HIT Institutionalization during COVID Turbulence

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ABSTRACT
Health information technology (HIT) institutionalization is one way to improve healthcare spending. However, it is remaining a challenge to realize. Using an institutional theory and environmental turbulence, we try to better understand the use of HIT within healthcare institutions. We tested structural equation modeling of 432 healthcare personnel survey data. The results show that institutional pressure and environmental turbulence have various (negative and positive) influences on HIT use. Academic and managerial contributions are further discussed in the final session of the study, as well as limitations and suggestions for future research.

Keywords: *Health Information Technology, Institutional Theory, and Environmental Turbulence*

1. INTRODUCTION

Public health investment is a key to universal health. Every country seeks to reduce its allocations and shift to other spending budget. Health Information Technology (HIT) implementation is considered an important component of healthcare spending reform, because it has the potential to reduce medical errors, curtail healthcare costs, streamline clinical processes, and improve overall quality [1].

However, HIT implementation results have been less than satisfactory. Based on a report from the Healthcare Information and Management Systems Society (HIMSS), in Q1 2013, approximately only 13% of health care providers had implemented a clinical data repository (CDR), the basic system of the HIT. HIT implementation has not always effortless and there are possible benefits that have not been generally acknowledged [2].

Previous research proposed directions related on how advanced use of HIT, while considering theoretical views of institutional logic and user behavior [3]. Institutional theory being used since healthcare sector is highly regulated: drugs, vaccines, professional association's role [4]. Furthermore, Kohli & Tan [3] also offer the use of theoretical frameworks accumulating in IS research, such as IS success model [5].

However, only a few studies explore D&M success model in healthcare, particularly in examining the success of HIT. Second, to the best of our knowledge, almost nothing research examined the relationship of Institutional theory and D&M success model. Prior IS research on Institutional perspective used Diffusion of Innovation theory to examine IS adoption [e.g. 6, 7, 8]. Prior IS research on Institutional perspective also used TAM to examine IS acceptance [9]. Prior IS research on Institutional perspective referred to theory of technology assimilation to examine IS implementation [10].

The primary objective of this research is to extend and develop a systematic understanding of IS Success Model by examining the relationship of institutional theory and testing the effect of environmental turbulence in the context of HIT implementation. Furthermore, this study aims to expand the practical application of HIT success implementation in different institutional contexts.

1.1. Healthcare Information Technology

HIT referring to information systems in all computer-based instruments used in healthcare (inpatient and outpatient patients), used in processing patient data, processing information and knowledge needed by health care professionals [11]. HIT covers various applications and technologies used by healthcare providers, such as EMR, EHR, CDSS, CPOE, robot for medication dispensing (ROBOT), bar-

coding at medication administration (BCMA or BarA), electronic medication administration records (e-MAR), and automated dispensing machines (ADM).

1.2. Hypothesis Development

Coercive pressures come from organizations with dominant resources, such as government agencies, and regulators [12]. The government holds a large control over the healthcare sector. The government makes regulations on medicines, regulates health institutions' operation, spends health budgets, and initiates national health insurance. That makes government has a dominant and powerful force controlling hospital and healthcare personnel resources and ultimately affect the behavior of medical personnel in hospitals in using HIT [13]

Previous research examined indicated that coercive pressure has a significant indirect positive effect on doctors' decision to resist the implementation of the German Electronic Health Card (eGK) [9]. Because the doctors perceived a decrease in utility after using new information technology. Furthermore, coercive pressure has a negative influence on IS programs in NPfIT [14], because it changes work practices (including clinical routines, norms, and physician behavior) [15]. Therefore, we draw hypothesis as below:

H1. Coercive pressure negatively influences HIT use.

Normative pressure defined to systems adoption due to the surrounding community, usually characterized by norms or association agreements [12]. Empirical research proves that the adoption of inter-organizational networks represents normative pressures, for example, in system adoption involving suppliers and customers [10]. Healthcare institutions are institutionalized services' networks (national hospitals, general hospitals, clinics, laboratories). Decision to engage in certain behaviors, such as HIT implementation, can be influenced by the number of other parties who do a similar thing within the network [25].

Empirical research shows that the adoption of security standards (ISO 17790 and BS 7799) is influenced by organizational exposure to security association and certification forums [22]. Information about the HIT implementation success is useful because it allows organizations to demonstrate their commitment to better HIT implementation practices [26]. Previous research indicated that normative pressure has a significant positive effect on EHR adoption in USA [13]. Therefore, we draw hypotheses as below:

H2. Normative pressure positively influences HIT use.

Mimetic pressure is organization tendency to imitate the similar IS from other organizations [8]. Organization mimicking others that has proven a successful approach [12]. Successful actions and practices adopted by competitors in the industry are often closely monitored by the organization. Interconnected third parties (e.g. technology vendors) that linked decision-makers and competitors can be relevant sources of information. As a result, decision-makers are aware of successful health IS projects implemented by competitors. They also estimate limitedly, the resources and investment spent by competitors for the health IS implementation.

Previous research indicated that mimetic pressure has a significant negative effect on doctors' decision to resist the implementation of the German Electronic Health Card (eGK) [9], as well as it has a positive effect on EHR adoption in USA [13]. Therefore, we draw hypotheses as below:

H3. Mimetic pressure positively influences HIT use

The turbulent environment is defined as a dynamic, unpredictable condition, with triggers that develop quickly and erratically [16]. Unclear information about market developments encourages organizations to imitate other organizations that have proven successful [17], including imitations in IT implementation [18]. Volberda [19] divides environmental turbulence dimensions into three things: dynamism, complexity, and unpredictability.

Dynamism in COVID - 19 reflects the ways and methods of handling patients developed exponentially [20]. Complexity in COVID – 19 describes the mortality risk is caused by various factors in the complex interactions [20]. Unpredictability in COVID - 19 reflects the potential for transmission in children and remote communities, virus incubation period, asymptomatic cases, and duration of the COVID-19 infection period [20]. Previous research shows that there is a positive effect on avoiding EMR implementation in a turbulent environment [23]. Therefore, we argue that the dynamism, complexity, and unpredictability of COVID-19 can have a negative effect on HIT implementation.

H4a. ET-Dynamism of COVID-19 negatively influences HIT use.

H4b. ET-Complexity of COVID-19 negatively influences HIT use.

H4c. ET-Unpredictability of COVID-19 negatively influences HIT use.

2. RESEARCH METHOD

2.1. Pilot test

We followed the guidelines from Neuman [21] in developing measurements used in empirical research. Some procedures that must be performed to strengthen the reliability and validity are contextualizing the

construct; ensuring content and face validity; increasing discriminant and convergent validity; and running a pilot test. We borrow measurements that have been used in previous studies, such as the constructs of institutional pressure from [22, 8], environmental turbulence from [18, 19], IS Success Models from DeLone & McLean [5, 27]. We then modified these measurements to suit the research context.

Furthermore, all the measurement items were translated into Bahasa Indonesia by two linguistic students. We then evaluate the results of their translations together to ensure the accuracy. The questionnaire items were then sent to two professors in the medical college to be examined and validated. This procedure resulted in some modifications of 7 questionnaire items. Furthermore, all the questionnaire items including 7 modified questionnaire items were pilot tested to 29 graduate (doctoral and masters) students of medical college at universities in Indonesia. They were chosen because they have adequate knowledge and experience in using HIT in hospitals.

The content validity ratio (CVR) is determined by the expert's assessment of the importance and relevance of the questionnaire items. The content validity index (CVI) is determined by the expert's assessment of the clarity of the questionnaire items. These two indicators are used in calculating pilot study items. The results shows were above the threshold. The seven-point Likert scale was used for all questionnaire items in survey for this study, starting from 1 to describe "strongly disagree" to 7 for "strongly agree".

2.2. Sampling

Researchers contacted medical association and nurse association and determined the hospital target. Respondents were asked whether they have used and or been familiar with HIT, in initial part of the survey. Respondents were verified their physician/nurse's registered identification of the Ministry of Health to ensure their occupation validity. An introductory email with a survey incentive totalling $365 USD for 20 randomly selected respondents were attached. Due to chaotic situation in the hospital during the COVID-19 pandemic, survey incentive is prepared to boost respondents' willingness to answer the questionnaire. Identity verification minimizes the concerns caused by unintended respondents and ensuring data validity. 432 valid and usable questionnaires from 533 responses who had been directly perform HIT during COVID-19 pandemic were collected. The main characteristics of respondents are: physicians (48%), have working experience of 3 to 10 years (38%), using HIT almost every day in a week (31%), become part of the COVID-19 team at their hospital (64%), and worked in the emergency department (20%).

3. RESULTS AND DISCUSSIONS

This study employed PLS-SEM by operating statistical software SmartPLS version 3. Assessment of measurement models include (1) composite reliability to evaluate internal consistency (above 0.7), (2) loading factors for each item (above 0.7), (3) average variance extracted (AVE) to evaluate convergent validity (equivalent or above 0.5), (4) Cronbach alpha to evaluate the reliability of internal consistency (above 0.708) (Hair et al., 2016). All reflective items were meet the cut-off value.

Table 1. Reliability and Convergent Validity

Construct	Item	FL	C' α	CR	AVE
Coercive Pressure	GR1	0.912	0.867	0.918	0.791
	GR2	0.923			
	IP1	0.866			
	IP2	0.912			
Normative Pressure	HAP1	0.777	0.843	0.906	0.769
	HAP2	0.868			
	RS1	0.908			
	RS2	0.931			
Mimetic Pressure	RHE1	0.899	0.865	0.917	0.788
	RHE2	0.914			
	SEC1	0.837			
	SEC2	0.846			
Environmental Turbulence of COVID -19	ETD1	0.811	0.818	0.886	0.693
	ETD2	0.861			
	ETC1	0.853			
	ETC2	0.880			
	ETU1	0.834			
	ETU2	0.781			
HIT-Use	EFU1	0.900	0.885	0.929	0.815
	EFU2	0.909			
	EXU1	0.935			
	EXU2	0.942			
	DHU1	0.857			
	DHU2	0.888			

Note: FL=Factor Loading; C'α=Cronbach's Alpha;
CR=Composite Reliability; AVE=Average Variance Extracted

There are two insignificant relationships and five significant relationships. The relationship of COVID-19's turbulence complexity and unpredictability (H4) to the HIT-Use were insignificant. The interaction form in more detail can be seen in Figure 1.

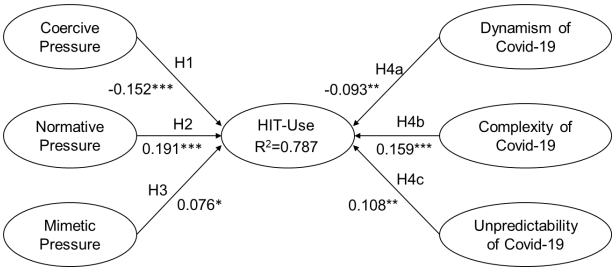

Figure 1 Structural model result

Table 2. Results of the Path Analysis and Hypothesis

Path	Co-efficient	P Values	Hypo	Result
CP → Use	-0.152	0.000	H1	Supported
NP → Use	0.191	0.000	H2	Supported
MP → Use	0.076	0.033	H3	Supported
Dyn → Use	-0.093	0.003	H4a	Supported
Comp → Use	0.159	0.000	H4b	Not Supported
Unp → Use	0.108	0.006	H4c	Not Supported

Note: ***p-value < 0.001, **p-value < 0.01, *p-value <0.05; bootstrapping: 1,000 samples with a total of 432 cases

4. CONCLUSION

The statistical results show that complexity and uncertainty of COVID-19 produce different results from our hypothesis, that both dimensions have a significant positive effect on HIT use (H4b and H4c). This may be due to the desire of healthcare personnel for certainty and clarity about COVID-19 [20]. All the institutional construct results were supported. Previous research shows that coercive, normative and mimetic pressure have positive influence on information systems use [27].

4.1. Theoretical Implications

This research presents several contributions to the body of knowledge. First, to the best of our knowledge, this research is probably the first to integrate institutional theory, environmental turbulence, and the IS success model. Second, this study supports previous research on the negative effects of coercive pressure [9, 14, 15]. This also strengthens the uniqueness of healthcare sector in an institutional context [4]. Third, this research may be the first to develop three specific constructs from the environmental turbulence perspective and examine its effects on IS use. Previous studies only used one construct, namely 'environmental turbulence' or 'market turbulence' [18, 24].

4.2. Practical Implications

First, the government can encourage professional associations to organize discussions, seminars, workshops, and academic activities regarding the HIT use. Our study shows that normative pressure manifested by exposure to HIT and healthcare networks can increase HIT use. Second, the government can encourage the private sector to conduct research and development on HIT. Our study shows that the high investment in developing HIT can increase the HIT use. Third, in a turbulent environment, the government must provide incentives of HIT development. Because only when environment turbulent, the HIT use increases. However, successful use of HIT requires research and development.

4.3. Research Limitation and Suggestions for Future Research

Several limitations in this study can be used as a basis for future research. First, the response rate in this study is quite low. This is because health personnel have limited time and very concerned about the research confidentiality [28]. To overcome this problem, future research needs to formally collaborate with a doctor or nurse association. Second, there are possibly work environmental factors that come into play. Despite, there is only a little research on organizational antecedents for the IS success model [27], we suggest that future research needs to be considered Technology-Organization-Environment (TOE) framework [29]. Third, the topic of IS health implementation is a broad topic. In addition, current health technology trends are developing not only from the provider (hospital) side but also from the patient side. We suggest future research can consider the integration of IS health and wearable health technology.

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