

Implementation and Acceptance of Hospital Information System

Total Hospital Information System (THIS), Intermediate Hospital Information System (IHIS) and Basic Hospital Information System (BHIS) in Malaysian Public Hospitals.

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Abstracts—Healthcare is important to every country, including developing country like Malaysia in providing a good life. Therefore, the Malaysian Government had taken several initiatives to enhance healthcare sector. One of the initiatives is bringing the Information System into Malaysian Public Hospitals. This is similar to enhance the ICT tools within Malaysia in achieving 2020 Vision to make Malaysia as developed country. Thus, this paper is aims to investigate the implementation of THIS, IHIS and BHIS in Malaysian Public Hospitals based on interviews. The findings were analysed by content analysis using Nvivo. From the findings, it was found that the HIS implementation phases have different phases in each category of HIS hospitals, however their activities are similar. Moreover, the types of HIS have faces with different issues and challenges of low satisfaction and acceptance levels.

Keywords—Hospital Information System (HIS); Total Hospital Information System (THIS); Intermediate Hospital Information System (IHIS); Basic Hospital Information System (BHIS)

I. Introduction

Public hospitals are important to serve healthcare treatments to the public. However, Saari [1] revealed that the public believe that the services in public hospitals are slow and inefficient. This is because, the patients have to wait for a long time before getting their medical treatments. Therefore, the Government had introduced Hospital Information System (HIS) as one of the initiatives to improve the public hospitals in Malaysia. The HIS is categorised into three, which are Total Hospital Information System (THIS), Intermediate Hospital Information System (IHIS), and Basic Hospital Information System (BHIS) , based on hospital size [2, 3, 4, 5]. According to Haslina and Sharifah Mastura [2], THIS is for the

hospitals with more than 400 beds, IHIS is for the hospitals with more than 200 beds but less than 400 beds, and BHIS is for the hospitals with less than 200 beds.

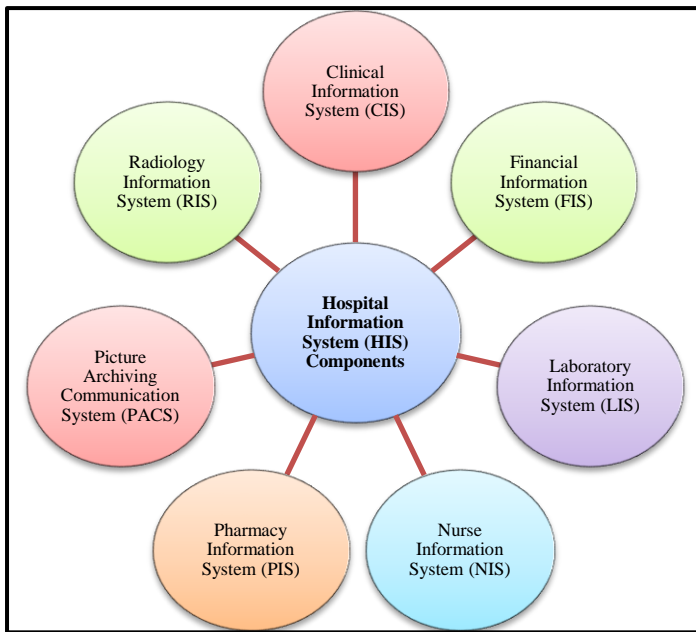
THIS is implemented in Hospital Putrajaya, Hospital Selayang, Hospital Serdang, Hospital Pandan, Hospital Ampang, Hospital Sg. Buloh, Hospital Alor Setar, Hospital Sungai Petani, Hospital Sultanah Zahirah, Hospital Sultan Haji Ahmad Shah, and Hospital Bintulu; IHIS is implemented in Hospital Keningau and Hospital Lahad Datu; and BHIS is implemented in Hospital Kuala Batas, Hospital Setiu, Hospital Pekan, Hospital Pitas, Hospital Kuala Penyu, Hospital Kunak, Hospital Tuanku Ja'afar, and Hospital Port Dickson [2,3,4,5].

II. Literature Review

HIS is defined as an integrated electronic systems that collect, store, retrieve and display overall patients' data and information such as history of patients' information, results of laboratory test, diagnoses, billing and others related hospital's procedures which are used in several departments within the hospitals [3,4,6].

Biomedical Informatics Ltd. [7] reported that HIS consists of two or more of these components; Clinical Information System (CIS), Financial Information System (FIS), Laboratory Information System (LIS), Nursing Information Systems (NIS), Pharmacy Information System (PIS), Picture Archiving Communication System (PACS) and Radiology Information System (RIS).

Fig. 1: HIS Components



However, each HIS component is different according to departments and type of users in hospitals as shows in Table 1.

TABLE 1. HIS COMPONENTS, DEPARTMENT AND TYPE OF USERS

HIS components	Differences	
	Departments	Type of Users
Clinical Information System (CIS)	Clinical	Doctors, Nurses
Financial Information System (FIS)	Financial	Accountant
Laboratory Information System (LIS)	Laboratory	Lab officers
Nursing Information Systems (NIS)	Ward	Nurses, Doctors
Pharmacy Information System (PIS)	Pharmacy	Pharmacists
Picture Archiving Communication System (PACS)	Imaging	Imaging Officer
Radiology Information System (RIS)	Imaging	Radiologists

However, according to Nor Bizura [4], although HIS offers various benefits to hospitals and patients, the implementation of HIS is not an easy task. This is because, HIS implementation is complex and it is a difficult multidisciplinary effort that will influence an

organisation's skills and capacity for change. This situation might bring challenges and stressful continuous learning experience. Moreover, it might create various HIS problems in future. However, the HIS also faced with several issues and challenges such as (1) high initial costs [8, 9, 10, 11, 12]; (2) time consuming [10, 11, 12, 13, 14]; (3) technology and technical problems such as complex system and integration problems [9, 13, 16, 17, 18]; (4) fundamental problems such as lack of computer skills, complex tasks, complex function [19, 20, 21, 9, 22, 23]; and (5) ethical issues such as certification, security, privacy, and confidentiality [8, 13, 24]. These problems might be minimised if an appropriate HIS implementation framework is developed. Thus, a good HIS implementation phases are required to ensure that the system is efficiency and systematically implemented in the hospitals.

These phases are considered more complex and complicated compared to other information system used in other sectors because they involve hospital services to patients. According to Budkin [25], HIS implementation process is divided into four phases namely planning, design, implementation, and operation. Houser et al.[26], on the other hand, indicated that the HIS implementation process is divided into three phases which includes preparatory activities for system implementation, certification and acceptance testing and system implementation, which focuses on plan of action of the system. Other than that, Rossi et al. [27] categorised these processes into two, which are preparatory phase and utilisation phase. Based on this discussion, it can be said that in HIS implementation, despite the different number of phases as discussed by [25, 26, 27], the activities in phases of implementation are similar.

This study employed two theories which includes Business Interaction Phases Model [28] and Technology-Organizational-Environmental Framework [29]. The Business Interaction Phases Model had been divided into six phases as (1) Business prerequisites phase, (2) Exposure and contact search phase, (3) Contact establishment and proposal phase, (4) Contractual phase, (5) Fulfilment phase and (6) Completion phase. This model is acts as an aid on HIS implementation phases model in this study. Therefore, Technology-Organizational-Environmental Framework had been divided into three important factors known as (1) Technology, (2) Organizational and (3) Environmental. This framework is acts as an aid on HIS acceptance and adoption in this study.

III. Research Methodology

In this study, a qualitative approach was used to investigate the HIS implementation among the Malaysian public hospitals in details. The research design of this study was multiple case studies. According to Yin [30], this kind of research design supports such nature study. In this study, three cases (i.e., hospitals) were selected to be used in purposive sampling. According to Merriam[31], purposive sampling is based on the assumption that the investigator wants to investigate and understand an issue by selecting one sample to be learned. In this study, the three hospitals selected were Hospital Sultan Ismail, Hospital Keningau, and Hospital Tuanku Ja'afar. These hospitals were chosen by the researcher as each of them represented each category of HIS; Hospital Sultan Ismail (HSI) represented THIS, Hospital Keningau (HK) represented IHIS, and Hospital Tuanku Ja'afar (HTJ) represented BHIS. In-depth interviews were conducted for data collection. According to Kvale [32], in-depth interviews allow primary data to be collected and this type of data collection enables the interviewees to further clarify their answers during the interview. Thus, in this study, an interview guide was designed to investigate the HIS implementation process. Moreover, purposive sampling was used to ensure that the data collected would help the researcher to achieve the research objectives of this study. Through this sampling method, snowball technique was used during interviews involving nine participants whom were Hospital Directors, IT officers, and HIS users. The interviews were done after the participants agreed to participate. The duration of the interviews was about 60 minutes for each participant using Malay and English as main languages. During the interviews, tape recorder was used and the recorded conversation was then transcribed verbatim. Next, Content Analysis was chosen to analyse the transcribe data from the interviews by using computer software known as NVivo. The data were coded to themes, categories, and sub-categories. Triangulation approach was used to measure the validity of data. For example, the data were triangulated with other supporting documents obtained during the study. The documents served as secondary data to ensure that the data were valid.

IV. Findings

For these study, Hospital A represented as THIS, Hospital B represented as IHIS while Hospital C represented as BHIS. According to the findings,

Hospital A were divided into seven phases which includes (1) Establish leading group, (2) Review work process, (3) Implementation plan, (4) Process & Data Migration, (5) Planning for Improvement, (6) Action and (7) Business Continuity. While Hospital B were divided into three phases which includes (1) pre-HIS Implementation, (2) HIS implementation and (3) Post-HIS Implementation as the third stage. Whereas Hospital C had been divided into three phases which includes (1) HIS implementation plan, (2) HIS Development and (3) Implementation of Remaining and Integration to other sub-system. Although that the phases are different, their activities were similar to each category of HIS implementation. Furthermore, according to the findings, Hospital A has low satisfaction level because the users required more powerful system, while Hospital B and Hospital C have low acceptance levels, because the users have less awareness and advantage of using HIS at their hospitals.

TABLE 2. HIS IMPLEMENTATION PHASES IN THIS, IHIS AND BHIS HOSPITALS IN MALAYSIA

Hospitals	HIS Implementation Phases
Hospital A	(1) Establish leading group, (2) Review work process, (3) Implementation plan, (4) Process & Data Migration, (5) Planning for Improvement, (6) Action and (7) Business Continuity.
Hospital B	(1) pre-HIS Implementation, (2) HIS implementation and (3) Post-HIS Implementation as the third stage.
Hospital C	(1) HIS implementation plan, (2) HIS Development and (3) Implementation of Remaining and Integration to other sub-system.

V. Conclusion

In nutshell, the HIS implementation framework in Malaysian Public Hospitals had similar activities, although the phases were different. Thus, it might be summarized that the HIS implementation framework in Malaysian Public Hospitals were categorized into four phases as (1) early planning, (2) system set-up, (3) system implementation, and (4) system utilisation as shown in Figure 2.

In early planning comes from the MOH. The Ministry is responsible to choose appropriate hospitals to implement HIS. MOH is in charge of opening the tender to develop the system. After that, the successful vendor will be decided by the MOH. Moreover, MOH is also responsible to set up a group which includes hospital staffs including hospital

directors, doctors, nurses and head of departments, and the vendor to cooperate in the implementation of HIS in the hospitals.

The System set-up is to plan the system required at the hospitals. The vendor and hospital staffs frequently meet to discuss matters related to setting up the systems. The vendor is responsible to select appropriate hardware and software to implement the system and then to set them up at the hospitals. The vendor has to develop the system in this phase.

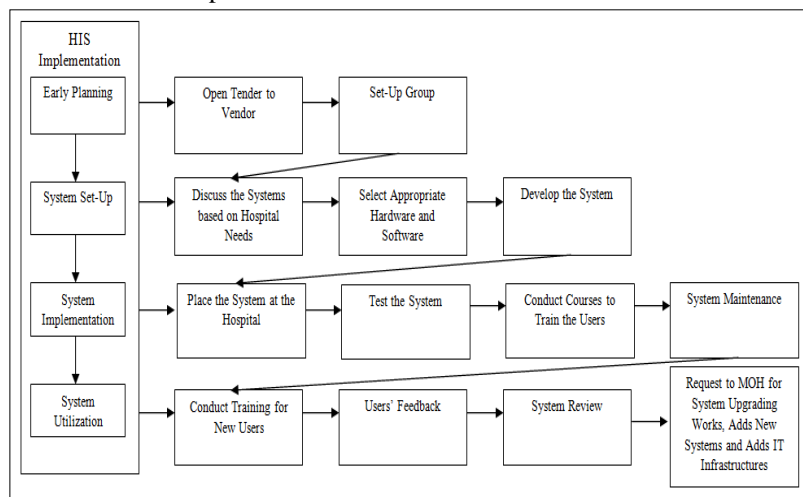
The System implementation is a phase to place and run the system at the hospitals. In this phase, the vendor is required to test the system. Moreover, the vendor has to conduct courses to train the users to use the system. After the users have been adequately trained, the system is ready to use at the hospitals. Besides that, the vendor or IT department is required to maintain the system to ensure it is always in a good condition. For example, hospitals implementing IHIS have their own vendor to maintain the system while hospitals implementing THIS and BHIS maintain the system through the IT departments.

The System utilisation is important to ensure the system is appropriately used by the users. Thus, training for new users is important to ensure successful implementation of the system at the hospitals. Therefore, the users' feedbacks are required in order to identify the system implementation effectiveness. This is a way to know whether they are satisfied with the system or not, and whether they accept the implementation of the system in the hospitals or not. This is important to ensure high level of user acceptance and satisfaction towards the system. Furthermore, system review for the hardware and software is also required. Usually, the IT department of the hospitals will be instructed by the MOH to upgrade the system, to insert new additional systems, and to install more infrastructures such as PC and laptops, provided that there are sufficient financial sources.

In spite of HIS acceptance and adoption, Hospital A has low satisfaction level. The users accepted the system, however they required more powerful and advance electronic system. This is because, most of the THIS hospitals are located at the rural areas where the users have high level of awareness on IT tools. Moreover, the scenarios in the THIS hospitals are paperless, where the users have to use the system in their daily work. On the other hand, Hospital B and Hospital C have low acceptance levels because the users have less awareness of using HIS at their hospitals. Moreover, the HIS in IHIS and BHIS hospitals are incomplete and this situation made the users feels reluctant to accept and use the system. Thus, the HIS Implementation Framework in Figure

2 has included with awareness programmes and trainings to guide the HIS implementation in Malaysian Public Hospitals. It might overcome the HIS implementation problems in future.

Fig. 2. HIS Implementation Framework in Malaysian Public Hospitals



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