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Hidayah Sulaiman

*RMIT University*, [hidayah.sulaiman@rmit.edu.au](mailto:hidayah.sulaiman@rmit.edu.au)

Nilmini Wickramasinghe

*RMIT University*, [nilmini.wickramasinghe@rmit.edu.au](mailto:nilmini.wickramasinghe@rmit.edu.au)

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# CRITICAL ISSUES IN ASSIMILATION OF HEALTHCARE INFORMATION SYSTEMS

Hidayah Sulaiman, School of Business Information Technology & Logistics, RMIT University, Melbourne, Australia, hidayah.sulaiman@rmit.edu.au

Nilmini Wickramasinghe, School of Business Information Technology & Logistics, RMIT University, Melbourne, Australia, nilmini.wickramasinghe@rmit.edu.au

## Abstract

*The implementation of information systems throughout the healthcare industry has increased dramatically over the past decade since it is now generally believed that IS/IT will be able to bring about immense benefit to medical personnel in delivering better services. However, the enthusiasm of having new information systems implemented usually deteriorates dramatically once the system is acquired. This causes a major issue in the assimilation of the newly implemented technology which could provide a negative impact on the successful ongoing use of the information system. This paper describes a research in progress that explores key technology innovation assimilation issues in a healthcare setting with the aim of developing a technology innovation assimilation model for hospitals to successfully implement and sustain the use of the healthcare information system.*

*Keywords: Assimilation, Technology Innovation, Technology-Organization-Environment, Healthcare Information System, healthcare.*

# 1 INTRODUCTION

The healthcare industry has been criticized for being slow in the adoption of technology to support delivery of care (Barnes 2001; Spil & Stegwee 2001; Suomi 2001; Wager, Lee & Glaser 2005; Wickramasinghe 2000). Various innovative technologies have successfully been introduced with the aim of improving hospitals' performance and providing better healthcare services. However, the delivery of these technologies is perceived to be inappropriate or inadequate for the medical staff (Wager, Lee & Glaser 2005). The introduction of new technology begins with great enthusiasm and an extensive spread of initial excitement about the acquisition, however the new technology fails to be deployed and sustained in many acquiring firms (Fichman, Robert G. & Kemerer 1999). This causes the existence of an assimilation gap for technology innovation as the initial acquisition of the technology does not always lead to sustained use of the technology.

The purpose of this paper is to discuss a current research study that focuses on the issues that too many hospitals are facing in the implementation of a healthcare information system (HIS). Specifically, this study will explore the technology innovation assimilation issues and contribute to the current body of literature of information technology innovation assimilation. Through the development of a focused theory tailored specifically to the technology implemented in the healthcare setting, it is hoped that this research will provide a technology assimilation model for IT/IS managers, hospital chief information officers and IT/IS executives in implementing or adopting healthcare information systems with the aim of delivering better healthcare services that can be fully utilized by medical personnel.

## 2 BACKGROUND

Assimilation can be defined as a series of stages beginning from the organization's initial evaluation of the potential system to be used to its formal adoption and finally to a well accepted deployment of the system to a point where it becomes a routine as well as an important part of the value chain activities (Fichman, R. G. 2000). Previous literature on technology innovation and diffusion was mostly based on the work of Everett Rogers (Agarwal, Tanniru & Wilemon 1997; Ahmed, Daim & Basoglu 2007; Burke et al. 2002; Gallivan 2001; Greenhalgh, Trisha et al. 2004) and since then the diffusion of innovation (DOI) model has been extended (Moore & Benbasat 1991) and has created an insightful role in moulding the basic idea, terminologies and scope of the field (Fichman, R. G. 2000). Nevertheless this model does not really apply well to various kinds of innovation adoption contexts (Fichman, R. G. 2000). It was also suggested that a study on healthcare innovations which can bring about good to the public but has diffusion and other related innovation issues is worthy of a study (Mcgrath & Zell 2001). Thereby making a study that looks into the organization, individual and technological level focusing on how a technology can be sustained throughout the innovation assimilation stages and why the assimilation gap exists is both important and serves to fill a void in the existing literature. Further, there is also a lack of theories being developed to a specific type of technology and to a particular adoption context due to the lack of generic theory of technology innovation (Fichman, R. G. 2000); hence taken together all these factors provide the motivation for this research in developing a technology innovation assimilation model for hospitals to successfully implement their healthcare information systems.

### 2.1 Theory of Innovation Assimilation

Based on the diffusion of innovation literature, there is a need for more research to be done on the IT innovation assimilation area in finding out reasons behind the failure of innovation usage amongst a population of a particular context. Innovation can be defined as an idea, practice, technology or entity that is considered to be new by an individual, a group or any other units of adoption (Rogers 2003b). The need for innovation assimilation can be seen in many of the healthcare information system implementation literatures (Heeks 2002; Jayasuriya & Anandaciva 1995; Littlejohns, Wyatt & Garvican 2003). In a study of the implementation of healthcare information systems where the HIS

are being evaluated, three quarters are found to have failed with no evidence that the system have actually improved healthcare professional's productivity (Littlejohns, Wyatt & Garvican 2003; Willcocks & Lester 1996). The affected hospitals undoubtedly suffered from a severe assimilation gap during its implementation and operation (Heeks 2002). Millions have been spent in the entire process of implementing the information system however due to the mismanagement of assimilating the new technology to the healthcare personnel, the information system failed to proclaim its benefits (Littlejohns, Wyatt & Garvican 2003). Therefore, a study on the processes of innovation assimilation is worth looking into based on the issues identified in the healthcare information system implementation.

## **2.2 Technology-Organization-Environment Framework**

In finding out how to address assimilation gaps, there is a need to consider elements that influence the success of innovation assimilation. Based on the reviewed literature, the technology-organization-environment (TOE) framework (Tornatzky & Fleischer 1990) provides aspects that firms should consider when studying influences to assimilation of technological innovation. These concepts are grouped in three firm's aspects: technological, organizational and environmental.(Tornatzky & Fleischer 1990; Zhu, Kraemer & Xu 2006). Technology context comprises of internal and external technologies pertaining to the firm involved that includes both equipment and processes (Tornatzky & Fleischer 1990). Organizational context involves the characteristics and resources of the firms such as firm size, managerial structure, human resources and linkages among employees (Tornatzky & Fleischer 1990). Environmental context includes structure of the industry, the firm's competitors, the macroeconomic concept and the regulatory environment(Tornatzky & Fleischer 1990). These elements influences the way a firm sees the need, the search and the way to adopt new technology (Tornatzky & Fleischer 1990).

A similar version of this framework is also applied in the work of Zhu et al.(2006) studying factors that influence e-business assimilation stages in both developed and developing countries. From this study, the germane findings included that factors such as technological readiness and regulatory environment are significant in innovation assimilation process. In addition, it was shown that the organizational context factors such as firm size and managerial obstacle which has been verified in the IS literature impacts IT adoption and usage (Gurbaxani & Whang 1991; Zhu 2004). Firm size is also seen as an important organizational attribute for innovation diffusion (Rogers 2003a). The managerial obstacle is referred to the organization's lack of managerial skills and efficiency in handling change management, thus causes the ineffectiveness of managing technology adoption and adaptation (Roberts et al 2003). This is inline with Mata's et al. (1995) view that the ability to merge managerial and IT skills highly depends on the firms' ability to assimilate information technology. Hence this requires firms to possess relevant managerial skills and overcome barriers in adopting and assimilating new technology. In line with the healthcare information system assimilation study, this research will adapt some of the influencing elements in the TOE framework such as hospital size and managerial obstacles as an influence to the HIS assimilation process.

## **2.3 IT resources in Resource Based View**

The Resource Based View (RBV) literature on IT resource classification begins with Grant's (1995) classification of key IT-based resources, and was categorized into IT Infrastructure (tangible resource which includes IT infrastructure components), IT expertise ( human IT resources which is divided into technical and managerial IT skills) and IT enabled intangibles (intangible IT enabled resources such as knowledge assets, and customer focus). Ross et al (1996) further extended the study by suggesting that the relationship and use of resources such as IT human resources, reusable technology infrastructure and strong IT-business partner relationship together would result to a faster strategic business needs in terms of cost effectiveness as compared to the organization's competitors. Merging the studies of both Ross et al (1996) and Grant (1995), Bharadwaj (2000) extended these concepts of IT resources redefining them as IT capabilities. Huang et al (2006) then further explored the study by Bhadrawaj (2000), revealing that the IT infrastructure and human IT resources cannot directly influence firm's performance, however, the two resources provide an influence to intangible resources

such as knowledge assets, improved customer service through IT, management of organizational knowledge, better synergy, improved coordination and sharing of resources across organizational divisions (Bharadwaj 2000; Huang et al. 2006). Hence, these intangibles are grouped as IT enabled intangibles (Bharadwaj 2000) which will directly influence the firm's performance.

A study by Glaser (2002) on the strategic applications of IT in healthcare organization has brought about the identification of healthcare organizational IT resources that was aimed towards realizing organization's strategies and achieving its goals. The resources identified relevant to this study are technical infrastructure, IT staff and IT governance since it coincides with another study on the identification of IT resources in healthcare by Khatri (2006) through literatures of resource based view. Therefore, this research will look into the influence of these resources to the assimilation of healthcare information system in hospitals.

### 3 DEVELOPMENT OF THE CONCEPTUAL FRAMEWORK

Integral to the design and development of the proposed research model to understand assimilation issues with healthcare information systems is the need to present the theoretical basis to answer the research question of how do we decrease problems and risks with HIS implementation systematically. It also identifies the assimilation gaps and different components of technology, organization and environment which acts as an influence to the success of the HIS innovation assimilation. This model is derived from a combination of previous work done by Huang et al. (2006) and Zhu, Kraemer & Xu (2006), in consistent with the classic conceptual work of Tornatzky & Fleischer (1990), Rogers (1995), Thompson (1965), Zmud (1982) and Grover & Goslar (1993). With this proposed model, this research will explore the interrelationship between innovation assimilation stages and contributing concepts that consist of technology, environment and organizational context to address the assimilation gaps.

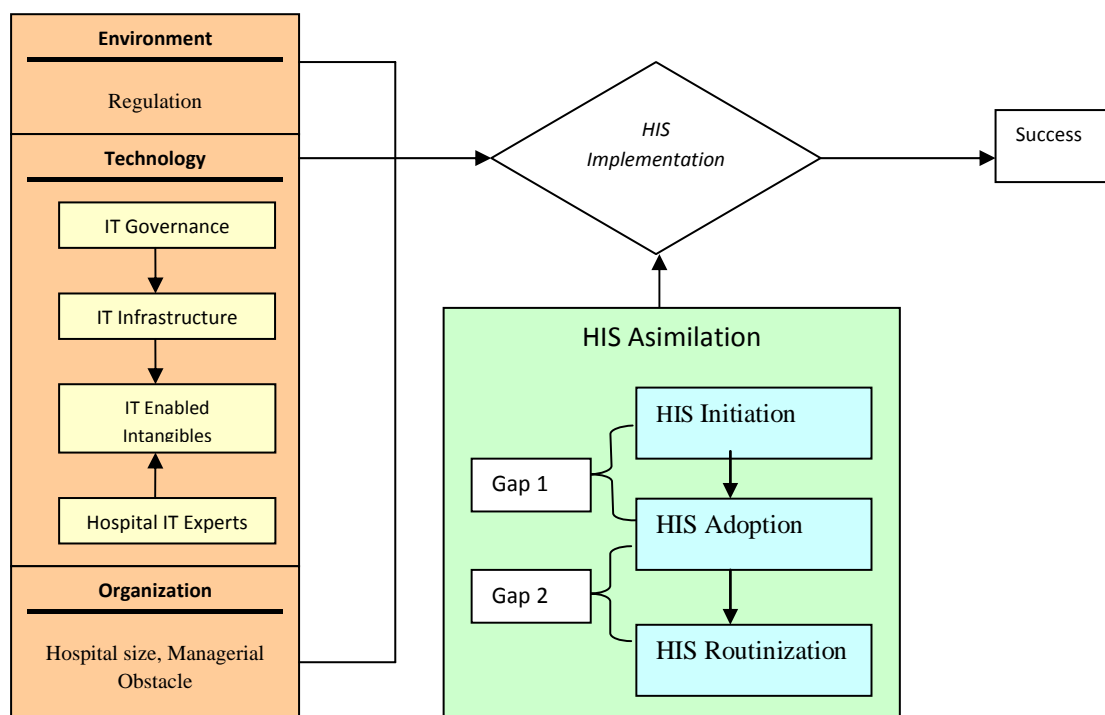


Figure 1 Conceptual Model of the Research: HIS Assimilation Model

Applying the innovation assimilation concept to the healthcare setting, this study will adopt the view of Zhu et al (2006) and Ammenwerth et al (2005), in classifying both awareness and evaluation in the initiation stage. This is inline with the conceptual framework of Thompson (1965) and many other empirical research (Agarwal, Tanniru & Wilemon 1997; Chengalur-Smith & Duchessi 1999; Cooper

& Zmud 1990; Gallivan 2001; Grover & Goslar 1993; Pierce & Delbecq 1977; Zhu, Kraemer & Xu 2006; Zmud 1982) which considers 'initiation' to be the first in an assimilation stage.

Subsequent to initiation is the adoption stage, where this stage involves the successful usage of the technology acquired (Agarwal, Tanniru & Wilemon 1997). Hence, adoption does not always indicate that the technology has been widely used in the organization, therefore this has to be followed by the utilization and institutionalization of the technology throughout the organization to a point where the technology adopted is becoming part of the organization's value chain (DeLone & McLean 1992; Devaraj & Kohli 2003; Sethi & King 1994; Zhu, Kraemer & Xu 2006). This stage is then known as routinization. However, there gaps exists between the stages as there is usually the enthusiasm of acquiring new technology however once it has been adopted, many failed to meet its purpose and was not able to sustain its use (Fichman, Robert G. & Kemerer 1999).

The research model will also include several concepts identified from the TOE framework namely those which have been identified to be relevant with this research. Among the selected concepts are regulatory environment, technology readiness context, firm size and managerial obstacle as shown in figure 1.

Based on the studies done by Grant (1995), Ross et al (1996), Bhadrawaj (2000) and Huang et al (2006) the identification of technology resources for this research shall include IT Infrastructure, human IT resources and IT enabled intangibles in the conceptual framework. These resources are deemed significant in finding out the influence that the IT resources could provide to the HIS innovation assimilation. Hence, exploring how they are being utilized, and how they can be leveraged in sustaining the use of HIS is relevant to this study.

Apart from that, IT governance is also included as a resource since many organisations including the healthcare industry adopted IT governance to ensure that IT is aligned with organization goals and objectives (Cater-Steel & Tan 2005). In order to sustain the use of technology, there is a necessity in establishing some order and control in the management of IT resources (Zachman 1987). The firm size concept is incorporated in this framework due to its importance for innovation diffusion (Rogers 2003b) and to distinguish between activities that are carried out between large and small firms in each of the assimilation stages according to their resource advantages (Zhu, Kraemer & Xu 2006). The managerial obstacles under the organizational context are also considered an important concept as the success of innovation implementation will not only rely on the innovation itself and the behaviour of the adopters but also the strength and support provided by the management (Attewell 1992; Greenhalgh, Trisha , Robert & Bate 2008; Yetton, Sharma & Southon 1999; Zmud 1984). Considering the theoretical aspect and literature above, the research model will portray the three innovation assimilation stages: initiation, adoption, routinization, the relevant TOE concepts and the gaps which will be explored in the healthcare setting as depicted in the above figure 1.

## 4 CONCLUSION

This paper has provided an overview of the contextual issues which surround the design of technology innovation assimilation in a healthcare environment with a particular attention to the implementation of healthcare information system. Aspects of technology innovation assimilation stages, the roles of the technology-organization-environment context have been explained to articulate the complex requirements of the HIS innovation assimilation design process. Further, it is necessary to address the assimilation gaps and this also foresees the important role of the contributing elements in successfully assimilating the HIS. Thus, the proposed study will address the gaps and challenges by merging different or commonly disparate theoretical frameworks to explore the technology assimilation stages and the contributing elements for the successful implementation of HIS. It is important in closing to underscore the importance and significance of this study in light of exponentially increasing healthcare costs globally and the growing trend of healthcare organisations to implement HIS as a solution and thus their huge reliance today on HIS this research will serve to facilitate better, more

effective and efficient use of HIS and thereby support superior value driven healthcare delivery as well as address a significant void in the existing literature.

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