the adopting organisation [Greenhalgh et al., 2008]. The proposed conceptual model will also account for the assimilation stages and components that consist in technology, environment and organisational contexts in addressing issues with assimilation and sustaining HIS usage.

The HIS Assimilation Stages

Studies by Cooper and Zmud [1990] highlighted six stages from initiation and adoption as the “early stages” and adaptation, acceptance, routinization and infusion as the “later stages”. Zhu, Kraemer and Xu [2003] identified three stages involving initiation, adoption and routinization which covers most aspects of technology innovation assimilation stages. Applying the innovation assimilation concept to the healthcare setting, some researchers have classified the early assimilation stage as awareness and evaluation [Meyer and Goes, 1988]. However, this study will adopt the view of Zhu et al. [2006] and Ammenwerth, Gräber, Bürkle and Iller [2005], in classifying both awareness and evaluation in the initiation stage in line with the conceptual framework of Thompson [1965] and many other empirical researchers [Agarwal, Tanniru and Wilemon, 1997; Chengalur-Smith and Duchessi, 1999; Cooper and Zmud, 1990; Gallivan, 2001; Grover and Goslar, 1993; Pierce and Delbecq, 1977; Zhu et al., 2006; Zmud, 1982] which considers “initiation” to be the first stage in an assimilation stage.

Subsequent to initiation is the adoption stage, where adoption involves the successful usage of the technology acquired [Agarwal et al., 1997]. A gap is identified between the stages of acquisition and adoption as there is usually enthusiasm of acquiring new technology. Once it has been adopted, however, the new technology failed to meet its purpose and was not able to sustain its use [Fichman and Kemerer, 1999]. Therefore, adoption does not always indicate that the technology has been widely used in the organisation; adoption has to be followed by the utilization and institutionalization of the technology throughout the organisation [DeLone and McLean, 1992; Devaraj and Kohli, 2003; Sethi and King, 1994; Zhu et al., 2006]. Having found similarities in the assimilation concepts of this research to the study of Zhu et al. [2003], the HIS assimilation stages described in this research go beyond the initiation and adoption stage to include routinization. This stage refers to the “later stage” of innovation diffusion to a point where the elaborated use of the HIS has become part of the business processes of the organisation and managerial systems [Pongpatrachai, Cragg and Fisher, 2009; Zmud and Apple, 1992].

There exists another gap between adoption and routinization which is highlighted after new information technology has been adopted. The adoption-routinization gap occurs when the organisation and its members lack sufficient knowledge to gain control and manage the system, thereby causing asynchrony with the fit between the technology implemented and the end-user's work context [Fichman and Kemerer, 1999; Zhu et al., 2006]. As a result, the system is rarely used and may be totally abandoned.

The Technology-Organisation-Environment (TOE) Context

The conceptual model considers several concepts identified from the TOE framework, namely those which have been identified to be relevant when studying developing countries. Among the selected concepts are regulatory environment, technology readiness, firm size and managerial obstacles.

a) Regulatory environment

Regulatory environment is an important concept to consider in this research as this study involves a healthcare setting in Malaysia, where the federal government has centralized control over the country's health policy through its constitutional powers. Hence the healthcare organisations must abide to any regulatory changes and implementation [Chee and Barraclough, 2007]. These impacts might involve elements such as support and funding provided for technology adoption [Chee and Barraclough, 2007].

b) Technology readiness

Technological readiness involves infrastructure, relevant systems, hardware and technical expertise which are considered important factors for successful IS/IT adoption [Armstrong and Sambamurthy, 1999; Kwon and Zmud, 1987]. This concept is very similar to the concept of IS/IT resources in the resource-based view theory. Hence, this research will merge the TOE technology readiness concept with the IS/IT resources concepts from a combination of resource-based view literature that relates to the influence of resources on organisation's processes [Bharadwaj, 2000; Grant, 1991, 1995; Huang et al., 2006; Khatri, 2006; Ross, Beath and Goodhue, 1996]. Based on studies done by Grant [1995], Ross et al. [1996], Bhadrawaj [2000] and Huang et al. [2006], the identification of resources for this research will include all three of the common resources from these authors (IS/IT Infrastructure, human IS/IT resources, IS/IT enabled intangibles) in the conceptual framework. These resources are deemed significant in assessing the influence that the IS/IT resources could provide to the HIS innovation assimilation. Exploring how IS/IT infrastructure, human IS/IT resources and IS/IT intangibles are being utilized, and how they can be leveraged in sustaining the use of HIS is relevant to this study.

Another concept that is specifically relevant to managing IS/IT is IT governance. Many organisations, including the healthcare industry, adopted IT governance to ensure that IS/IT is aligned with organisation goals and objectives [Cater-Steel and Tan, 2005]. As an integral part of enterprise governance, IT governance consists of leadership, organisational structures and processes that ensure the organisation's IS/IT sustains and extends the organisation's strategy [Sallé, 2004]. In order to sustain the use of technology, there is a necessity in establishing some order and control in the management of IS/IT resources [Zachman, 1987]. Hence, in managing IS/IT resources, effective IT governance is required. Therefore, this element will also be included in the technology context of the conceptual framework.

c) Firm size and managerial obstacle

The firm size concept is incorporated in this framework due to its importance for innovation diffusion [Rogers, 2003b] and to distinguish between activities that are carried out between large and small firms in each of the assimilation stages according to their resource advantage [Zhu et al., 2006].

The managerial obstacles under the organisational context are also considered an important concept as the success of innovation implementation will not only rely on the innovation itself and the behaviour of the adopters, but also on the strength and support provided by the management [Attewell, 1992; Greenhalgh et al., 2008; Yetton et al., 1999; Zmud, 1984]. The managerial skills and efficiency of the management in handling change could determine the effectiveness of the innovation assimilation and thus also lead to sustained use.

III. METHODOLOGY

This study is exploratory in nature with the aim of examining well-formulated theories in a unique context that in turn leads to confirming, challenging and building upon these theories. This research adopted a single case study approach with more than one unit of analysis embedded within a case. One of Malaysia's public hospitals which have had a significant number of years assimilating HIS was selected as the case for this study. This hospital

provides an excellent setting for this study as the phenomena under study are present at various levels in the organisation. This supports Yin [1981] and Eisendhart's [1991] argument that contrasting observations from several units of analysis within one case can create and highlight theoretical constructs. A major reason for the choice of this hospital as a single case study was that, in studying assimilation of IS/IT, this involves a number of stages from initiation, to adoption and finally to routinization. Hence, looking for a hospital already utilizing IS/IT throughout the entire hospital and adhering to a specific timeframe is crucial.

A Malaysian public hospital which will be known as the Alpha Hospital in this study was designed, constructed and equipped for an end-to-end hospital wide IS/IT environment using an integrated information system for both clinical and non-clinical operations. This hospital is seen as the best choice as it was the first hospital in Malaysia built to operate with hospital-wide computerization covering all aspects of its operation. It is anticipated that a number of implications would be derived from this exemplar case study as the assimilation of HIS in this public hospital has gone through a number of phases for the last eleven years.

The common question when adopting a single case study approach would be, "How can you generalize from a single case study?" A common misunderstanding among scholars is that one cannot generalise on the basis of a single case; therefore, the case study cannot contribute to scientific development [Flyvbjerg, 2006]. In answering this, Yin [1981] states that case studies are indeed able to generalise theoretical proposition and depending on how the case was chosen as well as the criticality of the case [Flyvbjerg, 2006]. This research also takes on the interpretivist view, where Walsham [1995] further extends this answer by claiming that interpretive case studies can be generalized through the development of concepts, generation and/or refinement of theory, drawing of specific implications and contribution of rich insights. To further strengthen the stand on adopting a single case study, this research also supports the argument of Markus [1989] where single cases may also be used for theory testing and disconfirming theory.

Participants

Participants for this interview were categorized into pilot study participants and main study participants. There were two participants for the pilot study and thirty-one participants for the main study conducted at the Alpha Hospital. The participant for the pilot study was a medical specialist from the Alpha Hospital and a subject-matter expert on information systems in healthcare. The pilot study was conducted in order to gauge responses on the suitability of the interview questions and preliminary insights on the issue of HIS use in the selected case study.

The main study was conducted in Malaysia based on the criteria of the hospital being the first to implement a hospital-wide IS/IT and have undergone every stage of the HIS assimilation. The participants for the main interview were recruited across multiple departments in the hospital, ranging from senior clinicians who participated in the planning of the HIS at the Alpha Hospital to the junior medical team as well as the non-clinical personnel.

Table 1: Data Collection Details

TYPE OF STUDY	NUMBER OF INTERVIEWEES	POSITION	DEPARTMENT	OTHER DATA SOURCES
Pilot	2	Clinician/Specialist	Pediatrics	
		Subject Matter Expert	RMIT	
Main	31	Clinicians, non-clinical staff, management	Director's office Hand and Micro Surgery Pharmacy Dermatology Otolaryngology Gynecology Laboratory Services/ Pathology Admissions Pediatrics Information Technology Department Emergency	Hospital documents

The participants were approached after permission was sought through the hospital's Deputy Director of Medicine, with some names being suggested as the point of contact for the relevant department. Participants were contacted

primarily via email, and an appointment was scheduled according to the participant's availability. The participants were given a Plain Language Statement describing the research using simple English language and a consent form to guarantee anonymity while participating in the interview. The consent form also asks if the participants were comfortable having the interview recorded and explained that the recordings would be used only by the researcher and only for the purpose of analysis. These documents were presented to the participants prior to the interview. Table 1 summarizes the pilot and main data collection details.

Interview

Interviews are suitable to be used in this qualitative research as it requires a technique that includes the capacity for accessing respondents' definition and interpretations of the phenomena under study [Murphy, Dingwall, Greatbatch, Parker and Watson, 1998]. As this research aimed to gather rich insight into the experiences of the HIS users, the interview approach was used to understand how the respondents understood their world. The interview was also aimed to uncover respondents' perspective on the way the HIS was implemented and used in the hospital. The researcher acted as an outside observer and the interviews were considered to be the primary data source to provide the interpretations that the participants have on the events and actions that are taking place in their context [Yin, 1994]. In viewing the researcher as an outside observer with no particular influence or specific interest from any stakeholders within and outside the hospital, an established rapport allows the interviewees to be frank in expressing their views [Walsham, 1995].

This research adopted a semi-structured interview method whereby the interviews were conducted on the basis of a loose structure consisting of open-ended questions. These questions provided a guide to understand areas being explored initially; however, as the interviews progressed, the interviewer and interviewees diverged into other relevant subjects pertaining to HIS use in order to produce a more detailed description of the issues being discussed [Britten, 1995].

Based on the experience of the researcher, semi-structured interview was chosen in order to have a better guide and produce a more informative interview session. The questions in the semi-structured interview were designed adapting the suggested list by Patton [1980] which starts by asking the interviewee about his/her background and demographic details. Then this is followed by their opinion, experience, feelings and knowledge about the current HIS use and issues. The semi-structured interview had eighteen questions where some questions were merged and devised by the researcher during the interviews in order to provide better explanation and understanding, especially to clinical staff who were not very well versed with IS/IT technological terms. All interviewees were given an explanation about the research question, the definition of assimilation and details on the assimilation concepts to obtain more insight and in-depth responses. The interviews were recorded upon approval of the interviewees and notes were taken where necessary. The interviews were mostly conducted in English; however, some of the participants were more comfortable in conducting the interview in both Malay and English language or in Malay. In situations especially involving work culture and political issues, participants were more comfortable in expressing their views using the national language, as it provides better detail and adds richness to the issues being discussed. Therefore, in this situation, the interviews were allowed to be conducted in Malay as the comfort of the participant is more important.

In addition to the semi-structured interviews, this research also involved the use of multiple data collection methods such as data, methodological and interdisciplinary triangulation [Denzin and Lincoln, 2005; Mantzana, Themistocleous, Irani and Morabito, 2007]. Data was also collected through several other sources such as archival documents, minutes of meetings, consultancy reports and the organisation's website. It is also the aim of this research to enhance or build upon existing theories through the findings of the data collected. Therefore, this is in line with Eisenhardt's [1989] suggestion that the usage of multiple data collection methods supports triangulation and provides a concrete and solid foundation of theory building.

Analysis

The use of thematic analysis was applied in the analysis of data in this research as it provides a structured way of understanding how to develop thematic codes and sense themes. The interviews were transcribed and themes were identified from the transcription. The analysis was also carried out with the initial conceptual framework in mind at all times.

There are three stages involved in the use of thematic analysis. Stage 1 involves deciding on sampling and design issues, Stage 2 involves developing themes and codes, and Stage 3 involves validating and using the codes [Boyatzis, 1998]. Stage 1 was successfully carried out before conducting the interviews and Stage 2 requires specific decision making, as there are various ways of conducting the second stage. Upon developing the themes

and codes for data analysis, the researcher has to decide among using a theory-driven approach, a prior-research or prior-data-driven approach, or an inductive approach.

This research adopted the theory and prior-research-driven approach in developing the themes and codes, as this approach allows the use of existing themes and codes in order to replicate, extend or refute prior discoveries [Boyatzis, 1998]. Moreover, this approach was also chosen due to the flexibility given to researchers who may not have the training or confidence in developing their own codes and may want to rely on established theories to assist in the development of themes and codes [Boyatzis, 1998]. The themes were first identified from the initial conceptual model, followed by emerging themes such as financial, political and procurement identified through interview transcription.

IV. FINDINGS

Table 2 displays the themes and sub-themes identified from the analysis of the issues discovered through the interview transcriptions.

Table 2 Themes and Sub-themes	
THEME	SUB-THEME
People	Clinical IS/IT experts
	Medical staff
	Vendor
Process	IT governance
	Clinical governance
	Financial
	Procurement
Technology	Healthcare IS/IT infrastructure
	Software/Hardware
	System design
	Performance
	Integration
Environment	Political
	Work culture
	Regulation
	Leadership

Responses from the medical personnel were methodically and carefully scrutinized and then categorized into the identified themes.

The People Context

Topics in relation to people at the Alpha Hospital are among the highest issues being discussed by respondents of the interview. The issues discussed and implied were related to clinicians having IS/IT knowledge and expertise, medical staff adjusting to change of work practices, patient information retrieval and repository, medical decision making, relationship with colleagues and interaction with patients, and finally the role of vendors in delivering the HIS technology. In order to successfully assimilate HIS at every stage, there is a need to have more people in the organisation possessing both clinical and IS/IT skills. However, the current lack of clinical and IS/IT-skilled people are not only an issue within the Alpha Hospital, it is also an issue at the Malaysian Ministry of Health.

In order to have clinical and IS/IT-skilled people, there is a need for training and exposure to both areas and for people to remain in the environment in order to increase their understanding through hands-on experience. Considering the Alpha Hospital is a public hospital that complies with the Malaysian government's human resource management policy, the possibility of people being transferred to other hospitals or other government healthcare agencies is certain, especially due to promotion. Therefore, it is difficult to retain a person in one position and train them to acquire the necessary skills on both clinical and IS/IT. Considering that staff may be transferred elsewhere, the attitude of taking IS/IT skills for granted can be seen in some clinicians, as the skills acquired in a hospital with HIS may not be useful at all once they are transferred to a non-HIS-equipped hospital. The Alpha Hospital still has a long way to go in encouraging the clinical staff to be skilled in IS/IT. The support from the IT department is crucial especially in the adoption stage. In addition to ensuring that the technical support is well delivered, it is important that the people in the IT department have the attributes of strong technical competency and excellent customer service skills. These attributes, as discussed by Wager et al. [2005], ensure the staff members are able to execute their tasks well and demonstrate a sound understanding of the organisation's needs, an ability to be good

consultants, and provide world-class support. The staff must also be able to keep up to date with new techniques and technology that may improve the organisation's IS/IT effectiveness. There is, however, a lack of soft skills and commitment to service amongst the vendor technical support team of the Alpha Hospital. This team consists mainly of outsourced local vendors who have minimal experience in IS/IT troubleshooting and virtually no clinical knowledge.

With regard to poor medical record documentation, the lack of initiative amongst clinical staff to record patient details into the HIS leads to incomplete data, thus compromising future patient enquiries and reports. Medical record documentation contributes to the completeness of patient's records which are essential for patient's safety and quality care [Jao, Helgason and Zych, 2007]. The poor history of medical record documentation by some clinicians in Alpha Hospital is very disturbing as these clinicians do not see the importance of storing relevant details about patients into the HIS. It is not entirely up to the champion or the Head of Department to constantly remind the staff to make sure that they do proper documentation. It is all part of the clinician's initiative, understanding and awareness to store complete patient's record.

As with all other Malaysian government ministries, projects are usually undertaken by outsourced vendors who have succeeded in winning the bidding process for the project. Maintaining the HIS of a hospital is considered to be a project with a three-to-five-year contract. The cultural norm for the vendor selection process in Malaysia usually revolves around the vendor's relationship with influential people; namely, a contact at the Malaysian Ministry of Health, who is authorized to approve government projects. Whom you know and who knows you are more important than demonstrating your competency and capability to handle the project. This creates major issues with the success of the HIS assimilation, as the level of competency, knowledge and work attitude of the vendors is questionable. These issues are supported by excerpts from the interviews in Table 3.

Table 3: Findings on the People Context

ISSUE	COMMENTS FROM THE INTERVIEW
The lack of clinical- and IS/IT-skilled people	<p>... actually we should have more people who know both sides, the work itself, the operation and a bit of IT, and a lot about information management, data management; the problem is we are not developing these people.</p> <p>Without people like me these people will not understand, and also they dare not venture out, like me. I can venture out to the ward, the clinics, x-ray department without being obtrusive, even now I'm trying to get the programmers and analysts out there, they are used to sit in here and just do their work. ... people in the ministry ... are not even sure what is it that we want out of this IT, even though I've been telling them about this data extraction and all, you want a report generated at the end of the year or something, the hard work is here, understanding the database, but people who wants to do that job [are] not here.</p> <p>... technology is there, but people are not there.</p> <p>In Malaysia everything is about project, then it is left to the development people whereas [it is] the operations people who should be more involved. The operations people will say this is how we do work and tell the development people, please buy us this kind of system; well they are just about doing it that way right now, but they don't bring in the right people.</p>
Staff turnover	<p>... the people who come in here the dynamics [are] very fast, so you train them then, they go away, then you have to retrain, so skill is lost along the way and people develop their own skill.</p> <p>I think in terms of IT staff also, well the Head changes so many times, so people come and go, so the continuity is not there, if this is to be our backbone, then that department has to be very strong.</p>
Lack of soft skills and commitment	<p>The most important thing I feel is that they should be more concerned and attentive to problems. If there is a problem they would have to rectify as soon as possible ... at the end of the day it's all about human nature, to be more professional in their conduct....</p> <p>... and when I complain, then they start saying "yes, we understand your problem but then the system is this and that", so it feels like there is no point complaining because nothing can be done.</p>

Table 3: Findings on the People Context – Continued

<p>Lack of initiative amongst clinical staff to record patient details</p>	<p>Documentation is poor here by the doctors, when you place orders you are supposed to document it in the system, it's part of the medical doctors practice, but still people don't document, it's a matter of habit, this one is not so much of the system but the attitude. This is the weakness of our own professionals.</p> <p>... well, our people as always they like short cuts so there's a lot of rubbish in there, quality is not there. Garbage in, garbage out....</p> <p>... we depend on the notes that are written by our junior doctors; they might not put in the right information. Most of us dictate the notes, they are supposed to type it in, if we were typing it it's fine, but when they type it, if they use short forms, we don't know what it means. We have lots of short forms in the system, and then later when you read it you have no idea what it is all about.</p>
<p>The level of competency, knowledge and work attitude of the vendors</p>	<p>... we do not have a good handover from the people who manage it initially, so they disintegrated, after our project was disintegrated, and we ourselves were not sure of what system administration entails. Therefore our contract is also very loose, there was no documentation from one contractor to another, these contractors were given a yearly renewable contract, they themselves are not sure and often they don't do good documentation ... people who are new (the vendor) they don't know what this business is all about, so they just can't maintain this properly, we have regular meetings with them, quite often we have to tell them what to do ... only a few of them are seniors and most of them are juniors.</p> <p>... they are contractors that come to do operation and maintenance, they run the call center as well. They are supposed to produce a report, but quite often we are supposed to tell them what to do rather than being professionals that already know what to do, that's why we still have our own people around, we got the system manager, application analyst people who know the backend, and then people like me who know the clinical aspects and the people who know a little bit about network and all....</p> <p>... some vendors, when they get the project, in the contract everything looks very nice, then suddenly during implementation, like some of the problems we face here, they say software is not compatible, we need to downgrade PC, those sort of things that we never expected ... they are also a little slow in implementation this time. We expect not to be up to a year, now it's almost a year already, still with problems.</p> <p>... yes, we call the helpdesk, but things tend to get collected ... okay your call is logged and they try to solve, and then tomorrow the same thing happens again, and you call them again and then tomorrow again and again and again, the users then get tired....</p> <p>... in the beginning I realize that there was very little monitoring by the vendor, they do not know what to look out for, they lack technical skills. Some staff are not competent, so they can't see, so they can't do well in monitoring, so it's a good thing we have our experienced staff, so we monitor together, so when we detect the problems we have to instruct them on what to do.</p>

Generally, the staff of the Alpha Hospital would like a more competent and knowledgeable vendor who does not possess any special interest in the projects being awarded and ultimately provide the best technical support with a guarantee of 99.9 percent uptime.

The Process Context

In the case of the Alpha Hospital, various IS/IT process issues were described during the interviews with IT department staff and the champion that these processes require immediate and ongoing attention from the relevant authorities governing the hospital. The IS/IT process issues discussed were IS/IT human resource management, information management, IS/IT workflow, IT vendor management, IS/IT maintenance, upgrades and testing, and adherence to public service standard processes. The participants' suggestions implied that the Alpha Hospital is in need of a proper IT governance structure especially in relation to change management, release management, vendor management and IS/IT financial management.

As organisations continue to grow and change, the IS/IT requirements evolve, thus leading to more new discoveries of errors and problems when applications are not upgraded accordingly to accommodate the organisational growth [Georgiou, Westbrook, Braithwaite, Iedema, Ray, Forsyth, Dimos and Germanos, 2007; Leonard and Mercer 2000]. In the case of the Alpha Hospital, the interview participants had mixed opinions on the issue of IT governance, these issues include both technology and organisational processes. Considering the technological aspect, adopting a

straight-forward well-known IT governance structure such as the IT Infrastructure Library¹ (ITIL) is very difficult as the IT department is dealing with numerous issues in adhering to policies set by the government. In addition, this situation is complicated further because it is necessary to maintain a legacy system which is technologically challenged in ways pertaining to the design and hardware capabilities. Reasons contributing to the IS/IT being technologically challenged were the lack of budget to install better hardware, the lack of technical competencies of the appointed IS/IT maintenance vendors and the lack of knowledge of the decision makers at the Malaysian Ministry of Health. Further, the decision makers and senior Ministry management did not anticipate the major role of ongoing IS/IT maintenance when the HIS project was in the planning stage. Table 4 highlights some of the issues and comments made by the interviewees.

Table 4: Findings on the Process Context

ISSUE	COMMENTS FROM THE INTERVIEW
Finance and budget matters	<p>... the management must also understand the need to spend money, because what I can see is that maintaining a hospital that is using IT is very costly, especially if it was not done in a correct manner. What I mean is when updates are not done, you wait too long to upgrade, then the cost will be super extravagant.</p> <p>... IT personnel, they are not good at maintaining the servers.... It's about maintenance, not the system per se, there are so many glitches, it puts people off.</p> <p>Since the beginning, from the start until now, the same problems still....</p> <p>... we have to keep up, but financially it cannot, because it's difficult ... it is also expensive ... to maintain; it needs a lot of money ... as a user, I wouldn't want to change, I just want to make it better but it's costly.</p> <p>... no matter what cost plays a major factor, buying computers for every ward for every doctor is not cheap, especially at the time when they say it is the economic downturn and they are slashing our budget for medication, I do not think they have enough money to spend for IT.</p>
The process of IS/IT maintenance and upgrades	<p>... basically it's all about organisation, just let us know when you plan to upgrade, scale down the number of patients activity, that would be sufficient because you know there will be disruption, but if they just do it without informing us then (sigh) they just don't understand the user implication, because we look after patients.</p> <p>... with this system when you can't look for something you would have to submit change requests, such a hassle. I wish the minor changes or upgrading can be done at the local level, meaning I myself can add new items on the list, new criteria, category....</p>
Testing of new modules and functionalities	<p>I feel the testing is too short ... you test a little while, then you go live ... the complexity of patients can't be seen in a short while. Perhaps they should have given us some time, maybe about 3 months for testing?</p> <p>There should also be proper testing. Like right now, there is not enough testing, than they just launch it, so that creates problem.</p>
The medical personnel workload and clinical governance	<p>... the workload is too much and then there's no time to do it ... especially when you are at the clinic and you are seeing so many patients, and you try to do that (some functions in HIS) so you may not want to do it, and then of course during peak hours when the system is slow, nobody wants to do that.</p> <p>With using the system, every time we see a patient for an appointment ... by the time the doctor clicks here and there, types in this and that, and as you know most people do not know how to type in properly, and they type everything, by the time you leave the room it would be about half an hour later, so the next patient's appointment is prolonged to another half an hour, so the list goes on and on to delay ... by the time you come to the last person he has been waiting maybe for 5 hours now.</p>

¹ ITIL is an approach to IT service management which provides a cohesive set of best practice derived from public and private sectors internationally (ITIL 2011). The focus of ITIL is to align IT services with the needs of the business through procedures, tasks and checklists in order to establish the targeted level of competency.

Table 4: Findings on the Process Context – Continued

The procurement process	<p>... the problem is that we have to submit our request, justify it and all that, then various levels of government would have to say if it's okay, then finally the Ministry of Finance will give us the money. Then only we can do things, so quite often when you want something now you will get it one year or a year and a half later or two years later. And sometimes when you ask for a certain amount you may only get half of it ... you see those cameras on the computer, we actually asked that to do telehealth, teleconferencing. At first they do not want to give us, suddenly because of new project "poof" it's here, so it's not given by needs, somebody comes to the minister's office and said, "... you know, Mr Minister, this technology is good, we'll do it nicely for you", and the person gets the project ... but what do I need? To get from Pentium 2 to this, it was such a hue and cry....</p> <p>I feel that there should be an improvement to the tendering system, I don't understand Malaysia's tendering system, please select vendors that can offer us the most value and after sales services.</p> <p>It is very important to have a solid vendor selection ... some vendors come in through direct negotiation.... If there is a change in vendor it should be done through open tender.</p>
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The Technology Context

Within the technology context, the IS/IT infrastructure, system design, performance and integration were elements found to be critical in ensuring success of HIS assimilation. Among all, the system design and performance issue was one the largest issues discussed by all levels of staff at the Alpha Hospital. Most of the comments were on user friendliness, inflexibility of the system to meet unexpected situations and the lack of robustness in the system which causes it to "hang" intermittently. The current performance is said to be rather poor at this point of time due to the system being quite obsolete and lack of maintenance by the IT department. On the surface the infrastructure for the hospital can be observed as quite new and advanced as compared to other public hospitals in Malaysia. Nevertheless, there are some concerns over the network that is being provided especially on the promised wireless access in the wards. Part of the Malaysian government's Telehealth plan is to integrate an Electronic Health Record for the entire nation. However, the basic integration between modules in the HIS of the Alpha Hospital is problematic and incomplete. In order to achieve the nationwide integration of the HIS, the integration issues of internal cohesion and integration with other HIS hospitals within the vicinity of the Alpha Hospital need to be resolved. These issues are highlighted in the interview as per Table 5.

Table 5: Findings on the Technology Context

ISSUE	COMMENTS FROM THE INTERVIEW
The current performance	<p>It's very important when we are designing the system we must think about the flow and how the doctors will use the system. So, the moment it is not user friendly the doctors will just refuse to use it....</p> <p>Besides that the design of the system is already 10 years old, it's not as user friendly as the newer systems you have now."</p> <p>... if you are talking about performance, we are not at the peak of our performance.</p>
The infrastructure	<p>... there is only so much you can do with wireless, but as you know in medical field people do rounds, so there are a lot of limitations in terms of wireless, it slows down, so doctors get frustrated.</p> <p>... it's not that we want to go against or do not want to use it, but with proper facilities and infrastructure, it would be fantastic....</p>
System integration	<p>I need the information fast, but then I now have to open this window first, close it, open the previous one; wouldn't it be nice if the notes were integrated? There's so much to fill in here and there, there's no linking to my diagnosis for that patient; if I reschedule this patient then it's just the patient information, but to see what I wrote last week, I have to open another application, key in his medical record number (sigh) ... you see the integration is not there.</p> <p>Apparently now there is also a problem of transition from the old software to the new software, something about the two softwares not being able to talk to each other.... So because of that we can't retrieve any images before 2009.</p>

With the ever-increasing number of patients in Malaysian public hospitals, people of Malaysia tend to flock to

hospitals which are frequently publicized in the general and government media as being the best technologically equipped hospitals with the latest and most advanced information systems. Despite the promises made by the government in improving the healthcare facilities, the hospitals still do not have enough beds and despite the media reports of having the latest technology, the data from one hospital to another is actually independent and not integrated. Hence, the occurrence of redundant patient records with the possibility of having different diagnoses may appear in two different hospitals. The clinicians at the Alpha Hospital were also concerned with this matter, as it would have been easier for them to assess the patient if there was one complete medical history on a patient across the whole Malaysian hospital system.

The Environment Context

Analysis of the environment context highlights significant facilitators to the success of HIS assimilation involving stability of the organisational political structure, public hospital work culture, government regulation and leadership. The political influence in the healthcare industry in Malaysia is very dominant to any of its other government ministries and agencies. The criticisms on the public sector including public hospitals have always been about their inefficiencies, red tape, lack of flexibility, ineffective accountability and poor performance [Siddiquee, 2006]. Various reformation plans were outlined and with the ambition of being competitive in the advent of globalization, there was a need to redesign governmental processes in order to provide service excellence [Siddiquee, 2010]. Nevertheless, having to be in a legacy system for over five decades, changes in processes is very difficult to accomplish, namely, amongst civil servants. This applies similarly to the healthcare industry of Malaysia. Although the government has launched the vision 2020 strategic plan in incorporating IS/IT as the backbone of every initiative including the healthcare reformation, nevertheless the actual implementation of these plans and projects are not as flourishing as intended [Yow, 2010].

The political influence in the healthcare industry in Malaysia is dominant to any of its other government ministries and agencies. The criticisms of the public sector, including public hospitals, have always been about their inefficiencies, red tape, lack of flexibility, ineffective accountability and poor performance [Siddiquee, 2006]. It is common after each national election, administration under a new Prime Minister promises administrative reforms and reorganisation to address these ailments in order to enhance efficiency in the performance of public bureaucracies [Siddiquee, 2006]. Various transformation plans were outlined by the newly or re-elected government with the ambition of being competitive with other developing countries in the advent of globalization [Siddiquee, 2006]. There was a need to redesign governmental processes in order to provide service excellence [Siddiquee, 2006, 2010]. Nevertheless, having been in a legacy system environment for over five decades, changes in government processes, including healthcare policies, are very difficult to accomplish due to resistance in changing current processes which provides a more transparent approach [Ibrahim, 2009]. The political influence at every stage of the assimilation process is considerable and causes many obstacles for the success of the HIS assimilation. The existence of a middle man in many Malaysian projects is a legacy from the second Prime Minister's ruling during the 1960s [Ibrahim, 2009]. Initially the "middle man" concept was a privilege given to an ethnic group of Malaysia known as the Bumiputeras, consisting mainly of Malays who were in financial difficulties [Ibrahim, 2009]. Their appointment was an attempt to improve their living standards, and this situation led to the introduction of the National Economic Policy (NEP) where the objective was to help the poor, eradicate poverty and provide the Malays with business opportunities [Roslan, 2001]. However, the former Prime Minister used this idea to justify his new ideology of creating a capitalist group, consisting of Malays, by giving projects to those who are considered qualified and authoritative [Ibrahim, 2009; Roslan, 2001]. Today, with the new policy, known as National Development Policy (NDP), replacing the NEP, an increase in the number of Malay capitalists and the extension of opportunities to the component parties who are in support of the leading ruling party has developed [Ibrahim, 2009]. Hence, today the Malays who are poor are still trapped in the quagmire of poverty [Ibrahim, 2009].

In the case of the Alpha Hospital, the IT maintenance vendor is seen as one of those capitalist groups which clearly portrays the arguments of Ibrahim [2009] that local companies tend to become greedy when they think they are entitled by the privileges bestowed upon them to siphon off and squander public wealth. It is these actions by the capitalist groups in disseminating project management that compromises the efforts of hospitals in Malaysia in regard to their integration with each other.

The typical working culture of a civil servant in Malaysia portrays that one should never be too clever, should not give ideas or propose new things, even though you are seen as a person with power in your organisation and the desire to bring about change or thinking dynamically will be considered as a threat or interpreted as challenging your superior [Ibrahim, 2009; Mastor, Jin and Cooper, 2000]. When people are outspoken and make numerous constructive or negative comments, they will be assumed to be bringing new culture and become troublemakers [Ibrahim, 2009]. Therefore, the civil servants normally adhere to any policies and rules and say only what the leader wants to hear even if it is clearly seen as a mistake. The consequences to staff of being outspoken or providing constructive critique are in the form of a work transfer to other locations, position removal or, in extreme cases,

being sacked. This is also implied in some of the interviews as transcribed below. Although at the time this matter was brought up, the participants responded with meaningful smiles and laughs, but it was clearly implied that the unstated rule and culture do exist. With regard to voicing their dissatisfaction with the Alpha Hospital's HIS, most participants feel that since the submissive culture is so apparent in government institutions, they would try to adapt to the system and share their complaints amongst each other but not to the higher management. There is also the culture of "not being accountable" in Malaysia, thus a "finger pointing" culture is very common when problems arise.

Being under the administration of the Health Ministry, the Alpha Hospital is obliged to adhere to the regulations, guidelines, policies and procedures outlined by the government and any relevant government agencies or ministries. These regulations have been in place for a number of years and require a form of change or amendment when there is a plan to assimilate IS/IT throughout the organisation [Siddiquee, 2010]. With the current obligation of having to meet the requirements of these regulations, this may deter the hospital while it undertakes wide usage of the HIS as there are conflicts with manual processing. Adhering to some of the government policies does limit the use of the HIS and provide difficulties in changing certain aspects of the hospital's processes. For example, there have been plans from within the Alpha Hospital for merging the medical record office with the IT department since they both involve managing the HIS but in different areas. The medical record office undertakes information management, whereas the IT department oversees the technical support and IS/IT management. However, it is difficult for the Alpha Hospital to undertake this merger as there has to be a policy or direction from the Malaysian Ministry of Health. A similar situation would prevail if the Alpha Hospital planned to make changes to the human resource management processes to be able to retain staff for the Alpha Hospital since they have already been trained in using the HIS in the hospital. In trying to successfully assimilate HIS, the issue of change management must actively involve the hospital's senior management in high-level meetings with the staff of the Malaysian Ministry of Health in planning change. Policy makers within the Ministry should also be aware of and exposed to the current IS/IT issues in healthcare to ensure suitable policies are created for future HIS hospitals.

The leadership structure of a public hospital in Malaysia consists of multiple levels of authority. The top management consists of the Minister of Health, Deputy Minister of Health, the Secretary General and the Director General of Health. The next level consists of a line of Deputy Director Generals in charge of several divisions, including medical development, medical practice, allied health and nursing. A level below a Director General is the respective medical directors of each state or tertiary hospital. With regard to good leadership on the assimilation of HIS at the Alpha Hospital, most interviewees felt that leadership plays an important role in the initial stage, especially with the existence of the clinicians who were among the HIS initial project team members. Table 6 highlights some of the issues and comments made by the interviewees.

Table 6: Findings on the Environment Context

ISSUE	COMMENTS FROM THE INTERVIEW
The political influences	<p>Political! always political ... not moving because in Malaysia every other fellow wants to make money out of everything. That's why it's not moving ... when this hospital was built, we were supposed to be a showcase to the world, and the then Prime Minister said money is no problem, he said, there will be no local company no middle man, go and find them, bring them here and do the system.... When they were successful here earlier, then they wanted to build another hospital, that's where politic starts, this company got this contract for that hospital, this company got another contract for another hospital, contract for this and that, then it's all a mess....</p> <p>You have to understand Malaysia. Malaysia has a lot of political influence ... it's very sad when you know we are controlled by one organisation but very fragmented ... the Health Ministry should organize it better, take control of it.... The Ministry of Health, like many of our other ministries, there's a lot of "unexpected revelation"... it's difficult ... difficult....</p> <p>... one thing is the business model, the way we do work, is mainly projects, projects , projects,</p>
The political influences	<p>whereas other places the users demand we want IT here and there, and they work for it; over here suddenly we have something "coming down from the top", suddenly there's a new computer there.</p>
The existence of the capitalist groups	<p>... when we built this hospital, if we were to use the telehealth model, we would have this hospital and all the peripherals, and other services will speak to another hospital somewhere else. We should be connected and they should use the same application system so we can refer to previous cases, send x rays. I've been writing papers about that, but it's not happening because different parties are involved, even now, after 11 years, we are still buying new systems for this hospital, I cannot get the ministry to say "okay, don't just buy for your hospital, buy for hospital C, D and E so we can have telehealth". But is not there....</p>



Table 6: Findings on the Environment Context – Continued

<p>The submissive working culture</p>	<p>If you are out of step with the ministry, then you might be called up, or reprimanded or whatever ... because you are trying to change ... so this part, we say we want people to innovate and all that, well it doesn't happen.</p> <p>I would have told you more on the issues, but I like it here; if I go overboard and it was discovered, I might be transferred somewhere remote.</p>
<p>The finger-pointing culture</p>	<p>Well, you just have to learn to work with it, you learn to "beat" the system on and off, you learn to adopt it, work round it.</p> <p>When we complain, then they say, oh, that's maintenance's job, oh that's developer's job, this one is vendor's ... so, no point complaining....</p> <p>When there is a problem and if we complain, then that starts the blame game. We blame the IT department for not giving the right application; the IT department blames us for not using it right....</p>
<p>Adhering to regulations</p>	<p>Again policies are pretty standard throughout; we have to actually adhere to the policies of the MOH.</p> <p>Other external issues are when you have documents which are government controlled, for example, the permits and medical certificates, computer generated ones may not be accepted, so you still have to go back to paper.</p> <p>The e-procurement and HERMIS system is a direction from the government in its e-government plan, so every government institution must use.</p>
<p>Leadership</p>	<p>When we started, the success factor was the leaders, Head of Department (HOD) are chosen among people who want to work with computers. They might not be computer savvy but they are willing to learn.</p> <p>The first stage itself, the most important, is leadership. So, you must have a committed leader at the top that will push us for this, and you need to have the buy-in from all the clinicians ... clinical leadership was also important, not only the hospital leadership but also a leader among the clinicians is also important. So that's how we became very successful. At that time we had a core team of all the specialists and head of department that was for IT, like our champion that was the kind of leadership we needed to be successful.</p> <p>... when we first started this project, the previous director general guided us, we were all happy to come here, but if you decide to bring your "Baggage" with you from elsewhere, then please leave.... In other words it's trying to tell you [that you] need to have your mindset changed and be into it.</p> <p>... the management support is very important, and the management must also understand the need to spend money, because what I can see is that maintaining a hospital that is using IT is very costly, especially if it was not done in a correct manner ... when updates are not done, they wait too long to upgrade, then the cost will be a bomb.... The problem is when they don't understand, if they do, it would be easier for us. We can see the difference when we had the previous Medical Director who was someone that has been in this hospital for a long time, so to deal with the Medical Director in these issues was easier, and we gained support.</p> <p>... when you have management who come in that doesn't understand how things work, what is the easiest way that they decide when they do not know how to work these things? Okay, we go to filing. Look at all this work manual, work order manual. All these should be electronic....</p>

The HIS is there as a tool to assist staff in doing their job more effectively. It is up to the staff, especially those concerned with clinical governance leadership, to ensure that with the assimilation of HIS the hospital is more active and efficient in producing a safe, efficient, and quality environment for its patients.

HIS Assimilation Barriers

On analysis of interview transcripts, several barriers were identified and categorized as being either global or local. Global barriers indicate that these barriers appear throughout all the assimilation stages and that a high level management involvement is required to overcome these barriers, while local barriers are those that occur at specific stages of the assimilation and may be resolved by specific groups or members of the organisation.

Among all barriers identified through the analysis and findings, the three most common and repetitive global barriers involving all levels of assimilation included overcoming financial difficulties, political influences and lack of up-to-date

knowledge on healthcare technology and systems. The financial investment in HIS will not only incur continuous increase in value but also become a rising issue in many healthcare organisations in the future [Bernstein, McCreless and Côté, 2007].

Table 7: Barriers to HIS Assimilation

BARRIERS	TYPE	ASSIMILATION STAGE INVOLVED
Financial	Global	All
Political	Global	All
Keeping up with medical technology	Global	All
Lack of IS/IT knowledge	Local	Initiation
Lack of leadership	Local	Initiation
Lack of proper planning	Local	Initiation
Clinicians buy into process	Local	Adoption
Maintenance	Local	Adoption
Sustaining the role of clinical and IT experts	Local	Adoption
Efficiency of vendor support	Local	Adoption
Thorough testing	Local	Adoption
Communication among staff	Local	Adoption
Sophisticated IS/IT infrastructure	Local	Adoption
Clinical and IT governance	Local	Routinization
Proactive communication	Local	Routinization
24X7 technical support	Local	Routinization

Public hospitals are faced with challenges of improving service quality and meeting demands of the ever increasing number of patients seeking immediate treatment while resorting to HIS as a solution [Costa, De Oliveira and De Oliveira Machado, 2004; Marino, 2002; Zailani and Zalazilah, 2006]. It is widely known that the implementation and maintenance of HIS is likely to incur expensive investment; however, proper and efficient planning throughout the assimilation stages could result to substantial savings in the future [Anderson, Frogner, Johns and Reinhardt, 2006; Goldzweig, Towfigh, Maglione and Shekelle, 2009; Øvretveit, Scott, Rundall, Shortell and Brommels, 2007; Bernstein et al., 2007]. The political barrier in many of the government organisations causes complications in many parts of the organisation, namely, the work process. It requires a change in work culture, good governance and high degree of political and administrative commitment by the top government authorities. There is a need for a more transparent way of managing the current business practices, namely, in vendor selection and procurement processes [Ludwick and Doucette, 2009]. Although it may be inevitable to have political pressures and influences meddling into the government organisations, public hospitals are not made to generate revenue from the patients; thus there should be an exception to the hospital administration to be independent in making decisions for the hospital in order to cater to people's healthcare and wellbeing. Finally, in assimilating HIS, the importance of having to overcome barriers on the lack of knowledge about systems, latest advancement in medical technology, and understanding of clinical procedures is required among staff members of a hospital, namely, clinicians, in order to achieve the aims of successful and sustained use of HIS.

The HIS Assimilation Framework

As highlighted in the previous section, this research focused on HIS, a technology that was being implemented in a hospital with an assimilation gap phenomenon discovered in the context. Nevertheless, in obtaining a more descriptive and concrete picture on successfully assimilating HIS, the people, process, technology and environment context is exhibited as a possible facilitator or contributing elements. In addition, there exist global and local barriers from findings of the study which healthcare organisations need to address and overcome accordingly. Based on the facilitators and barriers identified above, the initial conceptual model was revised to portray a better descriptive version of HIS assimilation for hospitals that was consistent with the findings of the research (Figure 2).

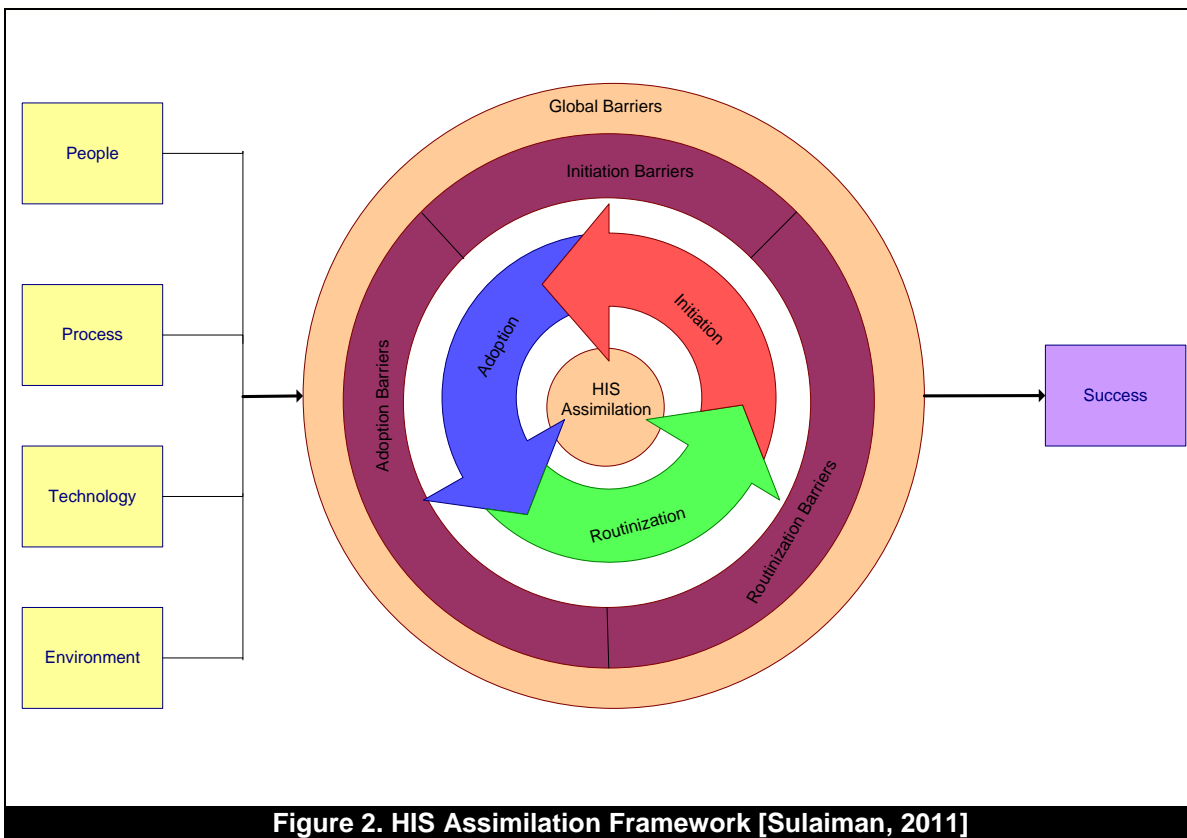


Figure 2. HIS Assimilation Framework [Sulaiman, 2011]

V. DISCUSSION

This exploratory study into HIS assimilation identified many unique aspects especially with regard to barriers and facilitators. Facilitating components consisting of people, process, technology and environment elements highlight the importance of developing knowledgeable people in both medical and IS/IT field, structured IT governance, sophistication in healthcare IS/IT infrastructure, work culture and balance in organisational politics, good system design and the need for standards in healthcare technology implementation. The existence of people with both clinical and IS/IT knowledge is critical especially in bridging communication gaps between both fields especially in fulfilling user needs and system requirements. A specific healthcare IT governance structure is also essential in ensuring goal alignment between the IT department and organisational goals as well as externally between the healthcare organisation and outsourced vendor companies. The IT governance structure simultaneously addresses issues in relation to IS/IT adoption and implementation including financial, human IS/IT resources and procurement. The assimilation of HIS will inevitably incur expensive investment, nevertheless with proper IT governance structure and effective financial planning will result in better management of investment and maintenance costs leading to substantial savings for new innovation or further system optimization projects. A structured and effective procurement system also should be in place, allowing for transparency in the selection of vendors regardless of local or international companies. Vendors should be selected based on healthcare IS/IT knowledge and capability in delivering high quality medical systems with excellent customer service and technical support services.

Formalizing standards on technology implementation is necessary to coordinate implementation and development activities among healthcare technology vendors. With proper standards on healthcare IS/IT application development and implementation, data and system synchronization could be achieved thus providing a more consistent platform for future HIS integration.

The Alpha Hospital should be commended on their initial effort of trying to produce an end-to-end integration of clinical applications across all departments in the hospital. This plan was drafted at a time when IT vendors were still concentrating on providing different applications to different departments and no other countries were attempting this initiative. The medical staff, especially the pioneering team consisting of senior surgeons and clinicians, should also be applauded for having to provide tireless efforts involving brainstorming on the healthcare IS/IT structure of the Alpha Hospital, even though they possessed very limited IS/IT knowledge at the time. Although there was a strong team at the Alpha Hospital who were all very enthusiastic in realizing the end-to-end IS/IT for the hospital, the assimilation was compromised due to circumstances beyond their control and issues such as budget constraints, political intervention and changes in government policies.

The existence of IT nurses and the IT clinical coordinator of the Alpha Hospital held by clinical personnel are regarded as a great influence in the success of assimilating the HIS. Having people with the knowledge of both IS/IT and medical provides a link in obtaining a better understanding of the clinician's needs and requirements. The requirements of clinicians usually involve their daily tasks, procedures and events that are commonly coded using the standard medical nomenclature, which is sometimes difficult for IS/IT personnel with very limited medical knowledge to understand. In view of this, the IT nurses and clinical coordinators are able to describe and explain the requirements of clinicians clearly to the IT department since they are able to translate better from one field to another. This will potentially decrease the issue of having clinicians not being understood by their IS/IT team and having applications developed which do not meet their needs and work processes [Anderson and Aydin, 2005].

It is clear from the findings of this study that successful assimilation of an HIS involves more than proper planning and implementation at the initial stage. Successful assimilation also requires clinical governance in understanding the needs of healthcare IS/IT, maintenance of the systems throughout adoption, and the input of clinical IS/IT experts. Clinical management support in terms of technical knowledge and financial resources must be accompanied by strong leadership and critical understanding of the demands of a computerized medical facility in order to promote the extensive use of HIS through to its routinization stage. However, with the absence of good leadership and knowledge of the HIS demands, the system remains part of the organisation's business processes, but has failed to meet its intended benefits. The absence of sufficient knowledge after a new IS/IT has been adopted in a healthcare facility is also supported by the findings of Fichman and Kemerer [1999] and further supported by Zhu et al. [2006], who added that the organisation and its members usually lack sufficient knowledge to gain control and manage the system after new IS/IT was adopted. This then causes an issue with the fit between the technology acquired and the end user's work context. As a result, systems may be abandoned or utilized less due to being irrelevant to the work environment.

The Alpha Hospital recognises the importance of the HIS as a strategic part of the clinical operations and healthcare delivery of the hospital. The importance of an IT governance structure for the Alpha Hospital is critical as a way to move forward. The Alpha Hospital has reached the final stage of assimilation, and the way forward is to plan for further improvisation, continuous effort on checking milestones that need to be reached and keep the momentum going in sustaining the use of the HIS.

Currently the process of maintaining the HIS is the hardest experience for the Alpha Hospital. This becomes harder considering the fact that the use of IS/IT in healthcare is a significantly dynamic and a rapidly evolving discipline. To keep the momentum going, the clinical governance must be sensitive and adaptive to change. There must be a mechanism for improvising the clinical governance structure to institutionalise change, perform ongoing audits, monitor and process review, reinforce business and IS/IT realignment continuously with outsourcing IT vendors and encourage knowledge management amongst staff.

An important practice that should be utilised to ensure the HIS is always performing at its best is to conduct reporting and statistical analysis. In the near future, it is recommended that assessment be carried out to solicit understanding of the Alpha Hospital's medical staff in the context of understanding the hospital's strategy, direction and issues and how these elements impact the assimilation of the HIS. Staff should also understand the Alpha Hospital's technology development and how these technologies may best be assimilated to support the overall objective of providing excellent patient care and medical treatment. It is also imperative that the senior management and the Malaysian Ministry of Health have a shared view of the current role of the HIS and its impact on hospital operations, and the consequences to overall healthcare delivery if the barriers and issues were resolved.

Therefore, it is recommended that the Malaysian Ministry of Health and the Alpha Hospital address the barriers and facilitators according to the HIS assimilation framework, which covers all the HIS assimilation stages. It is also recommended that in order to enhance the functionalities within the IT department, especially in formalizing the role of clinical IT experts and application specialists, the hospital senior management and health ministry need to review the existing policies and regulations pertaining to resource allocation in accordance with the fact that these resources provide substantial benefits to both the clinical and IT departments.

In successfully assimilating HIS, accountabilities and responsibilities must be fully understood and enforced. Contracts, guidelines, regulations and policies must be transparent and strictly followed. As a referral and tertiary hospital, it is proper for the Alpha Hospital to set up an electronic knowledge repository and communication on the clinical workflow, process manuals, training and training material pertaining to the HIS. This knowledge repository may be separated into a clinical knowledge repository and a technical knowledge repository. The clinical knowledge repository will be used by clinical staff as a means of proactive communication with regard to the use of the HIS especially in finding out about the latest updates to the HIS applications. The technical repository will be used by the IT department and maintenance IT vendor in sharing technical knowledge and solutions especially in resolving

technical support calls. It is also recommended for the Alpha Hospital to appoint a Chief Information Officer (CIO) to be responsible for the overall maintenance of the HIS applications, IS/IT infrastructure, patient data and medical records.

The ongoing issue with the use of the HIS at the Alpha Hospital is that the system constantly hangs and delivers poor quality of service due to a multitude of factors as described earlier in the previous sections. The newly formed CIO position and the IT team must establish a plan to ensure that the hospital is able to continue its functions despite faults and hitches with the HIS through a business continuity plan. The business continuity plan involves proactive and preventive precautions and measures to minimize downtime, mechanisms to ensure that various functions of the hospital dependent on the HIS are able to continue working during any complete or partial system downtime, and methods for restoring the HIS to its original state on recovery from serious incidents. A careful planning preparation has to take place in scheduling for system downtime. Users must be informed well in advance of the proposed downtime and activities carried out on the HIS during downtime. The outsourced IT vendor and IT department will be working together to ensure that the business continuity plan is in place and regularly reviewed with the approval of senior management and the ministry. Actions must also be taken to impose penalty charges to the outsourced IT vendor if the maintenance activity or issues failed to be resolved within a specified number of hours. This is to ensure that critical departments such as emergency and critical wards do not suffer from data loss and work redundancy due to delays in restarting the system. It is also the vendor's responsibility in ensuring that all backup has been done and mechanisms for restoration and recovery are in place for the purpose of post-disaster.

Hence, as highlighted in Table 8 this study suggests that, to overcome the HIS assimilation issues, the following recommendations should be considered by hospitals assimilating technology of similar context.

Table 8: Recommendations

RECOMMENDATIONS	CONTEXT
The re-organisation of the IT team to have a strong senior management team consisting of a Chief Information Officer (CIO), chief technology officer (CTO), chief security officer (CSO) and chief medical informatics officer (CMIO)—with the appropriate experience in both IS/IT and medical field	People
The alignment of the selected vendor organisation goals to the hospital's IS/IT strategic goals to ensure high quality delivery and support	People and Process
The need to conduct frequent assessment of the selected vendor company on the efficiency and effectiveness of their IS/IT services	Process
The need to adopt a customized IT governance structure specific for the healthcare organisation	Process and Technology
The need to have strong clinical governance in place as this is especially crucial in promoting and sustaining the use of HIS across all levels of healthcare staff	Process and People
The need for transparency in procurement and vendor selection process	Process
The need for education, training and awareness in IS/IT, medical advancement and work culture	People, Process, Technology and Environment
The need for strong leadership by the organisation's senior management team	Environment
The need to have a systematic and structured 24X7 technical support process.	Technology
The need for effective communication mechanism with all staff of the healthcare organisation	Process and Environment
The need to maintain positions of IS/IT Application Specialists and Clinical IT coordinators/experts with clinical background and strong IS/IT knowledge in the IT department	People
Given that this study has shown many of the issues with IS/IT in healthcare contexts are similar to those in other contexts, it would be useful for the implementation team in hospitals to also look at lessons learnt from other contexts when engaging in projects focusing on HIS assimilation.	Process

VI. CONCLUSION

This research set out to develop an HIS assimilation model for a hospital to successfully assimilate and sustain the use of its HIS. In understanding HIS and issues pertaining to HIS assimilation, a Malaysian public hospital, identified as the Alpha Hospital in this research, was critically examined on its dynamics and experience with HIS assimilation. This exemplar case study indicates significant findings and important recommendations for the Alpha hospital as well as other hospitals in a similar context. Findings from the analysis of each theme identified elements that could influence successful assimilation of HIS within a particular hospital. Through analysis of data, barriers were also

identified and categorized as either global or local for each of the assimilation stages. Since this was an embedded single case study, examining the opinions and experiences of the individuals has led to an in-depth understanding of a specific case and situations studied at a specific site. The data has provided rich information and insights pertaining to the case study; however, this reduces generalisability [Bostrom and Heinen, 1977]. Therefore, it must be clearly understood that the findings of this research are unique to the Alpha Hospital alone and at best can be used only as a guide to compare or make judgements about other hospitals assimilating HIS.

In view of the Malaysian context, this research supports the argument of Abdullah [2008] that the implementation of the Malaysian IS/IT in healthcare requires a realistic assessment, especially in producing a very clear policy, a committed leadership and an efficient assimilation program. Furthermore, a suitable IT governance structure is required in public healthcare facilities to better manage IS/IT acquisition, deployment and service. Recognizing that the HIS is an enabler to assist work practices of medical professionals and not the ultimate solution in solving all issues pertaining to healthcare in Malaysian public hospitals is pertinent. This study demonstrates that even though technology is available and may be possible to solve many potential healthcare issues in Malaysia, yet the selected technology is not without its people, process, technology and environmental issues.

Finally, in closing we believe that while the study is indeed focused on the Malaysian context the findings have importance and relevance to any or all healthcare organisations as they are currently embarking upon large scale ICT adoption. We also believe that future confirmatory studies in other context will prove particularly enlightening especially for research similar to the technology assimilation area. Hence, in future this study will be expanded to examine assimilation of HIS in other hospitals in Malaysia and other IT-equipped hospitals in other countries.

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Editor's Note: The following reference list contains hyperlinks to World Wide Web pages. Readers who have the ability to access the Web directly from their word processor or are reading the article on the Web, can gain direct access to these linked references. Readers are warned, however, that:

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