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Service Level Agreement in Malaysian Public Hospital: Human Factors Influence

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Abstract

Service Level Agreement (SLA) is an important contract between service provider and service recipient where services are expected to be delivered and received accordingly. SLA should include all information regarding the services provided along with their expected performance measures. Usually, the common parameter to define the quality of service (QoS) of these services are defined the time delivery, response time, execution time, service availability, access time, throughput, network bandwidth, service latency, or server uptime or down- time. Cumulatively at the end of the service chain, SLA should able to tell the services' performance, quality, faults and other non-compliance. If the quality of service does not meet the SLA agreement terms, certain level of penalties can legally be imposed. Normally the SLA violation occurred due to technical problem with either the software or the hardware. Despite the technical quality measures, human factors and its attributes are also important to achieve quality in providing services and to comply with SLA. This paper describes the significance and meaningfulness of relationships between negated human factors, namely, user resistance, lack of skill/knowledge, reluctant to share information and shortage of IT staff, with the SLA compliance. It also described in this paper how the relationship model should be used to in- crease SLA compliance as agreed in public hospitals.

Keywords: Human Factor, Service Level Agreement, Hospital Information System, Service Efficiency

1 Introduction

The Ministry of Health Malaysia is responsible to help people to achieve or to maintain the health standard for them which people in Malaysia can run a productive economic and social life. The vision of Ministry of Health Malaysia is to assure the individual, family and

community get a good health through a fair and equitable health system. Delivering health system should be in a simple or easy to understand by the people who receive the service. Ministry of Health Malaysia has taking initiative step to improve the quality of service delivered by implementing of Hospital Information System (HIS). HIS plays an important role within hospital to transact patient records between counters' end. The management of information within Malaysian public hospitals are normally outsourced to private software development companies. Due to this norm, Service Level Agreement (SLA) is used to detail out and determine lists of services they need to deliver. For security and convenience reasons, most HIS are stored in cloud platforms. However, issues such as system failure, service unavailability, technical problem, or hardware inaccessibility are common examples of problems occur in HIS. At operational level, these issues need to be addressed by human whom responsible to monitor and enforce SLA either at service provider or service recipient site. Due to the current practice of SLA monitoring and enforcement steps, this research is taking up human factor as the core attributes to be analyzed to study the effect of human factors in SLA monitoring and enforcement in public hospital in Malaysia.

The main objective of this paper is to identify the relationship between human factor and service level agreement (SLA) among workers such as service provider and service recipient in a selected government hospital. An assumption was made to the study that one public hospital and HIS implementation, represents a larger population. Human factors used are in ne- gated form as a reversed psychology approach in analyzing data and information, namely, user resistance, lack of skill/knowledge, refuse to share information, shortage IT staff will be used as attributes measured in relationship to SLA usage.

This paper is structured as follows; Section 1 described the background of the study, Section 2 covers the related work and literature review of SLA, hospital information system, and human factor (HF). Section 3 will elaborate the methodology used for this research work. Section 4 depicted part of the results and findings of the study. Section 5 discussed the results, and Section 6 draws conclusion of this research.

2 Literature review

Service Level Agreement (SLA) is a contract between service provider and end-user or service recipient, which the service is formally defined (Mirobi & Arockiam, 2015). Most commonly, the parameter of SLA defines QoS (Quality of Service) to give overall performance of a service included the response time; throughput, access time, delay and launch complain (Nteziryayo & Kibe, 2015). Nowadays most of the services are offered through cloud environment, which are accessed remotely. Government agencies such as hospital, immigration department, prime minister's department and other department are striving to deliver the service through cloud environment whether in private or public.

2.1 Service Level Agreement

The SLA is a negotiated document between service provider and service recipient in term or service being provided to service recipient (Radha, et al., 2015). The structure of (SLA) contain several parts such as name of agreement, the context and the terms which included two types; Service Terms and Guarantee Terms (Andrieux, et al., 2004). The most widely used for SLA specification is WS- Agreement. The structure of WS-Agreement is illustrated in Figure 1 as structure of an agreement. In Figure 1 show the structure of an agreement which contain a few sections. It is a set of meta-data called the XML. For section '*Name'* can be optional which name of the template. It is used to provide-understandable name to an agreement in case to avoid refer to a wrong template. '*Context'* section provides information about the parties, who involved, what service is delivered, the duration of the agreement, the price, the penalty cost of SLA violation etc. '*Terms'* section contains two type which is '*Service Description Terms*' and

'*Guarantee Terms*' to describe the functional and non-functional based on agreed service respectively.

Figure 1
Structure of an SLA agreement document

2.2 Hospital Information System

The hospital sector has given emphasizing to guarantee the quality of service delivery through cloud computing. The information of patients in cloud become more effectiveness and easy to access. This operation need agreement between service provider and service recipient based on the Service Level Agreement (SLA) which describe the details of service need to be delivered and penalties in case if there is any SLA violation occurred within duration of the agreement. The implementation of Hospital Information System (HIS) widely being used to improve the quality of public health service and information patient's management (Ismail & Abdullah, 2012). According to Biomedical Informatics Ltd. (2006), the hospital information system (HIS) consist several components such as Clinical Information System (CIS), Radiology Information System (RIS), Financial Information System (FIS), Picture Archiving Communication System (PACS), Laboratory Information System (LIS), Pharmacy Information System (PIS) and Nursing Information Systems (NIS) as shown in Figure 2.

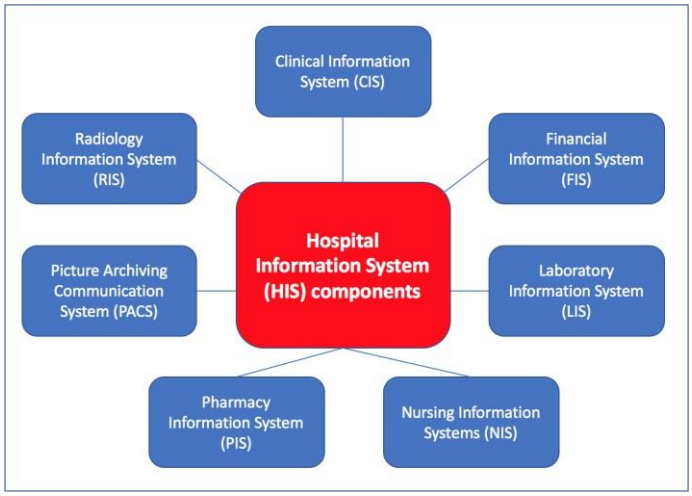

Figure 2
Components in Hospital Information System (HIS) (adapted by Biomedical Informatics Ltd., 2006)

The HIS components has their own purpose, type of department use and type of user. In Malaysia, the implementations of hospital information system (HIS) are being expanded to both private and public hospitals. This is due to improve the healthcare in term of service

quality. Several initiatives had been taken by Malaysian Government such as enhancing Information Technology (IT) application in Malaysia Public Hospitals (Izzaty, et al., 2015). The public hospital serves more patients as compared to private hospitals. Hence it is important to use IT application such as HIS which run in the cloud to ensure the patient's information and any related in- formation to be more accessible. Record until the year 2010 suggested that HIS can be divided into three categories, which are Total Hospital Information System (THIS), Intermediate Hospital Information System (IHIS) and Basic Hospital Information System (BHIS) as listed in Table 1 (Ismail & Abdullah, 2012).

Table 1
Categories of Hospital Information System (HIS) (adapted by Ismail N.I., 2012)

THIS	IHIS	BIH
Hospital Alor Setar, Hospital Ampang, Hospital Selayang, Hospital Serdang, Hospital Pandan, Hospital Putrajaya, Hospital Sg. Buloh and Hospital Sungai Petani	Hospital Keningau, Hospital Lahad Datu	Hospital Kuala Batas, Hospital Setiu, Hospital Pekan, Hospital Pitas, Hospital Kuala Penyu, Hospital Kunak.

2.3 Human Factor

The term of human factor can be defined in several ways but mostly the accepted definition is from Health and Safety Executive (Flin, et al., 2009). The human factor involved environment, organizational, job factor and human behavior which can affect to the quality of work or service. The Join Commission Resources in 2015 prepared a quick guide to human factors terminologies, questions to analyse system and human factors engineering strategies. It is about 80% to 90% of error made by human during research analysis and the most common mistake come from human factor such as leadership and communication. The human factor is the important issues need to be considered as they play important role in influencing the HIS adoption in hospital (Aziz & Mohamadali, 2015). Human factors considered in this research are as depicted in Figure 3.

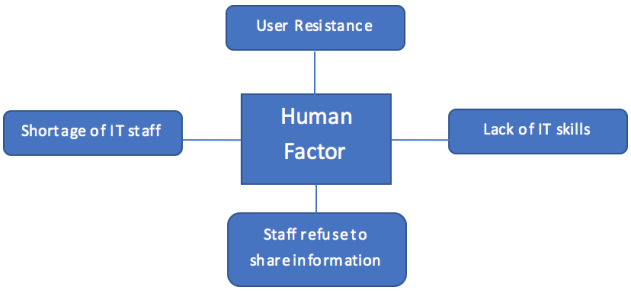

Figure 3
Human factors challenge for HIS implementation

- **User resistance (m^1)** - An investigation was conducted to measure user satisfaction in using HIS in Malaysia, and the result returned to be negative (attitude) towards HIS adoption (Amin, et al., 2011). System complexity is one of reasons for user resistance to HIS adaptation due to longer time consumed by the staffs to learn and use the system (Nugawela & Sahama, 2011). Poor system interface also caused for resistance to use the system.
- **Lack of skill (m^2)** - According to Hassan & Tajuddin, 2012), the implementation HIS was low in Malaysia due to the lack of computer skill among the medical practitioners. From this result, it shows that the knowledge and skill to use HIS is important and need to be considered to improve the quality of hospital care.

- **Refuse to share information (m^3) -** There are three effects from information exchange in HIS which are: improve the quality of hospital care, reduce operation costs for local hospital and increase demand for hospital care (Miller & Tucker, 2014). The information exchange might be unable to be proceed because of some reason such as system interoperability, system downtime, system unavailability etc. This issue happens will cause difficulties in understanding information.
- **Shortage IT staff (m^4) -** Lack of qualified IT employees and infrastructure are common problem face by hospital when they try to improve the quality of healthcare by implementing HIS system. To maintain the HIS system, skilled manpower is needed to ensure the support and assistance for system users and usages.

3 Methodology

There are two type of variable in this research; independent variable and dependent variable. The SLA usage is an independent variable and the dependent variable is 4 type of human factor which are (1) user resistance; (2) lack of skill/knowledge; (3) refuse to share information; (4) shortage IT staff as indicated above in Section 2.3. This study designed the measurement of relationships level between of SLA usage and all human factors (m^1 until m^4). Figure 4 show the model developed based on data collection and analysis from a public hospital utilizing HIS, hypothesis correlation-coefficient and their weighted values.

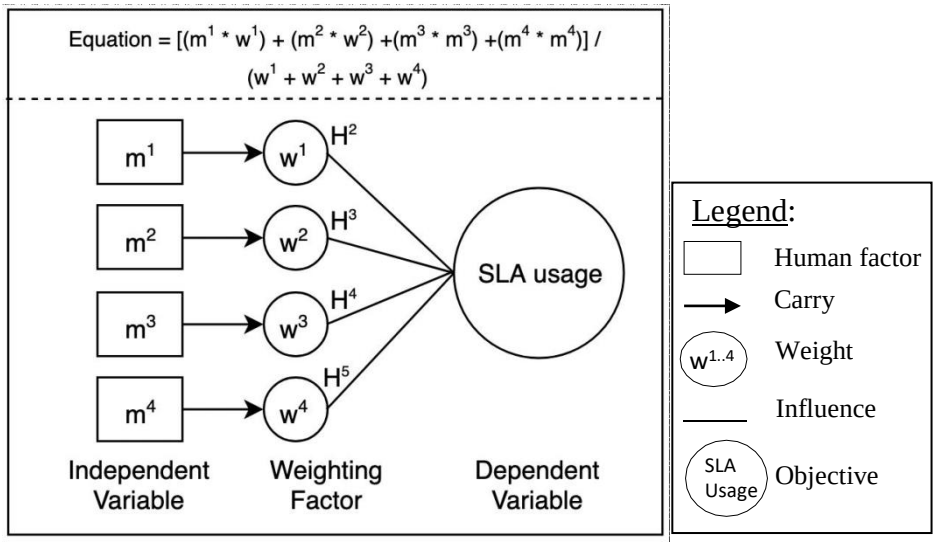

Figure 4
Proposed relationship model between Human Factors to SLA usage

4 Results

In this section, the result from data collection via survey form will be described. To analyse the data, the author used Statistical Package for The Social Science (SPSS) version 23. There are two types of statistical analysis used in the presentation of the study results which are static descriptive and inferential statistics. Descriptive analysis is a statistic used to de- scribe variable characteristics (Loeb, et al., 2017). Descriptive analysis such as frequency, mean and percentage is used to describe independent variables and dependent variables as well as respondent profiles. The Pearson correlation analysis method is used to see the relationship between the human factor and SLA usage.

The results analysis is presented in the order of hypotheses that have been formed and elaborated in table form. In this decision, the level of significance set is 0.05. A statistical inference method which is regression analysis has been used to test the hypothesis which is to see the significant value in human factor toward SLA usage.

Each of the factors shows the positive significant value between relationship human factor and SLA usage. Even though the level of significant value is moderate, it is still can give an impact to the SLA violation. Table 2 shows the correlation value between human factor and SLA usage.

Table 2
Pearson Correlation Coefficient for Relationship between X and Y

	Variable	Y	X1	X2	X3	X4
Y	SLA usage					
X1	User resistance	0.454*				
X2	Lack skill/Knowledge	0.416*	0.919**			
X3	Refuse to share information	0.410*	0.909**	0.939**		
X4	Shortage IT staff	0.423*	0.889**	0.886**	0.880**	

Note: ** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

5 Discussion

In this section, the result of analyses will be discussed. The results in Table 2 show that overall in moderate level ($p<0.5$). It shows that there is significant correlation between the variables of user resistance and SLA usage. This means the hypothesis is accepted because there has significant relationship between the human factor (user resistance, lack of skill/knowledge, refuse to share information, shortage IT staff) with SLA usage. The findings show that there is positive relationship between SLA usage and user resistance but the strength of the relationship between SLA usage and user resistance is still at moderate level of relationship ($r = 0.454$). This mean the user resistance occurred among the workers can cause the SLA violation. Indication of the quality of Hospital Information System (HIS) depends on the type of HIS' users such as physicians, laboratory technologies and other. Each of them play an important role to ensure the quality of HIS at high level and prevent the SLA breached occurred. User resistance involves with individuals to interact with the system is overall can give impact to the quality of the system. The highest of user resistance the higher rate of SLA violation would happen. The employer should provide any solution to overcome with user resistance among workers.

The result also shows that there is positive relationship between SLA usage and lack of skill or knowledge ($r = 0.416$). The use of system in the healthcare requires knowledge and skill to ensure it meet the user requirements and provide good quality of service. Lack of knowledge or skill becomes one of the challenges for the physicians to use electronic health record system more efficiently. The interface of the system also play role to make the system user friendly. The slower the system run, the lower productivity of work. The system developer should ensure the user interface easy to understand even for first time usage.

The strength of the relationship between SLA usage and refuse to share information is $r = 0.410$. Each hospital has different perception or motivation to share data because the lack of consistency in the system. Some of hospital would exchange the information and some do not. The unwilling sharing information from the external agency will lead to the less productivity of work. It is very important to provide a guideline to exchanging data to implement electronic health record systems. Last but not least, the strength of the relationship between SLA usage and shortage IT staff is still at moderate level of relationship ($r = 0.423$). Unavailability of IT staff is common problems in hospital when implementing the electronic healthcare information system. To overcome this barrier, the adequate training should be done before they use the hospital information system. Lack of well-trained medical informatics is one of barriers to adopt a health information technology. The organization

should have a clear understanding of the requirement involving the knowledge of medical and IT. However, it would be high in cost and time consuming.

6 Conclusion

Hospital Information System (HIS) was implemented to ensure the hospital management running smoothly. To ensure the quality of service meet user requirement, the service provider and service recipient should follow the SLA. SLA management should consider human factor while delivering services so that the organization can avoid the SLA violation. In this paper, the human factor such as user resistance, lack of skill/knowledge, refuse to share in- formation, shortage IT staff was being investigated to see its relationship with SLA usage. The finding shows the relationship between human factor (user resistance, lack of skill/knowledge, shortage IT staff) and SLA usage have a positive significant relationship. Although it is in moderate level, the organization should consider the human factor that can lead to the SLA violation.

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