Evaluation of The Application of Hospital Management Information System (SIMRS) in RSUD Dr. Kanujoso Djatiwibowo Using The HOT-Fit Method

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Keywords: Evaluation, HOT-Fit, Information System, SIMRS.

Abstract. Hospital Management Information System (SIMRS) is a system that can process and integrate the entire hospital service process flow in the form of a network of coordination, reporting and administrative procedures to obtain accurate data and information. At the RSUD Dr. Kanujoso Djatiwibowo (RSKD) of Balikpapan City, the application of SIMRS experienced problems such as the high number of troubleshooting cases and the redundancy of patient medical record numbers. This case is considered to inhibit the performance of hospital services related to efficiency. Based on this problem, the evaluation of SIMRS in the RSKD was carried out by using the constructed Human, Organization, Technology-Fit (HOT-Fit) model. This model involves eight variables which consists of System Quality, Information Quality, and Service Quality, System Use, User Satisfaction, Structure, and Environment, and Net Benefits. The results indicate that the proposed model either directly or indirectly affects the benefits obtained from implementing the SIMRS. Further implications of the results toward improvement of the system are provided.

Introduction

In the era of the industrial revolution 4.0 and the rapid development of technology, information technology has become an important component in the success of an organization to improve service quality, especially the ease of accessing data and information. One of organization that has a lot to do with data and information is the hospital. As a complex organization, the hospital considers data and information as important assets that need to be managed optimally to support decision making [1][2]. These data are processed in a system called the Hospital Management Information System (SIMRS) [3]. This information system is called SIMRS. In SIMRS implementation, support and synergy are needed from the hospital as an organization in making technology-related policies that are in line with the hospital’s vision and mission. In addition to the synergy between organizational and technological factors, to achieve the expected goals, the support from the Human Resources (HR) factor is needed. Humans are actors who have a role in operating SIMRS as well as employees who carry out organizational (hospital) policies. Therefore, the three basic components must work together to produce benefits that refer to effectiveness and efficiency so as to improve the quality and performance of hospital services [4].

At the RSUD Dr. Kanujoso Djatiwibowo (RSKD) SIMRS began to be implemented since 2013. However, in March 2018 the application of SIMRS encounter a change in developer partners. Starting from September 2018 during the implementation, the number of SIMRS troubleshooting cases was found significantly high, so that it was considered to bother the performance of hospital services related to efficiency. In addition, there were documented cases of redundancy in patient medical records until the end of 2019. This was triggered due to human error during the reporting process and hospital services. To solve the problem in the paragraph above, it is necessary to
conduct an evaluation activity that measures how well the application of the information system can benefit the organization so that it can improve performance in the future.

HOT-Fit model is aimed at the core components in information systems those are Human, Organization, Technology and compatibility between the three of that components.

Based on the problem, the main focus of this research is to understand the factors that influence the successful implementation of SIMRS in RSKD, also to find potential problems that is being faced by users and organizations. This can be proven through evaluating the application of SIMRS by considering the technological, human, and organizational factors that influence the successful implementation of SIMRS. From the evaluation activities it is expected to identify the factors that influence the successful implementation of SIMRS in RSKD. Also, as a consideration in the form of recommendations to improve the quality and increase the benefits of the application of SIMRS in RSKD.

**Literature Review**

**Human, Organization, and Technology-Fit (HOT-Fit)** is a model of information system evaluation method formulated by Yusof et al. (2006) based on a combination of the IS Success Model (ISSM) and IT-Organization Fit, resulting in a model that places important components of information systems, namely human, organization, technology, and compatibility between them. In this case, organizations must be equipped with appropriate technology and infrastructure to ensure that technology supports the goals of the organization. Furthermore, organizations must have the ability to prepare their staff members to adapt to new technologies or changes that occur. Things like this can be achieved with strategies and management such as leadership support, teamwork, and effective communication by staff. The HOT-Fit has three aspects and different dimensions in every aspect. In technology aspect, there are three dimensions that is, system quality, information quality, and service quality. In human aspect, there are two dimensions that is, system use, and user satisfaction. In organization aspect, there are two dimensions that is, structure, and environment. Those dimensions is used to measure the net benefits (see Fig. 1) [5].

![Figure 1 HOT-Fit Framework](image)

**Generalized Structured Component Analysis (GSCA)** is a component-based approach to SEM with latent variables defined as components of observed variables. GSCA structural models are not recursive, and latent variables in the measurement model have reflective and formative properties. The GSCA was developed in 2004 by Heungsun Hwang, Hec Montreal, and Yoshio Takane [1]. The software used to conduct GSCA analysis is GeSCA. This website-based software can be accessed at [http://sem-gesca.com/webgesca/](http://sem-gesca.com/webgesca/). In evaluating the suitability of the model in the GSCA, three types of assessments are carried out, there are [6]:

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1. Measures of fit measurement model. Outer models with reflective indicators are used to test the validity and reliability of research instruments.

2. Measures of fit structural model. The suitability of the structural model produces output in the form of path coefficients and R-square ($R^2$). Path coefficient shows the relationship that has a positive or negative effect and the significance of the influence between one latent variable with another. Positive or negative effects can be seen from the estimated value. Furthermore, the significance of the influence between variables can be determined if the value of CR (Critical Ratio) > 1.96 uses a degree of confidence of 95% [7]. Whereas $R^2$ shows the variability of endogenous variables explained by other latent variables [8].

3. Goodness of fit overall model. The goodness of fit the model is measured using the value of FIT, AFIT, and GFI.

Research Method

Research Model and Hypotheses. The hypotheses in this study refers to the research of Yusof et al. (2006) and developed by Erlirianto et al. (2015) [9]. There are 17 research hypotheses on the conceptual framework research that can be seen on Fig. 2.

Figure 2 Conceptual Framework Research

H1: The quality of the system has a significant positive effect on system use.
H2: The quality of the system has a significant positive effect on user satisfaction.
H3: The quality of the system has a significant positive effect on organizational structure.
H4: Information quality has a significant positive effect on system use.
H5: Information quality has a significant positive effect on user satisfaction.
H6: Information quality has a significant positive effect on organizational structure.
H7: Service quality has a significant positive effect on system use.
H8: Service quality has a significant positive effect on user satisfaction.
H9: Service quality has a significant positive effect on organizational structure.
H10: The use of the system has a significant positive effect on user satisfaction.
H11: User satisfaction has a significant positive effect on system use.
H12: Organizational structure has a significant positive effect on the organizational environment.
H13: Organizational environment has a significant positive effect on organizational structure.
H14: The use of the system has a significant positive effect on net benefit.
H15: User satisfaction has a significant positive effect on net benefit.
H16: Organizational structure has a significant positive effect on net benefit.
H17: The organizational environment has a significant positive effect on net benefit.
**Research Instrument.** This research adopted and modified a questionnaire based on the work of Yusof et al. (2006) and developed by Erlirianto et al. (2015) to suit the SIMRS fit context that may be reused in future research. There are 8 variables, and 24 indicators see [Table 1].

| Variables       | Indicators                                                                                       | Item Indicator                                                                                     |
|-----------------|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| **System Quality** |                                                                                                 |                                                                                                     |
| Ease of learning| a. SIMRS has features that are easy to learn because of the manuals and / or help features.    |                                                                                                     |
| Ease of use     | a. SIMRS is easy to use because it is used                                                      |                                                                                                     |
| Response time   | a. SIMRS presents data or information that is entered into the system quickly                    |                                                                                                     |
| Security        | a. Can maintain the confidentiality of patient data (no leakage of patient data)                |                                                                                                     |
|                 | b. SIMRS has never experienced interference which results in damage or loss of data             |                                                                                                     |
| **Information Quality** |                                                                                                 |                                                                                                     |
| Accuracy        | a. Information on SIMRS is accurate (can be justified)                                          |                                                                                                     |
|                 | b. Information on SIMRS is easily known if there are errors in the data                         |                                                                                                     |
|                 | c. Information on SIMRS is clear (easy to understand)                                          |                                                                                                     |
| Completeness    | a. Information on SIMRS is always complete                                                      |                                                                                                     |
|                 | b. Information on SIMRS is fit as needed                                                       |                                                                                                     |
| Availability    | a. Information on SIMRS can always be accessed anytime when needed                              |                                                                                                     |
|                 | b. Information on SIMRS can always be accessed on every computer that has SIMRS installed       |                                                                                                     |
| **Service Quality** |                                                                                                 |                                                                                                     |
| Responsiveness  | a. SIMRS managers can provide fast responses when needed                                        |                                                                                                     |
| Empathy         | a. SIMRS managers can show friendliness when helping users with SIMRS usage                     |                                                                                                     |
| Follow-up service| a. SIMRS managers calls back to the user to ask about obstacles that might be experienced when changes to the system occur |                                                                                                     |
| Assurance       | a. SIMRS managers can always be trusted in solving problems from SIMRS                           |                                                                                                     |
|                 | b. SIMRS managers always resolves problems with SIMRS until it is completed quickly             |                                                                                                     |
| **Human**       |                                                                                                 |                                                                                                     |
| **System Use**  |                                                                                                 |                                                                                                     |
| Level of use    | a. Users often use SIMRS in carrying out daily work tasks                                       |                                                                                                     |
| Knowledge       | a. The user operates SIMRS without asking for help from others                                   |                                                                                                     |
| **User Satisfaction** |                                                                                                 |                                                                                                     |
| Perceived usefulness | a. All work related to medical / non-medical / support services can be completed without the need for a manual process |                                                                                                     |
| User Satisfaction| b. Users can reduce errors in work                                                               |                                                                                                     |
|                 | a. Users are satisfied when working using SIMRS                                                 |                                                                                                     |
|                 | b. Users get the best service from SIMRS managers                                               |                                                                                                     |
| **Organization**|                                                                                                 |                                                                                                     |
| Structure       | Top management                                                                                  | a. The RSKD management provides full support in implementing                                       |
Variables | Indicators | Item Indicator
---|---|---
support | SIMRS | b. RSKD management provides training in the use of SIMRS
Strategy | a. The RSKD management uses SIMRS as one of the strategies in improving public services
Communication | a. Implementation of technology is a demand of the times | b. Factors in improving health services encourage the development of SIMRS
Competition | a. The implementation of SIMRS has been regulated in Permenkes | b. SIMRS as a factor facilitates communication between work units in RSKD regarding data on medical / non-medical / support services
Net Benefit | Effectiveness | a. SIMRS can increase the effectiveness of user performance | b. SIMRS helps improve data accuracy regarding medical / non-medical / support services
Efficiency | a. SIMRS makes users complete work faster
Direct benefits | a. SIMRS enhances RSKD image (example: deliver of open information) | b. SIMRS improves the quality of service (example: can reduce patient complaints by providing detailed billing details)

**Statistical procedure.** Data collected by the questionnaire were coded. The data were recorded first in an MS Excel program and later transferred to Statistical Package for the Social Sciences (SPSS) tool. The gathered data was checked for coding variability, and reliability. Descriptive statistical analyses such as mean, frequency, and percent were implemented using MS Excel. In order to test the hypotheses of the conceptual model by structural equation modeling (SEM), GeSCA website-based software was employed. The conceptual model is tested including the measurement model, structural model, and overall Goodness of Fit.

**Data Analysis and Result**

**Data Gathering.** Data of research were obtained through paper-based questionnaires given to respondents work units. As mentioned before that the number of respondents should at least 78 respondents. In its implementation, there are 84 respondents of SIMRS users in RSKD both operational and managerial (reporting) were obtained. [Table 2] presents the demographic profile of the sample.

| Variables | Number (respondent) | Percent (%) |
|---|---|---|
| Gender | | |
| Male | 57 | 68 |
| Female | 27 | 32 |
| Age | | |
| 20 – 30 years old | 30 | 36 |
| 31 – 40 years old | 26 | 31 |
| 41 – 50 years old | 26 | 31 |
| >50 years old | 2 | 2 |
| Work Unit | | |
| Depo 1 Outpatient Installation | 5 | 6 |
| Depo 2 Inpatient Installation | 8 | 10 |
| Depo 3 Emergency Installation | 2 | 2 |
| Electronic Data Processing Installation | 18 | 21 |
Variables | Number (respondent) | Percent (%)
---|---|---
Verification Subdivision | 14 | 17
Medical Rehabilitation Installation | 5 | 6
Mortuary Installation | 1 | 1
Executive Poly | 4 | 5
Stroke Unit | 8 | 10
Nutrition Installation | 7 | 8
Anggrek Hitam Nutrition Installation | 2 | 2
Outpatient Installation | 3 | 4
Medical Record Unit | 7 | 8

School Year

| | Senior High School | Associate Degree | Bachelor Degree | Other |
|---|---|---|---|---|
|FIT Measures | 24 | 42 | 17 | 1 |

Length of Employment

| | <1 year | 1 – 10 years | 11 – 20 years | 21 – 30 years | >30 years |
|---|---|---|---|---|---|
|FIT Measures | 2 | 45 | 19 | 17 | 1 |

**Instrument Quality Testing.** According to the result using the SPSS tool, shown that all indicators fulfill the threshold of the validity, and reliability testing. Validity test is used to determine the appropriateness of statement items in defining a variable [10]. A research instrument is valid when the Pearson Correlation value is greater than the r-table value [11]. Based on the calculations with a significance level of 0.01 on the number of respondents 84, accordingly the r-table values obtained were 0.279. Reliability test aims to determine the extent to which the results of measurements with these tools can be trusted. A data can be declared reliable when a Cronbach’s alpha value > 0.6. The higher the Cronbach’s alpha value, the more reliable the answers from respondents [12].

**Overall Goodness of FIT.** It is measured using the value of FIT, AFIT, and GFI. FIT shows the total variance of all variables that can be explained by the structural model see [Table 3].

Table 3 Goodness of FIT measures for SEM

| FIT Measures | Values | Recommended Value |
|---|---|---|
|FIT | 0.541 | 0 ≥ value ≤ 1 |
|AFIT | 0.528 | > 0.50 |
|GFI | 0.920 | ≥ 0.90 |
|SRMR | 0.254 | ≤ 0.80 |
|NPAR | 97 |

FIT value gives an information that 54.1% of system quality, information quality, service quality, system use, user satisfaction, structure, environment and net benefits can determine the model and 45.9% can determine by another variables that didn’t use in this research. While the adjusted FIT (AFIT) value is used as a reference for assessing the diversity of research model variables. A larger AFIT value indicates a better model, that is AFIT > 0.50 (the closer to 1 the better) [13]. In this research, AFIT value (0.528) close to FIT value (0.541). It can be concluded that system quality, information quality, service quality, system use, user satisfaction, structure, environment, and net benefits can determine the research model. The Goodness of Fit Index (GFI) value shows the correspondence between the theories used in the study of the facts studied. A good GFI value if the value is ≥ 0.90 [14]. In this research, the GFI value is 0.920. This means that the
HOT-Fit model is acceptable with this research and is stated to have a fairly strong correspondence between theory and research phenomena because the GFI value is greater than 0.90 and close to 1. According to, the model in the GSCA is declared a goodness fit overall model if it has an SRMR value ≤ 0.80 and a GFI value ≥ 0.90 [15]. In this research, the Standardised Root Mean Square Residual (SRMR) value of the model is 0.254 which means that the model based on the SRMR value is appropriate. Number of Free Parameters Estimated (NPAR) shows the number of free parameters used in GSCA assist tool calculations, including weights, loadings, and path coefficients [16]. In this research, the free parameters value are 97 parameters were used.

Result of R-Square ($R^2$). The values are identified to determine the ability to explain each variable. If the value of $R^2$ approaches 1 then it can be concluded that the independent variable strongly supports the dependent variable [8]. Based on the test result, it is known that:

- the value of $R^2$ on the system use variable is 0.239. It means that the system use can be explained by the system quality, information quality, service quality, and user satisfaction in the amount of 23.9%.
- the value of $R^2$ on the user satisfaction is 0.552. It means that the user satisfaction can be explained by the system quality, information quality, service quality, and system use in the amount of 55.2%.
- The value of $R^2$ on the organizational structure variable is 0.658. It means that the organizational structure variable can be explained by the system quality, information quality, service quality, and organizational environment variables in the amount of 65.8%.
- The value of $R^2$ on the organizational environment variable is 0.522. It means that organizational environment variables can be explained by organizational structure variables in the amount of 52.2%.
- The value of $R^2$ on the net benefit variable is 0.702. It means that the net benefit variable can be explained by the variable system usage, user satisfaction, organizational structure, and organizational environment in the amount of 70.2%.

Result of Path Coefficients. Based on the measurement of structural model using GeSCA tool, it can be shown that a hypothesis is accepted or rejected. Hypothesis can be declared acceptable if it has a positive influence indicated by a positive estimate value (+), and a significant critical ratio (CR) value above 1.96 (it can be determined with (*) symbol) [9]. There are 7 of 17 hypothesis that can be declared acceptable: H3, H7, H8, H12, H13, H14, H17. Following are the results of the path coefficient through GeSCA in [Table 4].

| Hypothesis | Description                        | Estimate Path Coefficient | CR   | Declaration |
|------------|-----------------------------------|---------------------------|------|-------------|
| H1         | System Quality $\rightarrow$ System Use | -0.163                   | 0.44 | Rejected    |
| H2         | System Quality $\rightarrow$ User Satisfaction | 0.060                    | 0.34 | Rejected    |
| H3         | System Quality $\rightarrow$ Structure | 0.409                   | 2.33 | Accepted    |
| H4         | Information Quality $\rightarrow$ System Use | 0.502                   | 1.41 | Rejected    |
| H5         | Information Quality $\rightarrow$ User Satisfaction | 0.361                   | 1.84 | Rejected    |
| H6         | Information Quality $\rightarrow$ Structure | 0.077                   | 0.47 | Rejected    |
| H7         | Service Quality $\rightarrow$ System Use | 0.304                   | 1.98*| Accepted    |
| H8         | Service Quality $\rightarrow$ User Satisfaction | 0.443                   | 3.13*| Accepted    |
| H9         | Service Quality $\rightarrow$ Structure | -0.108                  | 1.19 | Rejected    |
| H10        | System Use $\rightarrow$ User Satisfaction | -0.123                  | 1.11 | Rejected    |
| H11        | User Satisfaction $\rightarrow$ System Use | -0.208                  | 1.23 | Rejected    |
| H12        | Structure $\rightarrow$ Environment | 0.722                   | 9.07 | Accepted    |
| H13        | Environment $\rightarrow$ Structure | 0.541                   | 5.64 | Accepted    |
| H14        | System Use $\rightarrow$ Net Benefit | 0.196                   | 2.83 | Accepted    |
### Hypothesis

| Hypothesis   | Description                     | Estimate Path Coefficient | CR  | Declaration |
|--------------|---------------------------------|----------------------------|-----|-------------|
| H15          | User Satisfaction → Net Benefit | 0.105                      | 1.37| Rejected    |
| H16          | Structure → Net Benefit         | 0.321                      | 1.78| Rejected    |
| H17          | Environment → Net Benefit       | 0.409                      | 2.33*| Accepted    |

Based on the results of the path coefficient, the results of the hypothesis test can be explained as on Fig. 3.

**Figure 3 Result of Hypotheses Testing**

### Discussion

Similar to earlier studies [9], [17], this study confirmed HOT-Fit to be a useful theoretical model in helping to provide an explanation and evaluation of the correlation factors of a system in the field of health services from the human side as an end user, the quality and reliability of technology, management support in organization. Results of the present research led to the conclusion that the model well represented the collected data according to the result of goodness-of-fit test.

The result of the research shows that the net benefit is related by the use of the system from the human aspect, and the environment from the organizational aspect. While the influence between technology and human aspects occurs on the variable Service Quality on System Use, and User Satisfaction. Meanwhile, the influence between the technological aspects with the organization, only the System Quality will affect the Structure.

The use of the system is proven related by Service Quality. This influence explains that the increasing quality of services provided by SIMRS managers affects user intention to use the system will be better. By demographic information of the gathered data, the total amount of digital immigrant respondents (generation born before 1990) is more than digital native respondent (generation born after 1990) that need a good service quality and guidance of implementing the system.

From the organizational aspect, the net benefits are supported by the organization's external environment. And the environment is significantly related by the organizational structure. So practically, aspects of the organization affect the benefits derived from the implementation of SIMRS. Management support and the right strategy can support the needs of the organization's environment to communicate and compete.
In the technological aspects, it has an influence on User Satisfaction, and Organizational Structure. But User Satisfaction, and Organizational Structure do not affect benefits. This shows that the level of User Satisfaction is related by the system through services obtained from SIMRS managers. While Structure is related by the system through Quality Systems. When the user feels satisfied by using SIMRS, this shows that the user has felt a match between the expectations of the user relating to quality services from the SIMRS manager. Although not completely SIMRS users are reliable in operating SIMRS because - the use of the system is not their main job. Thus, user satisfaction - of technology has not been able to - influence the benefits. Referring to the above, the organization as the main factor influencing benefits can provide support and use policies for the quality of the system to determine the improvement of the quality of SIMRS so that technology can provide benefits.

Summary

The result of the study demonstrated that some HOT-Fit constructs had a direct and indirect effect on benefit obtained by implementing the SIMRS. Based on the results of research, the conclusions are (1) the variables that influence the successful implementation of SIMRS in RSKD are technology factors, those are System Quality, and Service Quality, while from human factors, those are System Use, and User Satisfaction, and from organizational factors, those are Structure, and Organizational Environment give significant correlation to each other.

For that reason, (2) there is potential for SIMRS implementation can fully provide maximum benefits and be accepted by its users. First, organization needs to improve the quality of the system and the intensity of training in the use of SIMRS. When conducting training, it would be better if given thoroughly to each user. This needs to be pursued so that all users can use SIMRS with a similar comprehension.

Second, the organization needs to improve the technological aspects especially those related to the completeness of the SIMRS features that appropriate to the needs of the work unit. This indicates that the user can feel the satisfaction by combining the two processes both manually, and by system. In addition, it is necessary to conduct periodic evaluations that measure the achievement of benefits obtained from the application of SIMRS.

Third, to meet the needs of communicating patient data, an electronic medical record information system is needed. This need is necessary to facilitate the recapitulation of patient data for integrated reporting. Additionally, an efficient health interoperability ecosystem provides an information infrastructure that uses technical standards, policies and protocols to enable seamless and secure capture, discovery, exchange and utilization of health information comprises individuals, systems and processes that want to share, exchange and access all forms of health information. By use an API with a strict auth protocol that is allowed by the patient. So, people can move around the hospital but the data is still attached to people.

Furthermore, the access response speed on SIMRS is still fairly slow so it is often hampered when it comes to access data. In responding this issue, the local server should have a processor access speed and memory capacity that is qualified so that performance is maintained especially at the time of service operations. In addition, it is necessary to update the system regularly so that the speed of response to data access goes fast.

Last, to support the user's ability there needs to be a clear guidebook so that it can be read again when the user feels forgotten. Some respondents argued that some SIMRS managers lacked in handling user issues regarding SIMRS. Responding to this, it needs to be given a thorough provisioning in a certain period of time to the SIMRS management staff in order to master to solve user problems regarding SIMRS.

Finally, this type of research needs to be implemented in other system circumstances or infrastructures. Conducting further research is strongly recommended, such as using COBIT as a framework that focuses on measuring the application of SIMRS to business needs and information system functions that support the implementation of SIMRS in RSUD Dr. Kanujoso Djiatibowono. In addition, department interviews need to be conducted with operators who operate the system.
every day. So, the research can be developed towards user-based development or UX research, not merely the requirements of the government alone.

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