

Implementation Differences of Hospital Information System (HIS) in Malaysian Public Hospitals

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Abstract—Hospital Information System (HIS) is important to healthcare sector especially in public hospitals as they need to serve the public with high-quality healthcare treatments. HIS helps to improve patients care services. Thus, the Malaysian Government has introduced three (3) categories of HIS namely Total Hospital Information System (THIS), Intermediate Hospital Information System (IHIS), and Basic Hospital Information System (BHIS) among Malaysian public hospitals. However, only 15.2% of the Malaysian public hospitals are implementing the system. Moreover, there is limited number of empirical studies on HIS implementation in Malaysia. Thus, this paper aims to investigate issues and challenges in HIS implementation for each category of HIS by using in-depth interviews. Nine participants were involved in the interviews. The interview data were transcribed verbatim and analysed based on Content and Thematic Analysis using NVivo software. The results showed that different category of HIS faced different issues and challenges.

Index Terms—Basic hospital information system, hospital information system, intermediate hospital information system, total hospital information system.

I. INTRODUCTION

Information technology (IT) has become vital in healthcare sector including public hospitals. The technology has been found to play significant role in improving patients care services. In Malaysia, the healthcare sector is divided into three healthcare providers, which are public, private, and Non-Governmental Organisations (NGOs) [1]. Specifically, public healthcare sector, especially the hospitals, has complex system. The public healthcare sector has more complex workflows than other healthcare providers. Moreover, the public hospitals have large number of patients – from the rich to the poor to get medical treatments, unlike the private hospitals that focus only on the rich who could afford to pay expensive medical bills. Therefore, the large number of patients in public hospitals may lead to complex and complicated environment. This may also lead to inefficient system implementation; patients need to wait for a long time before getting their medical treatment. This issue is related to low quality of healthcare services in public

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hospitals. In fact, the statistics by the Ministry of Health shows increasing number of negligence cases reported between 2000 and 2008 [2]. Hence, Hospital Information System (HIS) is hoped to improve the quality of healthcare services.

II. LITERATURE REVIEW

A. Hospital Information System (HIS)

HIS refers to a computer system designed to manage all the hospital's medical and administrative information in order to enable health professionals to perform their jobs more effectively and efficiently [3]. Moreover, HIS manages all the information processing activities within hospital to achieve high-quality patients care services and medical research [4]. HIS consists of at least two of the following components: Clinical Information System (CIS), Financial Information System (FIS), Laboratory Information System (LIS), Nursing Information System (NIS), Pharmacy Information System (PIS), Picture Archiving and Communication System (PACS), and Radiology Information System (RIS) [3]. Each category has its own function, department and users in improving hospital services. Table I tabulates the description for each component including its respective function, and department and users of the component.

HIS has many benefits to hospitals [5-36]. However, in the same time, there are several issues and challenges in HIS implementation [37-48]. Table II shows the benefits, the issues and challenges in the implementation of HIS according to previous researchers. The table verifies that HIS implementation is not easy.

In terms of division of HIS implementation, Budkin [49] describes that HIS implementation process is categorised into planning, design, implementation, and operation. Next, Houser et al. [50] indicate that HIS implementation process is divided into three (3) phases, which are preparatory activities for system implementation, certification and acceptance testing, and system implementation. But, according to Rossi [51], HIS implementation process is categorised into two (2) phases only, which are preparatory phase and utilisation phase, specifically, in Malaysia, Hassan [52], Mohd, and Syed Mohd. [5], Abdul Hamid [53], and Ismail et al. [54] describe that HIS implementation process is divided into three (3) stages, which are pre-implementation stage, implementation stage, and post-implementation stage. Therefore, all these researchers have similar opinions on division of HIS implementation.

TABLE I: HIS COMPONENTS AND THEIR FUNCTIONS, DEPARTMENTS AND USERS OF THE COMPONENT

| HIS Component | Function | Descriptions | |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---------------------------|
| | | Department | User |
| CIS | Computer-based system designed for collecting, storing, manipulating, and making available clinical information important to the healthcare delivery process. | Clinical | Doctors, Nurses |
| FIS | Computer system that manages the business aspects of a hospital; used by accountants in financial department. | Financial | Accountants |
| LIS | Computer information system that manages laboratory information for all the laboratory disciplines such as clinical chemistry, haematology, and microbiology, which are used in laboratory by laboratory officers. | Laboratory | Lab officers, Doctors |
| NIS | Computer system that manages clinical data from various healthcare environments; available in a timely and orderly fashion to aid doctors and especially nurses in improving patients care. | Ward | Nurses, Doctors |
| PIS | Complex computer system designed to meet the needs of pharmacy department. | Pharmacy | Pharmacists, Doctors |
| PACS | A loose term to describe a set of systems that facilitates the archiving, processing, and viewing of digital radiological images and their related information; this system is used in x-ray and imaging department. | Imaging | Imaging Officers, Doctors |
| RIS | Computer system that assists radiology services in the storing, manipulating and retrieving patients' information. | Radiology | Radiologists, Doctors |

TABLE II: HIS BENEFITS, ISSUES AND CHALLENGES

| HIS Benefits | Researchers | HIS Issues and Challenges | Researchers |
|-------------------------|------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|------------------------------------|
| Accessible | [5]; [6]; [7]; [8]; [9]; [10]; | High initial cost | [37]; [38]; [39]; [40]; [26]; [41] |
| Remote access | [11]; [12]; [6]; [13] | High initial physician time | [39]; [40]; [38]; [42]; [43] |
| Save time and space | [14]; [15]; [16]; [17]; [10]; [19]; [20]; [21]; [22] | Technology and technical matters | [37]; [44]; [45]; [46]; [41]. |
| Up-to-date and accurate | [12], [23] | Fundamental problems such as lack of computer skills, complex tasks, complex functions | [6]; [10]; [30]; [37]; [47]; [48] |
| Decrease medical errors | [24]; [25]; [26]; [27]; [28]; [29]; [30]; [31]; [32]; [33]; [34]; [35]; [36] | Ethical issues such as certification, security, privacy and confidentiality | [26]; [41]; [48] |

B. Implementation of HIS in Malaysia

According to Abdul Hamid [53], the planning of HIS implementation began in 1993, which started under 6th Malaysian Plan (MP), in Hospital Selayang and termed as THIS. Then, in 1996, telehealth project was launched on the 1st August 1996. Moreover, HIS implementation took place along with physical construction under the 7th MP. Today, only 21 out of 138 public hospitals are implementing the system [2, 53, 54]. Thus, the level of HIS implementation is still low.

C. Categories of HIS

There are three (3) categories of HIS, which are THIS, IHIS, and BHIS. As mentioned earlier, out of 138 public hospitals, 21 public hospitals are implementing any of these categories of the system [2, 5, 53, 54]. Table III tabulates the hospitals into THIS, IHIS, and BHIS. Based on the table, hospital size is vital to indicate the categories of HIS. THIS is for the hospitals with more than 400 beds, IHIS is for hospitals with more than 200 beds but less than 400 beds, and BHIS is for hospitals with less than 200 beds.

Moreover, each category of HIS has different set of information system as shown in Table III. THIS has more complete set of HIS than IHIS and BHIS. Moreover, the hospitals implementing THIS are also known as “paperless hospitals”.

III. RESEARCH METHODOLOGY

The research design of this study is multiple case studies. According to Yin [56], this research design supports the nature of the study. In this study, three cases were selected for purposive sampling. According to Merriam [57], purposive sampling is based on the assumption that the researcher wants to investigate and understand an issue based on several samples. The three cases selected were Hospital Sultan Ismail, Hospital Keningau, and Hospital Tuanku Ja’afar; each of these hospitals represents different categories of HIS. Hospital Sultan Ismail implements THIS, Hospital Keningan

implements IHIS, and Hospital Tuanku Ja'afar implements BHIS. Nine participants were selected among Hospital Directors, IT officers, and HIS users. Moreover, purposive sampling was used to ensure that the data collection was able to answer the research objectives. Besides that, snowball technique was used to investigate the HIS implementation process in Malaysian public hospitals.

TABLE III: HOSPITALS IMPLEMENTING HIS

| Categories of HIS | Name of Hospitals | Components of HIS Implemented | Number of Beds | | |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|----------------------------------------------------------------|--------------------|
| THIS | Hospital Putrajaya, | Patient Management | More than 400 beds | | |
| | Hospital Selayang, | System + Clinical Access | | | |
| | Hospital Pandan, | Information System + Laboratory | | | |
| IHIS | Hospital Ampang, Hospital Sg. Buloh, Hospital Alor Setar, Hospital Sungai Petani, Hospital Sultanah Zahirah, Hospital Sultan Haji Ahmad Shah and Hospital Bintulu | Information System + Picture Archiving and Communication System (PACS) + Administration Information System + Financial Information System + Inventory Information System + Personnel Information System | More than 200 beds but not less than 400 beds | | |
| | BHIS | Hospital Kuala Batas, Hospital Setiu, Hospital Pekan, Hospital Pitas, Hospital Kuala Penyu, Hospital Kunak, Hospital Tuanku Ja'afar and Hospital Port Dickson | | Patient Management System + Clinical Access Information System | Less than 200 beds |

Furthermore, qualitative method i.e., in-depth interviews, was selected to investigate the HIS implementation among the Malaysian public hospitals in details. According to Kvale [58], in-depth interviews allow primary data to be collected and enable the researchers to search and find further clarification about the answers given by the participants. In the interview session, which took about 60 minutes for each participant, an interview guide was prepared for investigating

the HIS implementation process. Malay and English languages were used as the main languages in the interview. The interviews were tape-recorded and later transcribed verbatim. For data analysis, Content and Thematic Analysis using computer software called NVivo was used. The data were triangulated with other supporting documents obtained during the study that served as the secondary data to ensure that the data were valid.

IV. RESULT

From the analysis, several issues have influenced overall HIS implementation in Malaysian public hospitals such as limited financial sources, maintenance by different department, HIS implementation order by the Malaysian Ministry of Health, addition of new systems, confidentiality issues, low acceptance level, low satisfaction level, different vendors, infrastructure issues, system breakdown, duplication of data, and different systems as shown in Table IV.

TABLE IV: RESULT OF ISSUES AND CHALLENGES OF HIS IMPLEMENTATION

| Issues and Challenges | Participants | | | | | | | | |
|--------------------------------------------------------------|-------------------------------|---|---|--------------------------|---|---|--------------------------------|---|---|
| | Hospital Sultan Ismail (THIS) | | | Hospital Keningau (IHIS) | | | Hospital Tuanku Ja'afar (BHIS) | | |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Limited Financial Sources | | | √ | √ | √ | √ | | | √ |
| Maintenance by Different Department | √ | | √ | √ | √ | √ | | | √ |
| HIS Implementation Order by the Malaysian Ministry of Health | √ | √ | √ | √ | √ | √ | √ | | |
| Addition of New Systems | | | | | √ | √ | | | |
| Confidentiality Issues | √ | | | | | | | | |
| Low Acceptance Level | | | | | √ | √ | √ | √ | √ |
| Low Satisfaction Level | √ | √ | √ | √ | | | | | |
| Different Vendors | √ | √ | √ | √ | √ | √ | √ | | |
| Infrastructure Issues | √ | | | √ | √ | | √ | √ | |
| System Breakdown | | √ | | √ | | √ | √ | | √ |
| Duplication of Data | √ | √ | | | √ | √ | | | √ |
| Different Systems | √ | √ | √ | √ | √ | √ | | | √ |

A. Limited Financial Sources

The implementation of HIS is expensive and the financial source comes from the Malaysian Government. The costs include start-up, maintenance, and training. The hospitals depend on the financial sources from the Malaysian Government. Although the hospitals obtain financial support from the Government to build hospitals with IT applications, the costs to maintain the system and train the users are increasing. Thus, the hospitals have limited financial sources other than the Government and they are in need of more financial sources to upgrade the system as well as to add new system. However, limited financial sources by the Government have made the system unchanged or not improved.

B. Maintenance by Different Departments

In THIS and BHIS hospitals, the IT department is responsible to maintain the system and to train new HIS users. However, hospitals especially those implementing IHIS have outsourced the responsibility to maintain the system. Thus, the difference in the department responsible for maintaining

the implementation of HIS between one HIS category to another has made it difficult for the system to be synchronised nationwide.

C. HIS Implementation Order by the Malaysian Ministry of Health

HIS Implementation is ordered by the Malaysian Ministry of Health (MOH). Usually, hospitals are built with the IT system, either THIS, IHIS or BHIS. Thus, the MOH has full authority of the overall HIS implementation.

D. Addition of New Systems

Due to limited financial sources as discussed earlier, the hospitals have difficulties in adding new systems to the currently used ones, especially for BHIS. However, the hospital with IHIS has added several new systems such as Day Care System, e-notification, e-registration and Registry Delivery System. These systems are developed as a cooperation work between the outsource company and the IT department of the hospital.

E. Confidentiality Issues

Hospital records are confidential. Thus, it is vital to keep all patients' data and records in a proper way. Thus, the system is designed to allow only authorised users with ID and password. However, the security level is not enough as all nurses or doctors can get access to all patients' data and records, under or not under their supervision.

F. Different Vendors

According to the participants, the hospitals with THIS, IHIS, and BHIS have multiple vendors to implement HIS. For example, Cerner is the main vendor for THIS in Hospital Sultan Ismail. Other than that, GE, Kaizen HR, and People Soft are also the vendors for Hospital Sultan Ismail for imaging, human resource, and billing. Meanwhile, in Hospital Keningau, I-Soft is the vendor implementing HIS in the hospital while Hi-Tech works in Hospital Tuanku Ja'afar.

G. Low Acceptance Level

There is low acceptance level by HIS users in the hospitals. According to the participants, most of the old-aged users especially among physicians have low acceptance towards the system. They believe that using the system is time-wasting because the system is too complex for them.

H. Low Satisfaction Level

Most HIS users have low satisfaction level because they want a more excellent system than the present one. They think that the present system is not good enough.

I. Infrastructure Issues

Due to limited number of computers and laptops, it is difficult for the hospitals to efficiently implement HIS in all hospitals.

J. System Breakdown

Sometimes the system breaks down when the users are dealing with the patients. This is one of the challenges of using the electronic system.

K. Duplication of Data

Sometimes the system breaks down when the users are dealing with the patients. This is one of the challenges of

using the electronic system.

L. Different Systems

According to interview result, each category of HIS has difference systems. For example, hospital of THIS has Radiology Information System, Laboratory Information System, Pharmacy Information System, Critical Care Information System, Picture Archiving & Communication System, Electronic Medical Records, Financial Information System, Administrative Systems and Dietary Information System. Moreover, the hospital with IHIS has Clinical Access, Person Management System, Billing System, Pharmacy Information System, Laboratory Information System, e-notification and Registry Delivery whereas the hospital with BHIS has Patient Management System, Billing information System, Dietary Information System, Ward Information System, Electronic Medical Records and Nurse and Staff Information System. Hence, it confirms that the different systems are depends on hospital needs.

V. CONCLUSION

In conclusion, different category of HIS faces different challenges. THIS has the most complete system whereas BHIS has the least complete and limited system. In addition, the most critical issues and challenges in HIS implementation are low of acceptance level and low of satisfaction level. Thus, these critical issues and challenges need to be studied and a HIS implementation model has to be developed using questionnaire as a quantitative approach for studying these issues and challenges in future work.

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