

Evaluating The Usability of Hospital Information System (HIS) Through Human Organization Technology-Fit (Hot-Fit) Model

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ABSTRACT

6 Dr. H. Koesnadi Hospital, one of hospital in Indonesia, has been using the information system management since 2015 but still delivering poor performance. The research aims to evaluate the usability of Hospital Information System (HIS) through Human Organization Technology-Fit (Hot-Fit) Model. Research used analytical survey with cross sectional design normally implemented in explanatory research. The research data were analyzed using multiple linear regressions. Human, Organization and Technology in HOT-Fit Model were presented through seven sub-variables such as system quality; information quality; service quality; users' satisfaction; organizational structure; environment and net benefit. The research was conducted at Dr. H. Koesnadi Hospital, Bondowoso, Indonesia on April to October 2018. Based on the findings, system quality ($P = 0.037$), information quality ($P = 0.000$) and service quality ($P = 0.002$) affected users' satisfaction. System quality ($P = 0.019$) affected structure. Users' satisfaction/ human affected organization ($P = 0.000$) and vice versa ($P = 0.000$). Structure affected environment ($P = 0.000$) and vice versa ($P = 0.000$). Users' satisfaction ($P = 0.000$) and structure ($P = 0.000$) affected net benefit. Nevertheless, several non-influential

variables indicated $P > 0.05$ such as information quality (0.627) and service quality (0.254) showing up toward structure, and environment (0.069) towards net benefit. The results become the basis for innovation to optimize the use of HIS through the aspects of technology, organization as well as human aspect.

Keywords: HOT-fit Model, Hospital Information System, Health Service

I. INTRODUCTION

Hospital is health care institution providing individual health services for inpatients, outpatients and emergency care services according to Indonesia's Minister of Health Number 82/ 2013 on Hospital Management Information System (HMIS). Moreover, hospital throughout the archipelago of Indonesia must implement HIS to generate national hospital policy and management according to the regulation of Indonesia's Minister of Health Number 1171/ 2011 on Hospital Information System (HIS). Thus, the existence of HIS obviously complies with regulations and is desperately needed by modern hospitals.



HIS provides hospitals with information required for supervision, observation, control, and evaluation. Hospitals should possess HIS to support HMIS. HMIS processes and integrates all procedures of health services in coordination with network, report to obtain accurate information. HMIS aims to improve performance; efficiency, effectiveness, professionalism for hospital services access (Health Minister of Indonesia, 2013).

Hospitals have documents also known as medical/health records comprising patients' identity, examination treatment and even other services provided for patients. Based on the regulation of Minister of Health number 269/ 2008, medical / health records should be written using electronic device. Electronic Health Records (EHR) have been discussed, implemented, and even developed through the advance of technology over the past 20 years. Several institutions have recently introduced EHR though types and scopes of EHR vary and each country applies different terms (WHO, 2006).

Several hospitals have implemented HIS including Dr. H. Koesnadi general hospital Bondowoso since 2015 (Kusniruk, et. al., 2008). According to the regulation of National Health Insurance, health costs are determined by social health insurance. Thus, medical records also indicate financial data as determined by Indonesia's health insurance provider.

Hospital service units deal with outpatient registration, emergency patient registration, poly, pharmacy, inpatient, and medical record unit with HIS. Whereas, the preliminary study conducted at Dr. H. Koesnadi Hospital, Bondowoso suggested that HIS provided patients with convenience. Ahmadi, et. al. (2015) suggested that HIS is a comprehensively integrated information system designed to manage hospital administration, finance, and clinic. HIS is aimed to reduce medical error, to increase cost efficiency and effectiveness,

to support decision making, and to develop health service quality. Moreover, HIS is mainly to eliminate manual process hindering the improvement of organizational performance especially for health service efficiency.

HIS is an effective, efficient, and enjoyable system. As an innovation, HIS can provide better health services despite some obstacles dealing with human-HIS interaction (human-computer interaction) (Kusniruk, et. al., 2008). The lack of system usability becomes main constraint of health information system adoption. In terms of human aspect, complaints from employees survive due to inefficient operational system.

Furthermore, HIS is operated beyond Standard Operational Procedure (SOP) as applied through patients' data input due to employees' limited time and reluctance for SOP consultation. In addition, employees have so many workloads that inpatients' data are eventually not well recorded. Moreover, recent complicated rules of health services have been imposed.

Moreover, according to employees' perspective, great number of patients and administrative workloads become major constraint, especially when it deals with decision making in the treatment for patients with self-control. (Ahmadi, et. al., 2015). In terms of organizational aspect, undisciplined employees with HIS implementation should receive appropriate punishment. Furthermore, trainings for employees on information system implementation were rarely conducted. Only those with managerial levels undergo adequate trainings. Yet in fact, regular staff is the ones responsible for HIS operational implementation.

Thus, the trainings are beyond targeted personnel. Yet, as a matter of fact, such trainings are desperately needed by system users (regular staff) for a better future performance. Moreover, some employees maintain manual reports implementation due to their inability of solving



problems in case of errors during report feature.

In terms of technological aspect, some modules of information system have not yet been completed. As a matter of fact, the modules of pharmacy working unit are still incomplete even though they have been provided since 2015. Furthermore, modules for surgery room, Central Sterile Supply Department (CSSD), and procurement unit have been provided since 2016, yet still incomplete even when this research was being conducted in 2017. This allows users' harder workload especially in relation to system information as paper-based works play a pivotal role especially in data input.

However, WHO (2006) confirmed that handicaps might not concern technological unavailability. Instead, it deals with insufficient financial support for hospital's information system manifestation. In the US, only 17% of hospitals implemented Computerized Physician Order Entry (CPOE) in 2009 (Ahmadi et. al., 2015). In addition, hospital staff's computer illiteracy and hospitals with insufficient facilities of computer data management become major problems in some developing countries.

Furthermore, failures in the implementation of information technology system arise due to irrelevant system information, business process required by organization (Krisbiantoro et. al., 2015). Moreover, the information system faces failures mostly due to factors beyond financial problems such as the ones concerning expectation fulfillment (Yusuf and Yusuf, 2013). Based on empirical experience, HIS has positive impacts on error reduction of medical works, the increase of working efficiency, cost effectiveness, accurate decision making, and the development of health service quality. Dr. H. Koesnadi Hospital in Bondowoso has implemented HIS since 2015. It has provided patients with convenience during hospital operations, also supported patients with better health service though poor performance arises.

Based on that fact, this research was aimed at evaluating the usability of HIS through Hot-Fit Model in Dr. H. Koesnadi Hospital. That way, the results expectedly become the basis for innovation to optimize the use of HIS in terms of technological, organizational, and human aspects.

II. METHODS

⁶ This is analytical survey or explanatory research with cross sectional design as the data were collected once at a time. The research was conducted at Dr. H. Koesnadi Hospital, Bondowoso, Indonesia on April to October 2018. All HIS users were involved as the research population divided into 3 levels such as top management (director and vice director), middle management (supervisor), and lower management (operational staffs). The samples, through Slovin formula, were 144 respondents using proportionate stratified random sampling, as the research indicated heterogeneous population which each consisted of several homogeneous stratum. Hospital staffs became the research respondents, while patients were not included as they were not Hospital Information System users. Thus, only hospital staffs operate Hospital Information System.

A. Data Collection

Prior to data collection, researcher conducted validity and reliability test in the form of questionnaire. Thirty staffs were involved in the test conducted in one of Hospitals in Jember Regency indicated to have the same characteristics as Dr. H. Koesnadi Hospital. The validity test used Pearson correlation test. Once Pearson correlation score indicated $> R$ table score (0.361) or the significant score was ($P < 0.05$), the instrument was valid. Whereas, reliability test was related to stability and consistency of the questionnaire. The reliability test was conducted by comparing



Cronbach's alpha score with R table. Once Cronbach's alpha score were indicated higher than R Table score (0,361), then the instrument showed good reliability. Hence, the validity and reliability test result indicated valid and reliable questions used in the questionnaire.

B. Data Analyze

Data statistical analysis was conducted using multiple linear regression to measure the influence of independent variable towards dependent variable through $P < \alpha = 0.05$ and adjusted R Square to determine to what extent the influence was indicated. dependent variables were concluded to have significant influence towards dependent variable if the $\alpha < 0,05$. The research independent variable were compatible with the evaluation model of HOT-fit (Yusof *et al.*, 2008) as part of the combination of Information System Success Model (ISSM) developed by W. Delone and E. McLean in 1992 and Information Technology-Organization Model (IT-Model) developed by MIT 90 (Erlirianto *et al.*, 2015). Variables were indicated in the method of HOT-fit such as human (system use and users' satisfaction), organization (structure and environment) and technology (system quality, information quality and service quality). Whereas, dependent variables are the work of information system which indicate net benefit.

III. RESULTS

A. Respondents' Characteristic

Questionnaire was aimed to collect data of 144 employees (HIS users) comprising top management (6 persons), middle management (9 persons) and lower management (150 persons). The data collection result indicated respondents'

characteristic as shown in the following Table 1.

Table 1. Respondents' Characteristics

Respondents Characteristics	Frequency	Percentage (%)
Gender		
Male	44	30.6
Female	100	69.4
Age		
Young Adulthood (15-24)	16	11.1
Middle Adulthood (25-44)	114	79.2
Older Adulthood (45-65)	14	9.7
Education Level		
Junior High School	2	1.4
Senior High School	13	9.0
Diploma 3	50	34.7
Bachelor's/ Diploma 4	66	45.8
Master/ Doctoral	13	9.0
Roles of respondents		
Top Management	6	4.0
Middle Management	9	6.2
Lower Management	129	89.8

Based on Table 1, most female respondents were involved (69.4%) with the age of middle adulthood (25-44) around (79.2%), while only a few the respondents were in the category of older adulthood (45-65). Thus, most of them are at the productive age.

In addition, most respondents possess Bachelor degree /Diploma 4 (45, 8%), thus likely deal with the questionnaires well, though, in the aspect of role in the organization, most of them were in the position of lower management/operational staffs (89,8%). In other words, most respondents were functional employees who directly involved in HIS implementation.

B. Result of HOT-fit Model

The research hypothesis was supported

by multiple linear regression analysis of which result of the statistical analysis is displayed in the following Table 2.

Table 2. Hypotheses Testing

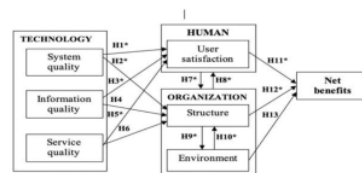
No	Independent Variable	Dependent Variable	P (Sig.)	Adjusted R ²	Remarks
1.	System Quality	User Satisfaction	0,037	0,588	H1 Accepted
2.	System Quality	Structure	0,019	0,064	H2 Accepted
3.	Information Quality	User Satisfaction	0,000	0,588	H3 Accepted
4.	Information Quality	Structure	0,627	0,064	H4 Rejected
5.	Service Quality	User Satisfaction	0,002	0,588	H5 Accepted
6.	Service Quality	Structure	0,254	0,064	H6 Rejected
7.	Human	Organization	0,000	0,088	H7 Accepted
8.	Organization	Human	0,000	0,088	H8 Accepted
9.	Structure	Environment	0,000	0,161	H9 Accepted
10.	Environment	Structure	0,000	0,161	H10 Accepted
11.	User Satisfaction	Net Benefits	0,000	0,305	H11 Accepted
12.	Structure	Net Benefits	0,000	0,305	H12 Accepted
13.	Environment	Net Benefits	0,069	0,305	H13 Rejected

The significance showed the impact of independent variables upon the dependent ones. If $p < \alpha = 0,05$, then the hypothesis was accepted, and vice versa. Adjusted R² showed how high impact of independent variables towards the dependent ones. Table 2 indicated that System Quality ($p = 0,037$), Information Quality ($p = 0,000$), and Service Quality ($p = 0,002$) have point $p < \alpha = 0,05$ which indicates significant effect toward users' satisfaction. The adjusted R² shows 0,588 which indicates magnitude influence of system quality, information quality and service quality upon users' satisfaction (58,8%)

The system quality has a significant effect towards structure ($p = 0,019$) with the adjusted R² value of 0,064 which indicates magnitude influence of system

quality toward structure (6,4%). Whereas, information quality ($p = 0,627$) and service quality ($p = 0,254$) does not indicate significant effect toward structure. Human has a significant effect towards organization ($p = 0,000$) with the adjusted R² value of 0,088 which indicates magnitude influence of human towards organization (8,8%) and vice versa.

Structure has a significant effect towards environment ($p = 0,000$) and the adjusted R² value is 0,161 which indicates magnitude influence of structure towards environment (16,1%) and vice versa. At last, users' satisfaction and structure have significant effect toward net benefits with significance ($p = 0,000$) for each variable. The adjusted R² value showed 0,305 which indicates magnitude influence of users satisfaction and structure towards net benefits (30,5%). Otherwise, environment does not have significant effect towards net benefits ($p = 0,069$), with the result of hypotheses testing indicated in Figure 3.



Information: (*) it means that accepted between two variables of research

Fig 1. The Result of Human-Organization-Technology Fit (HOT-Fit) Model Using Multiple Linear Regression (Hypotheses Testing)

IV. DISCUSSION

HIS is a comprehensive software program which integrates the information of patients and enables communication among different sections in the hospital. HIS is normally designed to manage administrative, financial aspects and clinics in the hospital as well as other health



services (Sadoughi et. al., 2016). HIS was also designed to improve health professional works and outputs of health organization. In consideration of the system availability, in terms of ethic system, evaluation and the efficiency assurance are desperately needed. The evaluation of HIS can play a pivotal role in measuring and comparing HIS benefits (Hyatt, 2015). Failures in evaluating system can trigger misunderstanding on potential benefits of HIS.

However, evaluation should be conducted with standard criteria and requirements to obtain maximum benefits. Due to HIS complexities, designing HIS evaluation is not easy to handle. Many researches have evaluated information system from different perspectives. HOT-fit framework was developed by Yusof et al (2008) identify the benefits of HIS in relation to aspects of technology, human and organization.

The result of statistic test with double linier regression showed that system quality (technology) has effect upon users' satisfaction (human). System quality refers to the quality of information process including software and data components, and it concerns good technical system.

Moreover, good system quality will eventually refer to easiness of learning, using and even maintaining (Gorla et. al., 2010). The easier the information system is to learn, to use, and to maintain, the higher is the users' satisfaction towards information system. Once users meet satisfaction, they will likely be more interested in using the information system. This is in line with a research conducted by (Kilsdonk et al, 2017) that good implementation of HIS deals with the suitability between system flexibility (technology), users' knowledge and skills. Once HIS indicates good quality, the users' satisfaction gets higher. On the contrary, if HIS works improperly, the users' satisfaction gets lower. Moreover, the system quality also has effect upon structure (organization).

In the research, structure (organization) refers to maintenance of information system in relation to the provision of technician, schedule, and updated antivirus) and higher employees' commitment (responsibility, attempt to supervise and complete the need of system). System quality will influence the decision of organization to provide some technicians for maintenance, the frequency of schedules provided to conduct maintenance of information system, and the frequency of antivirus updated. In addition, system quality also influences the employer's commitment which means the higher the system quality, the lower the employers need to supervise and complete the need of information system. On the contrary, the worse system quality the higher commitment needed for employers to supervise and complete the need of system.

Information quality is a concept related to the output quality of information system, or output benefits for end users, relevant for decision making, easy to understand, and output fulfilling the needs of information system users. Information quality influence users' satisfaction. The higher quality produced by information system, the higher the users' satisfaction. This is in line with a research conducted by Erlirianto et al (2015) that human-technology relationship deals with the relationship between information quality and service quality and users' satisfaction.

However, the research indicated that information quality did not have any effect on structure (organization). No matter how the quality of information output resulted by the system will unlikely influence the structure (organization) in the form of maintenance and employers' commitment. Maintenance and employers' commitment to be responsible for supervision and complete the need of system is obviously obligatory and frequently needs to be conducted by the hospital for a qualified information system and support their health service. Thus, improper maintenance and



commitment of employers will likely affect the quality of information output which will eventually disturbingly influence service and decision making of the hospital management.

Moreover, service quality has effect upon user's satisfaction. The better the service quality of information system, the higher user's satisfaction towards information system will likely be. Service quality in the aspect of technology is closely related to human aspect (users' satisfaction). Thus, service quality as the sub variable of technology has a significant relationship towards users' satisfaction (Erlirianto et. al., 2015). Gorla et. al., (2010) also suggested that service quality deals with users' expectation of information system (through the provision of information system to fulfill the user's need such as efficient service, trust, and humility during problem solving) and demonstrate benefits of information system (with competent expert, the information system is almost zero-error).

Nevertheless, as also indicated in information quality, service quality does not give any effect upon structure (organization). This is in line with the research conducted by Bradley (2006) in which system quality and organization showed significant relationship especially for limited company. Yet, it is fairly significant for a formal organization as indicated this research location. Service quality is the level of service proposed by the provider information system service (vendor) to users (compared to their expectations) in terms of reliability, sensibility, guarantee, and empathy. Service quality deals with information system fulfilling users' expectation (such as providing end users with service needed, building up end users' trust, and humility towards end users upon client's request).

Service quality is also indicated by benefits of information system (hiring experts of information system, with their expertise zero

error is under their guarantee). No matter how good or bad the service quality, it will have any effect upon structure (organization) as each organization has their own way of maintenance and improving the employer's commitment to be responsible for supervising and completing the need of system. Maintenance and employer's commitment are desperately needed to obtain qualified information system and support health service in the hospital. The research result showed that variables of users' satisfaction (human) have effect upon organization, and the other way around. In case of dissatisfaction experienced by users of information system towards the quality of information system, they will surely inform the employers or technician for identification of information system problems to fulfill the end users' expectation. The lower the users' satisfaction, the more attempts needed to maintain and complete the need of system and vice versa.

Moreover, sub-variables of structure in the organization have effect upon sub-variables of environment and vice versa. In practice, the environment of organization can influence net benefits electronic medical record system. The structure of organization has a significant influence towards organizational environment. The management of hospital supports and proper strategic implementation based on environment in the organization (Erlirianto et. al., 2015).

Users' satisfaction has effect upon net benefits of HIS. According to model HOT-fit, factor of human is the center of information system evaluation of health. The research results support the influence of human and organization aspect as the key to success of technology adoption in a hospital (Erlirianto et. al., 2015). According to HIS reference, many researches refer to this concept to identify human role in adopting HIS. (Lian, et. al. 2014). Ahmadi et. al. (2016) suggested that factors related to context of human needs to take into consideration when adopting technology in the hospital.



Moreover, the success and the development of technology of HIS (or other technologies) in the hospital is supported by end users' enthusiasm for a change, and new technology adoption. In some cases, new technology adoption among hospital managers and staff varies. For instance, so³⁷ hospital managers expect that technology will be able to reduce cost (Hakim, Renouf & Enderle, 2006) and even obtain profits upon the investment (Glabman, 2004). On the other hand, maintenance supports of staff in adopting technology depends on whether the new technology can facilitate them on duty (Yu, Ray and Motoc, 2008) and assist for easy implementation (Anggelidis & Chatzoglou, 2009).

Organizational structure has effect upon net benefits of HIS. Thus, the implementation of HIS needs to be taken seriously to improve net benefits. Organization can support system implementation and make decision so that technology will indirectly provide net benefits. (Erlirianto et al 2015). The adoption of IS in the organization will be closely related to the supports of top management. In terms of health service, the supports of top management become important to adopt Picture Archiving and Communication System (PACS) (Chang et. al, 2006). In the context of healthcare environment, Yang et. al. (2013) suggested the importance of top management in providing sufficient resources (finance and other resources) to adopt technology system of monitoring. To adopt and implement HIS, hospital as the organization might need some resources apart of the importance of possessing profound knowledge and experience of HIS. Therefore, hospitals with good support of HIS will likely adopt it.

Environment does not have effect upon net benefits. Hospital as the main environmental sector of public health service has more complex system and working procedure compared to other

health care providers (Ismail et. al.,2013; Lian et. al.,2014). Medical environment has recently involved IT-based significant transformation with the improvement of technology complexity and manage more patients with less resources. Thus, medical practitioners obtain more workload. In many innovations of information system, the complexity of information system can cause resistance due to lack of skills and knowledge of end user. Hence, organizational environment, hospital in this case, does not have effect upon net benefits of HIS.

The more relevant the technology, human and organization, the more potential HIS could be implemented or put into realization. Hence, the three components provide comprehensive evaluation with specific dimension (model HOT-fit) to evaluate the information system of health. The use of HOT-fit can expectedly be used comprehensively, not only in the hospital information system but also h²⁵h system of information in general (Ahmadi et.al, 2016).

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