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Organizational context of hospital information system (HIS) in Malaysian public hospitals

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Abstract

This study aims to recognize the factors affecting the organizational context of Hospital Information System (HIS) implementation at Total Hospital Information System (THIS), Intermediate Hospital Information System (IHIS) and Basic Hospital Information System (BHIS)'s hospitals. A quantitative approach was employed to meet the research objective. The quantitative result of the ANOVA test shows that the factors affecting THIS implementation were significantly different from those in IHIS, and BHIS's hospitals. In conclusion, each factor in the organizational context is required to be highlighted because it influences the success of HIS's implementation.

Keywords: Organizational Context; Hospital Information System.

Contexto organizativo del sistema de información de hospitales (HIS) en hospitales públicos de Malasia

Resumen

El objetivo de este estudio es reconocer los factores que afectan el contexto organizativo de la implementación del Sistema de información hospitalaria (HIS) en el Sistema de información hospitalaria total (THIS), el Sistema de información hospitalaria intermedia (IHIS) y el Sistema de información hospitalaria básica (BHIS). Se utilizó un enfoque cuantitativo para cumplir el objetivo de la investigación. El resultado cuantitativo de la prueba ANOVA muestra que los factores que afectan a ESTA implementación fueron significativamente diferentes de los de IHIS y de los hospitales de BHIS. En conclusión, se debe resaltar cada factor en el contexto organizacional porque influye en el éxito de la implementación de HIS.

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Palabras clave: contexto organizacional; Sistema de información hospitalaria.

1. INTRODUCTION

The healthcare sector plays a significant role in every country. Hence, it is given a priority in any country's development agenda. In Malaysia, the healthcare sector has been undergoing continuous improvements for years through numerous initiatives taken by the Malaysian Ministry of Health. One of the most important initiatives is the introduction of the Hospital Information System (HIS) using cutting-edge information technology. The rapid growth of IS in various sectors has also its presence felt in the healthcare sector under HIS (Amin et al., 2011). HIS is an integrated information system designed to manage healthcare services of hospital activities. There are three categories of HIS: Total Hospital Information System (THIS), Intermediate Hospital Information System (IHIS), and Basic Hospital Information System (BHIS) (Abdulhamid, 2010; Nugrahani & Imron, 2019). THIS's hospital is referred to as a completely integrated IS. IHIS's hospital is regarded as an intermediate integrated IS and BHIS's hospital is referred to as basic integrated IS.

Despite its importance, the progress of the implementation of the electronic health system in Malaysian public hospitals is currently very slow, even though the telehealth project has been implemented for decades. In addition, the implementation of HIS in less than 20% of the total number of public hospitals in Malaysia. According to previous studies, the organizational context has influenced the success of HIS

implementation as proven by various empirical studies on the effect of organizational context on Hospital Information System (HIS) implementation. Even though the HIS is a crucial tool to provide high-quality medical treatments and services, there is a lack of study on compared to the factors in organizational context at a different level of HIS implementation in Malaysia.

2. BACKGROUND

2.1. Organizational Context

Organizational context refers to the adoption of technological innovation that belongs to an organization that might be affected by several factors (Ahmadi et al., 2015). In this study, there are several factors which have influenced the organizational context pertaining to the HIS implementation as shown in Figure 1.

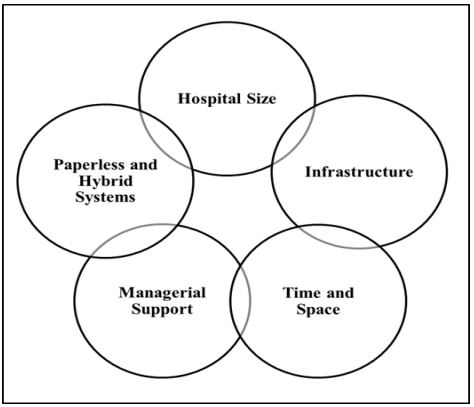

Figure 1: Organizational Contexts

2.1.1. Hospital Size

Hospital size has been considered a significant factor by a majority of previous literature. This is because large hospitals have more resources that can be utilized in their business transformation to adopt automated system management (Chang et al., 2007). The size of a hospital is usually determined by the number of beds it can accommodate. In fact, Ahmadi et al. (2015) agreed that the hospital size is considered more important than other factors in the organizational context. Apart from the available resources, the size of a hospital could influence the type of system that is compatible to be used. For example, in Malaysia, the hospitals with more than 400 beds were considered more suitable for the adoption of THIS, whereas a hospital with lower than 400 beds will be considered more appropriate for the adoption of IHIS or BHIS (Abdulhamid, 2010). It clearly illustrates that the larger size of a hospital, the more likely it is to adopt the information system, as they have more resources, flexibility, and ability to take risks. This is suggested by Ash and Bates (2005) who argued that the size of a hospital is positively-associated with the type of information system and technology adopted.

2.1.2 Managerial Support

Top management support refers to the level of support given by top management to adopt HIS in order to increase the efficiency in managing the hospital (Grover, 1993). This is because management support is required in influencing the organization's employees to provide organizational commitment needed to effectively mobilize the system into

operation. According to Jeyaraj et al. (2006), top management support is one of the three best predictors for IT innovation adoption by any organizations including organizations as the hospitals. Previous studies found a positive influence on information system adoption by the top management support in hospitals (Chang et al., 2007). This is proven by the study conducted by Lin, that the organizations with excellent top management support are more likely to adopt the information system. A qualitative study conducted by Ismail (2016) found that the Malaysian Ministry of Health (MOH) is responsible for providing any decision support to adopt or implement the information systems of Malaysian public hospitals based on the cooperation between the vendors and the management of the hospital.

2.1.3. Infrastructure

According to Grover (1993), IS infrastructure refers to the existence of sophisticated telecommunication and database facilities within an organization. Ministry Of Health emphasized that IS infrastructure is a critical sharable medium where technology is needed to integrate various systems in the organization. According to Grove et al. the Health Information Technology for Economic and Clinical Health (HITECH) has authorized two billion dollars for information system infrastructures and workforce training in American hospitals by the year 2019. This shows the importance of infrastructure in implementing and adopting the information systems in hospitals. In addition, sufficient infrastructure is required to make IS application more cost-effective,

especially in the area of operations and support. Hence, increasing the use of sophisticated IS infrastructure can result in massive advantages for the clinical workflow (Bardach, 2009). In Malaysia, the infrastructures are currently still inefficient to support the information systems provided as they have limited personal computers and laptops available in the hospitals (Ismail, 2016).

2.1.4. Time and Space

Several studies agreed that time could be significantly reduced at work when information systems are utilized. For example, the usage of HIS saves time in dealing with patients in hospitals. Besides that, HIS can improve the efficiency of running a hospital owing to the timely use of data. In Malaysia, the hospitals which have implemented the THIS agreed that the HIS is beneficial to reduce the user's time while dealing with patients. Subsequently, it would lead to an increase in the efficiency of the hospital's workflows. The patients' data can be quickly retrieved which provides important parameters for improving the quality of medical care (Biron et al., 2014). The application of HIS creates a paperless office environment which means that less workspace is required. The hospital staff need not worry about misplaced paperwork because all the information is saved on the computer. Thus, the space that was previously used to store and file charts can be reclaimed. This has been proven by a qualitative study conducted by Ismail and Abdullah (2016), which highlighted that the use of a building space could be reduced by using HIS in hospitals.

2.1.5. Paperless and Hybrid Systems

Another factor that affects the HIS implementation in the organizational context is the paperless system, which refers to the use of paper at the hospital. According to Ismail (2016), there will be no paper used in THIS's hospital. This is because, all medication data and information of the patients, including x-ray films, are kept in HIS complete system. Previous studies have shown that every department has its own information system which is connected to another information system in another department within the hospital. However, the IHIS and the BHIS's hospitals are maintained using a hybrid method which is a combination of both manual and electronic systems which means that papers are still being used at these hospitals.

3. METHODOLOGY

This study employed a quantitative method by distributing survey forms to the selected respondents among the users of HIS application at THIS, IHIS and BHIS's hospitals in Malaysia. The total of 229 respondents participated in the survey. The questionnaires are adapted from (Ismail, 2016). It comprised of two sections with their respective constructs. Section A had eight questions concerning the demographic information of the respondents, while Section B had thirty-four questions pertaining to the organizational context.

4. RESULTS

According to Table 1, 229 respondents have participated in the survey which comprises 73 respondents from THIS's hospital, 83 respondents from IHIS's hospitals and 73 respondents from BHIS's hospitals.

Table 1: Descriptive

Organizational Context	Categories of HIS	N	Mean	Std. Deviation	Std. Error
Hospital Size	BHIS	73	5.1301	.91298	.10686
	IHIS	83	4.9398	1.00425	.11023
	THIS	73	4.321	9.99432	.11638
	Total	229	4.8035	1.02631	.06782
Managerial Structure	BHIS	73	5.118	7.87730	.10268
	IHIS	83	4.927	7.89116	.09782
	THIS	73	4.178	1.92310	.10804
	Total	229	4.749	6.97852	.06466
Infrastructure	BHIS	73	4.937	2.69123	.08090
	IHIS	83	4.814	1.91112	.10001
	THIS	73	4.025	3.89441	.10468
	Total	229	4.601	9.92785	.06131
Time Space	BHIS	73	5.047	9.86668	.10144
	IHIS	83	4.973	9.96343	.10575
	THIS	73	4.232	91.04776	.12263
	Total	229	4.761	31.02463	.06771
Paperless Hybrid	BHIS	73	5.000	0.84163	.09850
	IHIS	83	4.927	71.02151	.11213

	THIS	73	4.03701.13889	.13330
	Total	2294.66681.09358		.07227

Note: *p < 0.05, **p < 0.01

Thereafter, an analysis of variance (ANOVA) test was conducted proceeded by the normality, homogeneity and Levene tests. ANOVA is a statistical test to measure the differences involved when more than one group is involved.

Table 2: ANOVA Test

Organization Context		**Sum Squares**	**ofdf**	**Mean Square**	**F**	**Sig.**
Hospital Size	Between Groups	26.260	2	13.130	13.873	.000
	Within Groups	213.897	226.946			
	Total	240.157	228			
Managerial Structure	Between Groups	36.424	2	18.212	22.628	.000
	Within Groups	181.889	226.805			
	Total	218.312	228			
Infrastructure	Between Groups	36.217	2	18.109	25.567	.000
	Within Groups	160.069	226.708			
	Total	196.286	228			
Time and Space	Between Groups	30.133	2	15.066	16.274	.000
	Within Groups	209.235	226.926			
	Total	239.368	228			
Paperless and Hybrid	Between Groups	42.712	2	21.356	20.988	.000

	Within Groups	229.956	2261.018
	Total	272.668	228

Note: *p < 0.05, **p < 0.01

Moreover, a Post-hoc test was conducted to compare the differences between each category within the HIS's hospitals based on the factors outlined in the on organizational context as shown in Table 3.

Table 3: Post-Hoc Test of ANOVA

Organizational Context	**(I) TYPE**	**(J) TYPE**	**Mean Difference (I-J)**	**Std. Error**	**Sig.**
Hospital Size	BHIS	IHIS	.190	.156	.443
		THIS	.808*	.161	.000
	IHIS	BHIS	-.190	.156	.443
		THIS	.618*	.156	.000
	THIS	BHIS	-.808*	.161	.000
		IHIS	-.618*	.156	.000
Managerial Structure	BHIS	IHIS	.191	.144	.382
		THIS	.941*	.149	.000
	IHIS	BHIS	-.191	.144	.382
		THIS	.750*	.144	.000
	THIS	BHIS	-.941*	.148	.000
		IHIS	-.750*	.144	.000
Infrastructure	BHIS	IHIS	.123	.135	.634
		THIS	.912*	.139	.000
	IHIS	BHIS	-.123	.135	.634
		THIS	.789*	.135	.000
	THIS	BHIS	-.912*	.139	.000
		IHIS	-.789*	.135	.000
Time and Space	BHIS	IHIS	.074	.154	.881
		THIS	.815*	.159	.000
	IHIS	BHIS	-.074	.154	.881
		THIS	.741*	.154	.000

	THIS	BHIS	-.815*	.159	.000
		IHIS	-.741*	.154	.000
Paperless and Hybrid System	BHIS	IHIS	.072	.162	.896
		THIS	.963*	.167	.000
	IHIS	BHIS	-.072	.162	.896
		THIS	.891*	.162	.000
	THIS	BHIS	-.963*	.167	.000
		IHIS	-.891*	.162	.000

Note: *p < 0.05, **p < 0.01

Table 3 illustrates that Hospital Size is statistically significant between THIS and IHIS hospitals (p=0.000) and between THIS and BHIS hospitals (p=0.000). However, there is no statistical significance between IHIS and BHIS hospitals based on the Hospital Size (p=0.443). Burns and Stalker (1994) found that hospital size is one of the affected factors in HIS applications in hospital. This is because the size of the hospital and the numbers of patients affected the components of HIS installed at the hospitals. The vast, hectic and complicated environment of a hospital required various HIS components. Managerial Structure is statistically significant between THIS and IHIS hospitals (p=0.000), and between THIS and BHIS hospitals (p=0.000). However, there is no statistical significance between IHIS and BHIS hospitals based on the Managerial Structure (p=0.382). Ahmadi et al. (2015) highlighted the managerial structure that had affected the HIS implementation in their previous studies. This was because, several bodies had participated in the execution of the system to plan, control and supervise the entire HIS system. According to Ismail and Abdullah (2016), HIS implementation is

controlled by the Malaysian Ministry of Health (MOH) together with the hospitals as well as the vendors.

Infrastructure is statistically significant between THIS and IHIS hospitals (p=0.000) and between THIS and BHIS hospitals (p=0.000). However, there is no statistical significance between IHIS and BHIS hospitals based on Infrastructure (p=0.634). Rahman et al. (2014), as well as Kwon and Zmud (1987), highlighted that facilities or infrastructures could affect the functional aspects of HIS applications. Most of these hospitals faced with limited infrastructures, for example, limited computers and laptops that might decrease the level of services offered by the hospitals. Time and Space are statistically significant between THIS and IHIS hospitals (p=0.000), and between THIS and BHIS hospitals (p=0.000). However, there is no statistical significance between IHIS and BHIS hospitals based on the category Time and Space (p=0.881). Garrido et al. (2004), in their studies, found that time and space affected the implementation of HIS. This is because the time that was previously required to fulfil various tasks can be reduced by using the system. However, some senior physicians are reluctant to use HIS because they feel it is time-consuming when dealing with patients. Apart from saving time, the problem of limited space in the hospital can be avoided by implementing HIS because all the patients' data and information can now be stored on the computer.

In terms of the Paperless and Hybrid system, there is statistical significance between THIS and IHIS hospitals (p=0.001), and between THIS and BHIS hospitals (p=0.000). However, the current study found

no statistical significance between IHIS and BHIS hospitals based on Paperless and Hybrid System (p=0.896). According to Ismail (2016), THIS's hospitals are installed with completed HIS to transform them into paperless hospitals. It benefited the hospital by time saving of patients and hospital personnel, as well as saving hospital space to keep the patients' documents and files. Whereas, IHIS and BHIS's hospitals, both maintain the hybrid systems as they are installed with incomplete HIS.

5. DISCUSSIONS

Hospital Size, Managerial Structure, Infrastructure, Time and Space as well as Paperless and Hybrid System are essential elements under the organizational context that could affect the HIS implementation and adoption by different categories of HIS' in Malaysian hospitals. The ANOVA test shows that THIS implementation was significantly different compared to the implementation at IHIS as well as BHIS. Nevertheless, based on the five factors identified under the organizational context, the implementation of HIS in IHIS and BHIS showed no significant difference. Nevertheless, it was necessary to carry out the ANOVA test on the factor involving Hospital Size in order to determine the strength of the differences involving this factor. According to Brown (2008), the effect of size can be examined using the Eta squared as illustrated below. Table 4 shows the findings of Eta-Squared, which

was run using SPSS. The rule of thumb for assessing the magnitude of eta-squared devised by Cohen (1988) identified the value of 0.1 as small, 0.3 as a medium, and 0.5 are as strong. According to the findings, all the side effects are considered small. However, the Infrastructure shows the highest effect size of $\eta 2 = 0.185$.

Table 4: Eta-Squared

Organizational Context	**Eta-Squared**
Hospital Size	0.109
Managerial Structure	0.167
Infrastructure	0.185
Time and Space	0.126
Paperless and Hybrid System	0.157

This evidence shows that Infrastructure is an important factor in influencing the HIS implementation at THIS, IHIS and BHIS's hospitals in the Malaysian public hospitals. The HIS implementation and adoption will be unsuccessful with limited infrastructures and facilities related to information technology in these hospitals.

6. LIMITATION OF STUDY

The data collection process using the qualitative method is constrained by several limitations. First, some of the hospitals

refused to furnish the author with the name lists of hospital staff members. In addition, there was a problem to obtain the cooperation of the most frequent users of HIS, which are physicians to participate in this survey. As a result, stratification sampling could not be done. Instead, purposive sampling was employed since the problem was identified in the hospitals under study. The data sourced from the purposive sampling might contain elements of bias even though the participants had been identified as HIS users.

7. CONCLUSION AND FUTURE RESEARCH

This study shows that the Malaysian public hospitals' implementations of the HIS are currently facing a critical percentage. Therefore, this study focused on the organizational context of HIS implementation in Malaysian public hospitals. There are promising possibilities for further future research including the potential benefits in using Structural Equation Modelling (SEM) as it can simultaneously analyse all the factors involved. This research is significant because it has implications for several organizations, for example on researchers, the Ministry of Health (MOH) and the Malaysian public hospitals regarding HIS implementation which serves as a guide for the responsible agencies to enhance the quality of HIS implementation and the effective adoption of the system in all the Malaysian public

hospitals in the future. Moreover, these organizational contexts would benefit from an in-depth qualitative study in the future.

8. SUMMARY

• There are five factors affecting the HIS implementation in Malaysian public hospital based on the organizational context which are hospital size, managerial structure, infrastructure, time and space as well as paperless and hybrid systems.

• The results showed that the hospitals that implemented THIS were significantly different from the hospitals that implemented IHIS and BHIS.

• There is no significant difference between the hospitals' that implemented IHIS and the hospitals that implemented BHIS.

The infrastructures showed the most important factor that affecting the HIS implementation in Malaysian public hospitals.

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