FACTORS INFLUENCING THE SUCCESS OF HOSPITAL MANAGEMENT INFORMATION SYSTEMS IN A MENTAL HOSPITAL IN INDONESIA

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Abstract

A hospital, as a healthcare provider, has a main business process, i.e. to provide the best healthcare services for its customers. Performing a wrong and error work could lead to an irreversible disaster in the issue of the health of patients. Therefore, the work of all staffs in a hospital must be managed according to the principal of correctness, accuracy and timeliness of any information. Hospital information systems (HIS) provide significant information processing for hospitals to manage all the data and information in an accurate and short time way. A hospital that utilizes HMIS is believed to gain more benefits for its patients, staffs and organization itself.

However, many hospitals implementing Hospital Information Systems are failed to reap the offered benefits. Many reasons were identified by scholars and one of which raises the necessity for evaluating the systems. This paper presents the evaluation of Hospital Management Information Systems (HMIS) to identify the most influencing factor that leads to a higher net benefits in implementing the HMIS for a hospital. The case study used is the biggest mental hospital in East Java, Indonesia. The result is expected to contribute to add literature on the evaluation of healthcare information systems especially in Indonesia.

Key Terms: Hospital, management information systems, success model, evaluation

1. Introduction
For any organization including healthcare field, the advance of technology has shifted the way people work from a manual to an automatic processes. A hospital, as a healthcare provider, has a main business process, i.e. to provide the best healthcare services for its customers. In its daily operation, dozens of patients come to a hospital expecting that they will be quickly and correctly treated. Performing a wrong and error work could lead to an irreversible disaster in the issue of the health of patients. Therefore, the work of all staffs in a hospital must be managed according to the principal of correctness, accuracy and timeliness of any information.

Hospital Management of Information Systems (HMIS) is an information system used by a hospital to manage its daily operations ranging from handling its patients, administration process, accounting and financial process to its management purposes. The coverage of HMIS encompasses the management of information, physical data processing and other components (Haux et al., 2004). The aim of HMIS is to streamline the complex processes in a hospital so that the hospital could provide a better healthcare services for its patients. There are thousands data collected by a hospital in its daily operation, ranging from the data of patients (including its medical records), the data of its staffs (including its profile, salary, etc.) to the data of the daily operations of hospital itself. Before the presence of Information Technology, these data is managed manually in which requires a lot of time and resources. Hospital information systems (HIS) provide significant information processing for hospitals to manage all the data and information in an accurate and short time (Winter et al., 2011). A hospital that utilizes HMIS is believed to gain more benefits for its patients, staffs and organization itself.

However, many hospitals implementing Hospital Information Systems are failed to reap the offered benefits. Literature on HIS highlights some underlying reasons behind the failure, such as software issues, slow documentation, bad vendors, limited initial return on investment, failure on deployment approach (Renner, 2009). In addition to that, a hospital often fails to notice that the implementation of healthcare information systems depends on its staffs and their responsibilities (Kleinau, 2000). Another scholar also notices that the successful hospital information systems depends on technical, social, organizational factors and the perception of key stakeholders (Heeks et al, 1999).

Realizing the existence of a paradox where healthcare information systems do not provide benefits for hospitals, this state constitutes many studies on the evaluation of HIS in a hospital. The study is ranging from the pre-implementation (i.e. analyzing the acceptance of hospitals for HIS implementation) to the post-implementation (i.e. evaluation on the success of HIS) (Al-Mamary et al, 2013).

In Indonesia case, many hospitals are utilizing hospital information systems to provide a better healthcare services to its customers. However, almost none of the hospitals evaluates its HIS. Evaluation is necessary to find factors influencing the success of HIS so that the HIS implementation can be improved and optimized. Information Systems Success Model (ISSM) proposed by DeLone and McLean provides a model for this purpose.

This paper presents an analysis on the implementation of Hospital Management Information Systems in a hospital in Surabaya, Indonesia. Based on ISSM model, the analysis is conducted to obtain factors influencing the success of HMIS and therefore to propose a recommendation for improvement. The result of this paper shows the influencing factor that the hospital must pay attention to in order to gain the benefits of HMIS. This paper contributes to add literature on the evaluation of HIS.

2. **DeLone McLean Information Systems Success Model (ISSM)**

Information system success model was proposed by DeLone and McLean in 1992 and subsequently updated in 2003 (Petter et al., 2006). The model consists of several variables i.e. service quality, information quality, system quality, intention to use, user satisfaction, use and net benefits. These variables are constructed to find their causal relationship in the model. The measurement of each variable is calculated dependently, meaning that one could affect others. The ISSM model is depicted in the figure below.
Overall, the success of information systems can be identified by analyzing the correlation of all variables in the model. An information system (IS) is believed successful when it gives impacts to both organizational and individual of which in the model is represented by net benefits variable. IS impacts are perceived to be affected by the satisfaction of users (User Satisfaction variable) using the IS and also the amount of users to use (Use variable) the IS itself. The amount of users to use a system (Use) may also affect the value of user satisfaction (User Satisfaction) positively and negatively. Reciprocally, the satisfaction of users may also influence the frequent of users accessing system. In this sense, user satisfactions might be influenced by the quality of service, information and system of the information system. The intention of users to use an information system might also be influenced by the quality of information system in term of service, information and its system itself. All these variables are independent each other. However, they all are measured dependently in order to find out the correlation between one and other variables in the model.

2.1 The Variables

The success of information systems according to DeLone and McLean Model can be identified by analyzing variables in the model. Each variable is explained in Table 1.

| Variables             | Definition                                                                                                                                 |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Service quality       | Service quality is the degree that the support of a system meets its customer needs. (DeLone and McLean, 1992, Pitt et al., 1995)            |
| Information quality   | The output of an information system, concerning the value, benefits, relevance, and urgency of information produced. (Pitt et al., 1995) |
| System quality        | The performance of system which refers to how well the capabilities of the hardware, software, policies and procedures of information systems can provide the information needed by users. (DeLone and McLean, 1992) |
| User satisfaction     | The response and feedback that appear after the users using the information system.                                                          |
| Intention to Use      | Underlying reasons which trigger users to use an information system.                                                                       |
| Use                   | The frequency of users to use an information system                                                                                        |
| Net Benefit           | The effect of the application to the user behavior and organizational behavior                                                              |

2.2 The Indicators of Variables
Each variable in the model has some indicators. These indicators contain different focus of each variable in a more-detailed way. Currently, there are vast literature discussing ISSM with its variables and indicators. Some indicators and their definition used as guideline in this research are presented in Table 2.

| Variables         | Indicators | Definition                                                                 |
|-------------------|------------|-----------------------------------------------------------------------------|
| Service quality   | Assurance  | The system gives trust to its users in term of service delivered to them     |
|                   | Reliability| The system provides reliable services to its users                          |
|                   | Responsiveness | The staffs or the system is responsive to any complaint/request from its users |
|                   | Empathy    | The system/staffs show willingness to help/care to its users                |
|                   | Tangibles  | The language/words chosen of the admin/staffs in responding users problem is convincing. |
| Information quality | Accuracy  | Information provided in the system is accurate.                             |
|                   | Content    | The system provides a complete information/content.                         |
|                   | Currency   | The system does provide up-to-date information                              |
| System quality    | Accessibility | Users are easy to access the system                                         |
|                   | Ease of Use| The system is easily to be learned and used.                                |
|                   | Response time | The system provides a quick response to any given input.                   |
|                   | Security   | The system ensures restriction to any unauthorized access.                  |
| User satisfaction | Usefulness | Users perceive that the system is useful for them.                          |
|                   | Overall satisfaction | Exploring the overall satisfactory of users towards the system.             |
| Intention to Use  | Availability | The system is frequent to be used because the system is always available.   |
|                   | Necessity  | The system is frequent to use because the users need it.                   |
| Net benefit       | Incremental efficiency | The system improves the efficiency of organization's business processes. |
|                   | Incremental effectiveness | The system improves the effectiveness of organization.                      |

This research utilizes the DeLone McLean model in order to analyze the successful implementation of Hospital Management Information Systems.

3. Methodology

The methodology consists of four steps. First, it begins with determining the research conceptual framework (sub chapter 3.1). According to the conceptual framework, indicator variables are also determined. Second, following the conceptual framework, a research design is then constructed (sub chapter 3.2). Third, the case study, sampling and data collection are described (sub chapter 3.3). Forth, analysis of the collected data including descriptive and inferential analysis is then performed (chapter 4). According to the analysis, recommendations are then constructed (chapter 4).

In this chapter, we provide the result of stages 1 to three. In the next chapter, the result of data analysis including recommendation is presented.

3.1 Determining the Conceptual Framework
This research adopts the DeLone and McLean Success Model (2003). Based on the model, hypotheses are constructed. Figure 2 depicts the model and the hypothesis.

![Conceptual Framework](image)

**Figure 2. Conceptual Framework**

In order to analyse the success of Hospital Management IS, there are six variables used in the model with nine hypotheses to be analysed. Use variable is forsaken in this research considering that the staffs in the hospital always access Hospital Management Information Systems every day since this information system in order to operate their daily activities. The hypotheses to be proven in this research are as follow.

- **H1**: Information quality has significant and a positive influence on the intention of use of its users.
- **H2**: Information quality has significant and a positive influence on user satisfaction.
- **H3**: System quality has significant and a positive influence on the intention of use of its users.
- **H4**: System quality has significant and a positive influence on user satisfaction.
- **H5**: Service quality has significant and a positive influence on the intention of use of its users.
- **H6**: Service quality has significant and a positive influence on user satisfaction.
- **H7**: User satisfaction has significant and positive influence on intention to use.
- **H8**: Intention to use has significant and positive influence on net benefits.
- **H9**: User satisfaction has significant and positive influence on net benefits.

Having a conceptual model including its variables and hypothesis, the indicators of each variable are determined. Referring to literature study as presented earlier, indicators used in this research are as follow.

| Variables        | Indicators                                      |
|------------------|-------------------------------------------------|
| Service quality  | Assurance, reliability, responsiveness, empathy, tangibles |
| Information quality | Accuracy, content, currency                      |
| System quality   | Accessibility, ease of use, response time, security |
| User satisfaction| Usefulness, overall satisfaction                 |
| Intention to Use | Availability                                     |
| Net benefit      | Incremental efficiency, incremental effectiveness |

### 3.2 Constructing Research Design

Research design visualizes the model with all variables and their indicators, which is helpful to construct questionnaire for collecting data. The research design of this research is presented in Figure 3. The figure contains variables (represented in a rounded rectangle) with their indicators (represented in rectangle) in which each indicator of each variable is composed of several items or questions (represented in small rounded rectangles with a number inside).
3.3 Defining the Case Study, Sampling, Data Collection and Analysis Tool

The case study used for conducting this research is a mental hospital in Surabaya, East Java, Indonesia. The object of study is the users of Hospital Management Information Systems (HMIS) whom are staffs in the hospital.

The population used in this research is all staffs using the HMIS. Since the number of population using the HMIS is 40 people, the number of sample for research is similar to the number of population.

Regarding the data collection, we use questionnaire. The questionnaire consists of questions that represent each indicator per variable in the conceptual framework. The questionnaire has to be completed by respondents in order to be proceeded for analysis. The analysis is performed based on descriptive and inferential using tools. Descriptive statistical analysis makes use SPSS 16.0 for validity, reliability and linearity tests while inferential analysis makes use GSCA (Generalized Structured Component Analysis), part of Structural Equation Model (SEM-based).

4. Results and Analysis

This chapter comprises of twofold: it presents the analysis of the collected data and the discussion following the analysis result.

4.1 Result

Within four weeks of collecting data in the mental hospital in Surabaya, 40 questionnaire were filled. So, the number of sample used in this study is 40 respondents.

In order to analyze the data, we require to conduct descriptive statistics including reliability and validity tests. To do so, this study uses SPSS 17.0 to conduct the tests. Reliability test is aimed to check the consistency of our survey while validity test is used to ensure that our test or survey correctly measures what we aim to measure. For reliability test, we rely on Cronbach’s Alpha to measure how close the relation between items is. A sample is called reliable when the value of its Cronbach’s Alpha is larger than 0.6. The reliability test result of this research is summed up in Table 4.

| Variables | Cronbach’s Alpha | Reliability Status |
|-----------|------------------|--------------------|

Table 4 Reliability test result
Information quality 0.885 Reliable
System quality 0.727 Reliable
Service quality 0.898 Reliable
Intention to Use 0.799 Reliable
User satisfaction 0.859 Reliable
Net benefits 0.943 Reliable

Overall, the reliability test indicates that all variables used in this research are reliable. Because the value of Cronbach’s Alpha for all variables is more than 0.6, the consistency of this survey is good.

As for the validity test, we use Spearma’s rho correlation since the questionnaire uses Likert scale. The correlation result is then compared to a specified value of r-table. Since the number of samples is 40, the degree of freedom (df) to calculate Spearma’s rho correlation is 38. The significance level is 0.01 (two-tailed). According to this information, the value of R-table as the lowest limit for the correlation coefficient is 0.4026. It means that the whole items for each indicator in each variable is called valid when its value is above 0.4026. As the validity test result is applied for each item in the model, we only present part of the result, as seen in Table 5. However, according to our result, all variables are valid.

Table 5 Validity test result for information quality variable

| Variables       | Indicators | Items   | Spearma’s rho | R-table (the limit) | Validity Status |
|-----------------|------------|---------|---------------|---------------------|-----------------|
| Information     | Accuracy   | D1C1A  | 0.679**       | 0.4026              | Valid           |
| Quality         |            | D1C1B  | 0.772**       | 0.4026              |                 |
| Content         | D1C2A      | 0.674** | 0.4026       | Valid               |
|                 | D1C2B      | 0.535** | 0.4026       | Valid               |
| Currency        | D1C3A      | 0.619** | 0.4026       | Valid               |
|                 | D1C3B      | 0.770** | 0.4026       | Valid               |

After conducting the validity and reliability test, the proposed hypotheses are analyzed using GSCA. As pointed out earlier, this research is intended to answer nine hypotheses. To do so, the collected data is run using GeSCA online tool. The path coefficients table in Table 6 is an output obtained from GSCA, the basis to answer the hypotheses. The significance of each correlation is seen from its CR while the type of correlation (whether positive or negative) is identified from the value of its Estimate. When the CR value is followed by asterisk (*) it means it has significant correlation. While for estimate, positive value means having a positive correlation while negative Estimate value is on the contrary. The closer the value to 1, the strongest the correlation is.

Table 6 Path coefficient and the conclusion for the hypotheses

| Hypotheses | Path Coefficients | Estimate | SE   | CR   | Result |
|------------|-------------------|----------|------|------|--------|
| $H_1$     | Information Quality$\rightarrow$Intention to Use | -0.019   | 0.453 | 0.04 |Rejected |
| $H_2$     | Information Quality$\rightarrow$User Satisfaction | 0.512 | 0.430 | 1.19 |Rejected |
| $H_3$     | System Quality$\rightarrow$Intention to Use | 0.659 | 0.570 | 1.16 |Rejected |
| $H_4$     | System Quality$\rightarrow$User Satisfaction | 0.075 | 0.641 | 0.12 |Rejected |
| $H_5$     | Service Quality$\rightarrow$Intention to Use | -0.074 | 0.315 | 0.23 |Rejected |
| $H_6$     | Service Quality$\rightarrow$User Satisfaction | 0.048 | 0.356 | 0.14 |Rejected |
| $H_7$     | Intention to Use$\rightarrow$Net Benefit | 0.904 | 0.088 | 10.29$^*$ | Accepted |
| $H_8$     | User Satisfaction$\rightarrow$Net Benefit | -0.137 | 0.131 | 1.05 |Rejected |
4.2 Analysis

Surprisingly, Table 6 clearly shows that almost all hypotheses are rejected while only one hypothesis is accepted. The result is in contrary with the proposed hypotheses in which we perceive that all the variables in the model has a significant and positive correlation. The result shows that all variables have no significance each other except one fact, i.e. intention-to-use have significant and positive correlation to net benefits. This means that in order to improve the benefits of Hospital Management Information Systems (HMIS), the case study must not neglect the intention to use of its users. Instead, the case study must trigger the use of its information system. The case study might neglect user satisfaction since it has no significance to net benefits. However, the intention to use of its users might vary. According to the model, intention to use comprises of one indicator i.e. availability which have two items of questions. Considering the mean of two items of the intention to use variable, currently, the users mostly agree that their intention to using HMIS is mainly because the system provides 24 hour access and is easy to access. In this sense, the case study is now in the state where the availability of its system is already good. If the case study wants to increase the net benefits of its HMIS, they must retain or even improve its system's availability.

The fact that almost all the correlation paths are not significant has provoked us to analyse paths which have estimate value above 0.5 since they might have a stronger correlation either positive or negative. In addition to the path “Intention to Use → Net benefit” which have the strongest positive correlation, there are other two paths that interestingly have enough positive correlation. According to the table, even though they have no significant correlation, the path "Information Quality → User Satisfaction" and "System Quality → Intention to Use" have more than 0.5 in its estimate value (0.512 and 0.659 respectively). Since user satisfaction has no significant impact on net benefits, we neglect the path "Information Quality → User Satisfaction". Instead, we are interested to analyse another path, i.e. "System Quality → Intention to Use" because intention to use is an important variable for the case study to improve the success of its HMIS. Interpreting from its estimate value, system quality is perceived to have a strong positive correlation to intention to use. This means, if the case study wants to improve the intent of its users to use the system, the case study could improve its system quality. If the system quality is good, users are more willing to use the system and the benefits of HMIS for the case study is also improving. This finding quite makes sense since the indicators system quality (i.e. accessibility, response time, ease of use, security) are closely related to the indicator of intention to use variable (i.e. availability). The more system is reliable and accessible, the system is more available to access.

5. Conclusion

To conclude, this paper presents the evaluation of Hospital Management Information Systems (HMIS) of a mental hospital in Surabaya, Indonesia. The evaluation makes use Information Systems Success Model (ISSM) proposed by DeLone and McLean (2003) to explore factors influencing the success implementation of HMIS in the hospital as the case study. There are several variables used in the model, i.e. systems quality, information quality, service quality which are perceived to have correlation with user satisfaction variable and intention to use variable. The last two variables are also perceived to influence the degree of the benefits of HMIS for individual and organization. All the variables have indicators of which have items of questions. According to the model, nine hypotheses are developed to explore the correlation of all variables in the model.

Having the data collected from 40 respondents and tested using validity and reliability test, the data are then analyzed using GeSCA online tool to explore the correlation among variables. According to the path coefficient, the result shows that the most influencing factor for improving net benefits of HMIS is the intent of users to use the system (Intention to Use → Net benefits). This is the only accepted hypothesis in this study. All the other correlation among variables in the model are not proven accepted. Therefore, the case study should pay its high attention to keep or even improve the intention to use of its users in using the HMIS. In addition,
we also find out that the path "System Quality \(\rightarrow\) Intention to Use" also have a strong positive correlation even though they both have no significant influence. This means that an improvement in system quality could lead to an improvement in intention to use which at the end could also improve the net benefits of HMIS.

Lastly, this study remains a question on the underlying reasons behind the fact that most hypotheses are rejected. We realize that this study has a limitation (one of which is the small number of sample) that leads to a difficulty for us to track the rejection of hypotheses. Therefore, a similar study on the evaluation of Hospital Information Management Systems needs to be conducted with the involvement of more participants.

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