Hospital Information System adoption: Expert perspectives on an adoption framework for Malaysian public hospitals

Hossein Ahmadi [a, **], Mehrbakhsh Nilashi [c, *], Leila Shahmoradi [a], Othman Ibrahim [b]

[a] Health Information Management Department, 5th Floor, School of Allied Medical Sciences, Tehran University of Medical Sciences, No #17, Farredanesh Alley, Ghods St, Enghelab Ave, Tehran, Iran
[b] Faculty of Computing, Universiti Teknologi Malaysia, 81310 Skudai, Johor, Malaysia
[c] Department of Computer Engineering, Lahijan Branch, Islamic Azad University, Lahijan, Iran

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ABSTRACT

Hospital Information System (HIS) is important in the healthcare industry as it supports a wide range of highly specialized health-care tasks and services. In Malaysia, HIS diffusion is still in its early stage and there is slow rate of adoption among large, medium, and small public hospitals. To investigate the factors influencing the adoption of HIS in the hospitals' work processes, this study proposed the initial theoretical framework based on the combined Technology Organization Environment (TOE), institutional theory, and Human Organization Technology (HOT) fit model. A nationwide survey was conducted on small, medium, and large public hospitals involving both HIS adopters and non-adopters in Malaysia to verify the validity of the initial integrated framework. We find that relative advantage, compatibility, security concern, hospital size, mimetic pressure-competitors, vendor support, perceived technical competence of IS staff, and employees' IS knowledge as the influential factors on HIS adoption. In addition to the only moderator of this study (occupational level), any significant moderating effects on the Technology-Organization-Environment-Human dimensional factors and the adoption of HIS by Malaysian public hospitals was not found. Hence, these results indicated that the developed integrated framework provides an effective prediction of the HIS adoption by Malaysian public hospitals.

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1. Introduction

Over the years, various innovations have been introduced into healthcare organizations in order to incorporate better use of technology, to reduce medical error, to decrease costs, to aid decision making, and to facilitate the search for medical solutions. This allows integration between experts in the medical field either throughout the organization or globally (Ahmadi, Nilashi, & Ibrahim, 2015; Sepucha et al., 2016). One of these innovations is Hospital Information System (HIS) that has been intended to utilize the information systems with the aim of delivering supreme health services for the citizens and solve issues that have been found as cumbersome for those looking for medical treatment (Lee, Ramayah, & Zakaria, 2012). Nonetheless, various issues and challenges exist related to internal and external factors regarding the adoption of HIS innovation (Ahmadi et al., 2015; Lin, Lin, Roan, & Yeh, 2012; Masrom & Rahimly, 2015; Sherer, Meyerhoefer, & Peng, 2016; Hsiao et al., 2009).

The adoption and use of HIS has an important role in cost reduction and enhancing hospital performance (Sulaiman & Wickramasinghe, 2014). Adoption refers to the decision of employing HIS in the public hospital work practices and encouraging healthcare professionals to apply HIS (Ahmadi et al., 2015; Lian, Yen, & Wang, 2014). In Malaysia, it has been reported that there is a slow progress on the trend of HIS adoption (Ahmadi et al., 2015; Ismail, Abdullah, Shamsudin, & Ariffin, 2013, p. 22, 2015; Lee et al., 2012; Masrom & Rahimly, 2015; Sulaiman, 2011).

By focusing on the theories for innovation adoption, it is recommended that Technology Organization Environment (TOE) perspective can be applied as a potential lens to explore the important factors influencing the adoption of health information system at the hospital level by concentrating on the technological, organizational, and environmental dimensions (Ahmadi et al., 2015; Chang, Hwang, Hung, Lin, & Yen, 2007; Hung, Hung, Tsai, &

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* Corresponding author.
** Corresponding author.
E-mail addresses: hosseinis3007@gmail.com (H. Ahmadi), nilashidotnet@hotmail.com (M. Nilashi).

Jiang, 2010; Lian et al., 2014; Sulaiman & Wickramasinghe, 2014; Wang, Li, Li, & Zhang, 2016; Zhu, Kraemer, & Xu, 2003, 2006). In this manner, external environmental pressures as the critical insight of institutional theory that is related to institutional environment, push organizations to conform the new action as others. Additionally, Human Organization Technology (HOT) fit model (Yusof, Kuljis, Papazafeiropoulou, & Stergioulas, 2008a, 2008b) emphasizes the importance of three dimensions of human, organization, and technology in the environment of healthcare and scrutinizes their impacts on the successful adoption of health information system (Hsiao & Chen, 2016; Lian et al., 2014). Hence, the critical case of human in the improvement and adoption of Information System (IS) was asserted through the literature of IS (Ahmadi et al., 2015; Carayon, 2016; Davis, 1993; Goodhue, Klein, & March, 2000; Tsiknakis & Kouroubali, 2009).

There are at least three distinct motivations underlying our study. According to Abidi, Goh, and Yusoff (1998), "in Malaysia, Multimedia Super Corridor (MSC) project began in 1996 to emphasize on the national vision of 2020." Through particular objectives, this project has been established to aid Malaysia towards becoming a developed country by year 2020. One of the specific focuses of MSC project is on flagship projects that consist of various subprojects. In this case, Telemedicine is being approached to be intensively developed (Lee et al., 2012; Li, 2010). Lifetime Health Plan (LHP) is under the MSC telemedicine for the purpose of developing the healthcare platform that would suit the public hospitals in serving personal LHP to the citizens. Furthermore, HIS was introduced under the LHP project, to start the digitalization process within the healthcare organization (Lee et al., 2012; Sulaiman, 2011).

At this time, in Malaysia, there are 141 public healthcare facilities comprising of 137 hospitals and four special medical institutions possessing more than 39000 beds (MOH-Malaysia, 2015). It has been reported that 8.39% of total Ministry of Health (MOH) is allocated to national budget (MOH-Malaysia, 2015). Surprisingly, only 22 out of 137 public hospitals are fully integrated or partially integrated with HIS from the time when the Telehealth project was began (Ismail et al., 2010, 2013, p. 22; Masrom & Rahimly, 2015; Sulaiman, 2011). This shows that the progress of HIS on the trend of HIS adoption in Malaysia is slow.

Hence, this study serves to fill a gap in the existing literature through explaining of "how can HIS be adopted by Malaysian public hospitals?"; by identifying the potential factors of and barriers to the adoption of HIS in settings of both adopter and non-adopter groups. In addition to that, little research, if any, has been done to elucidate the moderating effect of the occupational level, where the adoption of HIS within a hospital deeply involve different stakeholders such as decision makers (top and mid managers) and HIS users in hospitals (healthcare and supporting staff). Hence, the current study additionally attempted to highlight the effect of stakeholder's occupational level on the relationship between the foresaid determinants and HIS adoption.

Therefore, based on the above discussion, it can be concluded that there are hedonic motivations for this study in developing an incorporated view of theoretical framework. Based on the relevant foresaid theories, this theoretical framework is established for public hospitals to foster the adoption of HIS for the benefit of hospitals and patients community at large.

2. Literature review

2.1. Hospital Information System (HIS)

The term, adoption refers to the decision of any individuals or organizations to make use of innovation, whereas diffusion refers to the accumulated level of users of an innovation in a market (Frambach & Schillewaert, 2002, pp. 163–176; Rogers Everett, 1995). In the organizational context, adoption is related to admit a new innovation for the implementation (Deering, Tatnall, & Burgess, 2012). As such, in terms of the research topic, adoption refers to the decision to admit or start to use HIS as a new technology in public hospitals setting.

2.2. The current state of HIS in healthcare

The state of HIS adoption has been evaluated by many empirical studies. Schoen et al. (2009) conducted a critical review to determine the level of ambulatory Electronic Health Record (EHR) adoption in U.S. hospitals. They indicated that in year 2005–2007, the adoption level ranged from 17 to 35%. Furthermore, American Hospital Association (AHA) in 2006 did an investigation of inpatient setting. They wrote that 11% of hospitals in the U.S. applied the EHR system, while the survey of AHA shows that the EHR adoption level in U.S. hospitals was around 9% in 2008 (Jha et al., 2009) and 12% in 2009 (Ash, Gorman, Seshadri, & Hersh, 2004; Cutler, Feldman, & Horwitz, 2005; Jha et al., 2009, 2010). Hence, a challenge of low adoption rate in terms of IS adoption within U.S. healthcare, remains (Blumenthal & Tavenner, 2010).

Despite a few studies on the assessment of HIS adoption state within other countries, significant evidences exist indicating the satisfactory level of IS adoption in the ambulatory setting within the Western countries. Protti (2006) in his study on IS adoption determined that in ten countries (Sweden, Scotland, Norway, Aealand, Netherlands, Germany, England, Denmark, Austria and Australia), general practice offices had adopted IT widely. It has been reported that in some of the countries, some functions including viewing laboratory results, receiving discharge summaries, and Health Information Exchange (HIE) were less being used (Lin et al., 2012; Protti, 2006). In the study, the role of public policy is the main point, indicating the social contexts affecting the use of IT in these countries. Also, Protti (2006) believed that the satisfactory levels of adoption in these countries are highly dependent on the governments to mandate the electronic billing, and financial incentives that impact professional organizations.

Rothstein (2011) noted that in developing countries, merely a small number of patients were provided with Patient Health Record (PHR); and EHR was utilized by less than 50% of medical staff. Furthermore, Clifford, Blaya, Hall-Clifford, and Fraser (2008) stated that health infrastructure in developing countries is not sufficiently equipped. Although various technologies have been proposed, the experts are uncertain on-the-ground influence of what type of technology would be the most optimum, and for what type of setting would they be the most appropriate. In order to design a precise evaluation of the degree of efficiency and usefulness of interferences and health care services offered in the hospitals, a bigger volume of data related to medical requirements must be widely gathered.

In Taiwan, several researches were conducted related to the adoption of HIS technology. Pertaining to the e-signature as a core component of Electronic Medical Record (EMR), the proportion of hospitals that adopted Electronic signature to those that did not adopt is 29.4%–70.6% (Chang et al., 2007); with respect to the Health Level Seven (HL7), 14.3% hospitals adopted it and 85.7% of hospitals had yet to adopt (Lin et al., 2012); regarding the mobile technology in Taiwan, 11.15% of hospitals adopted some kind of mobile technologies in their clinical practices (Hsiao, Li, Chen, & Ko, 2009); and at last the adopters for PACS technology diffusion in Taiwan were in the early majority, whereby, 40% adopted it (Chang, Hwang, Yen, & Lian, 2006). Theera-Ampornpunt (2011) in a nationwide survey in Thailand found out that Thai hospitals overall