The Case of Organizational Innovation Capability and Health Information Technology Implementation Success: As You Sow, So You Reap?

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ABSTRACT

Organizational innovation capability is defined as the ability to continuously transform knowledge and ideas into new products, processes, and systems for the benefit of an organization and its stakeholders. This study examines the relationship between the innovation capability of healthcare organizations and their ability to successfully implement electronic medical records (EMR), a health information technology (HIT) innovation. Data was collected using a cross-sectional survey, and structural equation modeling (SEM) method was used to analyze the data. Results demonstrate that organizational product innovation capability positively affects EMR implementation success. A positive relationship also exists between organizational process innovation capability and EMR implementation success. This study is one of the first to empirically validate the relationship between healthcare organization's innovation capability and HIT innovation implementation success, in the context of EMRs. Implications of the study for the academic and industry practitioner are discussed.

KEYWORDS

Electronic Medical Records (EMR), Health Information Technology Implementations, Organizational Innovation, Socio-Technical Systems Theory, Tri-Core Model for Information System Innovation

INTRODUCTION

Organizational innovation capability has been considered an important ingredient for success. This is more relevant today than ever before, due to the intense competition in the healthcare and non-healthcare industry (Calantone, Cavusgil & Zhao, 2002; Damanpour, 1996, 1991, 1987; Damanpour & Evan, 1984; Gonzalez-Zapatero et al., 2016; Mu et al., 2017; Najafi-Tavani et al., 2016). Innovation can be defined as the intentional introduction and application within a role, group, or organization, of ideas, processes, products, or procedures new to the relevant unit of adoption and designed to significantly benefit the individual the group or the wider society (West, 1990). Technological innovation refers to "the implementation of an idea for a new product, or a new service, or the introduction of new elements in an organization's production process or service operation" (Damanpour and Evan, 1984,

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p. 394). Innovation capability is “the ability to continuously transform knowledge and ideas into new products, processes and systems for the benefit of the firm and its stakeholders” with this higher order capability enabling the molding and management of multiple capabilities to successfully stimulate innovation (Lawson and Samson 2001, pp. 380, 384). Organizational innovation capability essentially involves the bringing to the market and/or successful implementation of a new product or service (Adler & Shenbar, 1990). Scholars have described it as the ability to mobilize the knowledge of the employees and the organization from past innovation implementation experiences to create new knowledge, and use such new knowledge to implement a new product or service (Çakar & Ertürk, 2010; Kogut & Zander, 1992; Ranganathan & Afnan, 2012). A firm with the capability to enhance its organization’s learning and assimilate existing and new knowledge would also have the capability to successfully create and implement product and process innovations (Therin, 2003).

Research literature informs us about the important role of health information technology (HIT) innovations in improving healthcare quality and the cost of care (Bezboruah *et al.*, 2014; Chaudhry *et al.*, 2006; Cresswell & Sheikh, 2013; Gewald & Gewald, 2020; Gagnon *et al.*, 2012; Li *et al.*, 2013; Narattharaksa *et al.*, 2016). In the realm of healthcare, electronic medical records (EMR) fit the profile of technology innovations (Crane & Crane, 2006; Dansky *et al.*, 2006; Dansky & Dirani, 1998; Dansky *et al.*, 1998; Holt *et al.*, 2019; Krist, 2015; Lee *et al.*, 2016; Lee, 2000; Pellizzoni *et al.*, 2020; Perez *et al.*, 2017). EMR implementation is an important aspect of HIT, perhaps the most important aspect, since it has the potential to directly impact cost reduction and quality improvement in healthcare delivery through: (i) lowering the processing times associated with enormous amounts of patient information within and between hospitals, (ii) enhancing the speed and quality of communications between patients and the healthcare providers, and between healthcare providers and other healthcare providers or specialists that need to be involved in patient care, and (iii) delivering evidence-based high-quality healthcare through collection and mining of patient information using computers (Hillestad *et al.*, 2005; Jardim & Martins, 2016; Sharma *et al.*, 2016). HIT and EMR are eventually expected to contribute to the delivery of high-quality healthcare to all sections of society at a reasonable cost (Byrd & Clayton, 2001; Ferlie & Shortell, 2001; Jardim & Martins, 2016; Sharma *et al.*, 2016; Thakur *et al.*, 2012; Trzeciak & Rivers, 2003).

The healthcare industry has been characterized as complex, turbulent, fragmented, and tightly coupled (Shekelle *et al.*, 2006; Greenhalgh *et al.*, 2009). This is mirrored in research studies which have highlighted complexities inherent in the implementation of HIT innovations (Martikainen *et al.*, 2020; Parks *et al.*, 2019; Sittig & Singh, 2015; Sligo *et al.*, 2017; Stroetmann, 2014). EMR implementations around the world have been slow and fraught with problems (Cresswell *et al.*, 2020b; Jawhari *et al.*, 2016a; Raut *et al.*, 2017; Reisman, 2017; Yi, 2018). It is known from research literature that 50% to 95% of information systems (IS) projects fail to be implemented successfully, and 20% to 30% of EMR implementations fail within the first year (Palvia *et al.*, 2015; Sumner, 2015). This situation persists in the United States too, despite the monetary incentives provided by the government (Adler-Milstein *et al.*, 2015; Barrett, 2018; Kharrazi *et al.*, 2018). In the United States, the healthcare system is very complex, in part due to the various types of healthcare-providing institutions and the many insurance establishments involved in providing healthcare, as well as due to the complex laws that cover healthcare schemes such as Medicare and Medicaid (Byrd & Clayton, 2001; Ferlie & Shortell, 2001; Thakur *et al.*, 2012; Trzeciak & Rivers, 2003). The ever-increasing healthcare costs and ever-changing complex laws make delivering high-quality evidence-based healthcare at an affordable cost a perpetual challenge for healthcare providers in the United States (Byrd & Clayton, 2001; Ferlie & Shortell, 2001; Thakur *et al.*, 2012; Trzeciak & Rivers, 2003).

A deeper investigation into the reasons for EMR implementation challenges in past research studies has identified the causes to be largely organizational and social in nature and less to do with the technology itself, though there is some evidence in favor of the latter as well. These socio-technical challenges include a perceived lack of information technology (IT) support, perceived lack of productivity and efficiency in transitioning to a paperless system, financial capabilities related

to the total cost of EMR ownership, vendor selection related to integrating of EMR technology, and perceived loss of privacy and security of patient data (Chan et al., 2016; Palabindala et al., 2016; Zandieh et al., 2008). Physician's resistance to change and physician burnout has also been widely studied among HIT scholars (Barrett, 2018; Beglaryan et al., 2017; Colicchio et al., 2019; Zandieh et al., 2008). By contrast, EMR implementation costs are typically documented as upfront implementation costs and annual maintenance costs (Brooks & Grotz, 2010; Hillestad et al., 2010; Kanga et al., 2016; Patil et al., 2008). It is evident from research literature that the planning for large-scale HIT implementations such as EMR often does not account for the effort and costs involved in addressing the socio-technical challenges mentioned above. Perhaps due to the varied dimensions of difficulties associated with their successful implementation, the implementation of HIT innovations such as EMR's has lagged the implementation of non-healthcare innovations in industry (Black et al., 2011; Cresswell & Sheikh, 2013). The relationship between the socio-technical perspective, impact of HIT innovations on healthcare quality and costs, complexities relating to HIT innovation implementations, and the lagging of the HIT innovation implementation scenario is a symbiotic one as described previously. Our research on the impact of organizational innovation capability on HIT implementation success is based on such symbiotic relationship.

BACKGROUND AND THEORETICAL FRAMEWORK

The two major areas of research literature providing the necessary theoretical foundation for this study are the organizational innovation capability literature, and the research literature in the two major areas of IS and HIT innovation implementation - the socio-technical systems (STS) theory (Trist et al., 1963), and the tri-core model of IS innovation (Swanson, 1994). Together they support the formation of the research hypotheses for this research study, and are discussed next.

Organizational Innovation Capability

That continual innovation is critical to organizational success is indisputable, especially in the extremely competitive industrial climate we live in today (Al-Hakim & Hassan, 2016; Damanpour, 1996; Joshi et al., 2010; Kim & Chung, 2017; Ries, 2011). Innovation has been studied from different perspectives in academic research. Organizational innovation capability requires finding a good balance between flexibility and control which are often in conflict with each other. While flexibility enables creativity and change vital for the exploration that stimulates innovation, control underscores discipline, long-term goals, core competencies and budgets (Khazanchi et al., 2007). Because even the most stable environments do change, which leads to organizations adopting innovations continually over time, organizational innovativeness is more accurately represented when multiple innovations over a period of time are considered (Damanpour, 1987, 1991, 1996). Christensen (1999) contended that in addition to his/her other duties and responsibilities, a manager must also manage innovation within the organization. Downs and Mohr (1976) questioned whether variability in the type of innovation has an influence on its adoption, or if different variables may have different explanatory roles depending on the innovation's context.

Organizational psychologists Klein and Knight (2005) have researched the organizational challenges that impede innovation implementation along with certain characteristics that need to work together to increase the likelihood of successful implementation. Such characteristics, which could also become stumbling blocks on the road to implementation, include i) unreliability of the innovation, ii) need for users to acquire new technical knowledge and skills, iii) disparity in organizational hierarchies making decisions and those implementing them, iv) disruption in pre-established organizational norms, v) up-front time and financial investments, and vi) organizational inertia to maintain status quo (Klein & Knight, 2005). Obviously, most of these barriers are organizational issues rather than technical issues. Antecedents to effective implementation include an organizational climate for innovation implementation, and organizational learning orientation (Klein & Knight, 2005). Learning conditions

are individual characteristics of a single user, while learning is also a multi-step social process through which an organization acquires tacit knowledge from its external environment (MacVaugh & Schiavone, 2010). In their expansive literature study on the limits of the diffusion of innovation across marketing, new product development and sociology domains, MacVaugh and Schiavone (2010) emphasized that innovation diffusion is affected by the technological, social, and learning conditions which operate in the contextual domain of the individual, community or market/industry.

Innovation could be the creation or adoption of a product or service, a new production process technology, a new structure or administrative system, or a new plan or program pertaining to organizational members (Çakar & Ertürk, 2010; Damanpour & Evan, 1984; Khazanchi et al., 2007; Zaltman et al., 1973). Innovation capability and organizational innovativeness are conceptualized from the perspective of the rate of adoption of innovations as well as an organization's inclination to change (Calantone, Cavusgil & Zhao, 2002; Hurt et al., 1977). An organization's ability to innovate also depends on a supporting culture that encourages creativity, experimentation and risk taking (Jassawalla & Sashittal, 2002). It could conceivably refer to how early an organization seeks to adopt a new product, process or service relative to other organizations (Damanpour, 1991; Hunt & Morgan, 1996; Hurt et al., 1977; Hurt & Teigen, 1977; Rogers & Shoemaker, 1971).

Innovations in the Information Systems and Health Information Technology Context

In the context of information systems (IS), innovation has been described as any new way of developing, implementing, and maintaining information systems in an organizational context (Avgerou, 2003). Prior work in IS innovation research has forwarded the resource-based view, which interprets the ability to leverage IS in new ways as being a core competence of an organization as well as a source of sustainable competitive advantage (Feeny and Willcocks, 1998). For successful adoption of IS innovations, institutional processes need to be engaged early (Swanson and Ramiller, 1997). To leverage the value of IS, organizations need to recognize and develop competencies whose elements are distributed throughout the organization, and are not solely resident in the IS function (Peppard et al., 2000). Over the last two decades, numerous researchers have forwarded frameworks for IS innovation from a socio-technical perspective (Avgerou, 2003; Baxter & Sommerville, 2011; Gregor & Hevner, 2015; Lee et al., 2008; Lin et al., 2016; Luna-Reyes et al., 2005; Palvia et al., 2001; Winter et al., 2014). However, the adoption of such frameworks in HIT research has been limited.

The healthcare sector is considered to have a unique, complex, dynamic context as stated previously, which differs significantly from that of other industries where IS innovations have been applied (Andargoli et al., 2017; Savory & Fortune, 2015; Westbrook et al., 2004). Therefore, taking a contextual sensitive approach towards HIT research is critical (Chiasson & Davidson, 2004). Unfortunately, the study of organizational dimensions involved in HIT innovation implementation success is not a clearly defined area of interest (Cresswell & Sheikh, 2013; Cresswell et al., 2020). The reasons for HIT adoption and implementation failures in healthcare organizations are primarily organizational rather than technical (Kaplan & Harris-Salamone, 2009). This statement is consistent with the findings in research literature of a body of scholars involved in HIT research who have cited the need to incorporate perspectives other than the technology itself when studying the implementation of HIT innovations. Some researchers have also utilized Roger's diffusion of innovation (DOI) model to explain innovation diffusion within healthcare organizations and within a HIT implementation success context (Ash 1997; Barrett & Stephens, 2017; Cain & Mittman, 2002; Dolezel & Mcleod, 2019; Emani et al., 2012; Emani et al., 2018; Gagnon et al, 2014; Gosling et al., 2003; Greenhalgh et al., 2004; Lin et al., 2016; Neumeier, 2013; Putzer & Park, 2012). However, its focus is on the adoption of the diffused innovations by individuals within organizations and (Lundblad, 2003) where less attention is paid to different structural and social processes within the whole system that make up the innovation's journey (Cranfield et al., 2015).

With regards to the implementations of HIT innovations such as EMR, there is no one particular over-arching conceptual framework available from academic literature (Creswell & Sheikh, 2013;

Cresswell et al., 2020). Identifying this as a systemic gap, some healthcare scholars have attempted to identify frameworks applicable in a HIT context (Chaudoir et al., 2013; Cresswell et al., 2020; Sittig & Singh, 2015). Few studies have examined the association between organizational innovation and HIT implementation (Basole & Rouse, 2009; Leidner et al., 2010; Acar & Acar, 2012). Scholars have reviewed the impact of broader organizational and social factors on EMR implementation success (Chan et al., 2016; Cresswell et al., 2013; Kilsdonk et al., 2017; Sittig & Singh, 2015; Tutty et al., 2019). Others have studied the impact of corporate culture and managerial absorptive capacity on HIT implementations (do Carmo Caccia-Bava et al., 2006). However, there are no research studies that have specifically investigated the association between organizational innovation capability and EMR implementation success, particularly by way of examining the application of STS and tri-core model on EMR innovation implementations in the healthcare domain. In the next section, we examine and discuss the applicability of the aforementioned theories in the context of this research study.

The Socio-Technical Systems Theory

The socio-technical systems (STS) theory, originally developed at the Tavistock Institute of Human Relations in London, has been widely adopted as a framework for studying successful organizational change driven by technology adoption and incorporation of technological advancement within organizations (Applebaum, 1997, Damanpour et al., 1989). The theory posits that an organization is a combination of its social and technical parts and is open to its environment (Trist et al., 1963). For balance to be maintained between the two systems, changes introduced in the two systems should be congruous. While a one-to-one correspondence between administrative and technical innovations is not advocated or expected, a balance in the rate of adoption of the two innovation types is necessary to ensure equilibrium between the social structure and the technical system for effective operation of the entire organization (Trist, 1981). In other words, organizational innovation is a necessary precondition for technological innovation to be fully implemented and exploited (Azar & Ciabuschi, 2017; Damanpour, et al., 1989; Lam, 2005). Organizational innovations lead to enhanced intra-organizational coordination and cooperation, which, in turn create the appropriate environment for adoption and utilization of technological innovations (Damanpour & Evan, 1984).

Past research studies have utilized the STS theory to understand the relationship between organizational innovation and technology innovation implementation (Azar & Ciabuschi, 2017; Damanpour & Evan, 1984; Hamel, 2006; Baxter & Hester, 2014; Kwahk and Ahn, 2010; Liu et al., 2006; Sackey et al., 2015; Westbrook et al., 2007).

Tri-Core Model of IS Innovation

Swanson (1994) proposed the tri-core model to address certain aspects of IS innovations such as: how IS innovations differ from other organizational innovations, are there different forms of IS innovations, and how IS innovations diffuse among organizations and with what consequences. To answer these questions, Swanson (1994) identified a typology of IS innovations realizing that IS innovations may involve a new IS product of service, a new IS work technology, or a new IS administrative arrangement. Type I innovations focus on IS administration, and can incorporate IS administrative tasks or technical IS tasks. Type II innovations apply IS products and services to the administrative core of the organization's business, with important ramifications to the internal IS work processes. Type III innovations integrate IS products and services with core business technology and typically impacts general business administration. These types of innovations are typically strategic and offer competitive advantage through product or service differentiation. Interaction among the innovation types is posited leading to diffusion and adoption in an organizational context. Scholars have utilized the tri-core model to better understand the role IS innovations play in administrative, technical, and operational effectiveness (Costello & Donnellan, 2007; Grover et al., 1997; Lee & Fiedler, 2011; Lyytinen & Rose, 2003; Liu et al., 2014).

Figure 1. Theoretical context of research model

In the context of the tri-core framework, Swanson (1994) emphasized that IS innovations may involve a new IS product or service, a new IS work technology, or a new IS administrative arrangement. EMRs encompass Type I innovations such as the core EMR technology, including the supporting database storage technology and supporting hardware infrastructure (Azaria et al., 2016). From a Type II innovation perspective, use of EMR has been associated with healthcare workflow related efficiency gains (Vishwanath et al., 2010). When implemented successfully, EMRs have been reported to enhance competitive advantage for healthcare providers by enabling complementary products or services thereby supporting Type III innovations (Porter, 2009). Therefore, it can be stated that the tri-core model aptly provides an IS innovation lens to examine the success and failure of HIT implementations (e.g., EMR) in an organizational context. Figure 1 depicts the overall theoretical context for this study.

HYPOTHESES

Innovation scholars have cited that product and process innovation within an organization influence the innovation capability of the organization, which in-turn influences the innovation performance of the organization (Damanpour, 1991; Hurley & Hult, 1998; Mir et al., 2016; Therin, 2003). Organizational innovation is a necessary precondition for technological innovation to be fully implemented and exploited (Azar & Ciabuschi, 2017; Damanpour, et al., 1989; Lam, 2005). Such reasoning is consistent with the essence of the STS theory. Moreover, scholars have also viewed EMR as both a process innovation (Carayon et al., 2015; Laird-Maddox et al., 2014; Lorenzi et al., 2004), and a product innovation (Bloomfield et al., 2017; Guo et al., 2017; Katzan et al., 2011). To holistically assess implementation success, we argue that a comprehensive view that assimilates both the organizational process and product aspects of HIT innovation is required. This can help answer the following important research questions: why do some technologically sound HIT innovations fail, can the innovation capability of a healthcare organization play a role in successful HIT implementations, what is the value attained from the time and monetary investments of healthcare organizations in

Figure 2. Research model

improving their organizational innovation capability. Finding the answers to these questions will help in better understanding the role played by organizational innovation capability in the implementation success of HIT innovations such as EMR.

The United Nations Educational, Scientific and Cultural Organization (UNESCO) (2005) defines product innovation as the introduction of a good or service, that is new or significantly improved with respect to its characteristics or intended uses. Such significant improvements include improvements in technical specifications, components and materials, incorporated software, and friendliness or other functional characteristics. Process innovation is defined as the implementation of a new or significantly improved production or delivery method. This includes significant improvements in techniques, equipment and/or software. Though the customer does not usually pay directly for the process, the process is required in order to deliver a product or service that offers value and satisfaction to the customer. The process should also enable the management of the relationship with the various stakeholders (UNESCO, 2005).

Therefore, we posit that an organization with a high level of product and process innovation based on high innovation capability and past product implementation successes would have the experience and know-how to successfully implement a technology innovation such as an EMR system. Based on the above discussion, the following hypotheses are presented and depicted in figure 2.

Hypothesis 1 (H1): The level of process innovation existing in the organization will positively correlate with EMR implementation success.

Hypothesis 2 (H2): The level of product innovation existing in the organization will positively correlate with EMR implementation success.

Implementation Success

Delone and Mclean (1992) suggested that when the use of a specific system/technology is geared towards a specific purpose, user satisfaction may be an appropriate measure of success. User satisfaction has the advantage of having a high degree of face validity since it is hard to deny the success of a system which its users say they like (Delone & Mclean, 1992). EMR implementation is concerned with medical records in electronic format, and hence involves a specific and unique system/technology. In the United States, with few exceptions, EMR implementation and use is required as opposed to being voluntary or non-mandatory. Keeping this in mind, user satisfaction has been adopted as one of the constructs in this study to measure the dependent variable EMR implementation success.

Implementing a new technology innovation such as EMR involves considerable expense of time and money, and so it is conceivable that organizations implementing EMR will want to assess the success of the implementation in terms of the value offered by the EMR system through its functionality, versus the cost to implement. Other IS implementations such as enterprise resource planning (ERP) implementations have regarded system functionality as one of the main factors for implementation success (Hong & Kim, 2002; Laughlin, 1999; Rolland & Prakash, 2001). EMR and ERP systems have a lot in common, such as both being relatively new technologies in their respective application areas, both having generic software modules that need to be customized in order to successfully implement the system to satisfy end users, and both being cost and labor intensive IS technologies. System functionality has therefore been utilized as an implementation success measure.

METHOD

Sample

It should be noted that EMR implementations in the United States typically include modules which assist in an array of healthcare functions. While this is not an exhaustive list, some functionality provided by EMRs include: i) managing emergency room visits, ii) performing ambulatory functions such as documenting visits, placing orders, sending communications to patients, iii) an in-patient version of the same that includes support for clinical notes, orders, medication administration, patient monitoring, discharge orders, iv) features that support providing specialized long-term care for ailments such as oncology treatments, v) laboratory system integration, vi) enabling patient access of EMR data through patient-portals, vii) supporting multiple technical activities such as data warehousing, data reporting and analytics, data integration bridges, viii) aiding in healthcare provider's revenue cycle activities, and ix) tools and utilities for managing the system utilized by analysts, project managers, resource managers and healthcare executives ("About Cerner", 2020; "Epic Software & Services", 2020; Newman, 2018). EMR systems in the United States are used by a wide variety of health professionals and healthcare industry employees including physicians, nurses, hospital administrators, project managers, and information technology professionals in the healthcare field, and therefore there cannot be a better set of respondents for a study such as this than these very professionals who use EMR day-in and day-out. In consideration of this, the respondent profile for this study consisted of health professionals (including physicians, nurses, hospital administrators, project managers), information technology professionals (IT consultants, project managers), and managers in the United States healthcare industry involved with the implementation, maintenance, and/or use of EMR for a minimum period of one year during the five years prior to taking the survey. Data was collected by distributing paper copies of the questionnaire, handing out postcards with the survey link at the leading healthcare conference of the Healthcare Information and Management Systems Society (HIMSS) conference, and posting the web link to the survey in the newsletter of HIMSS and in the intranet of healthcare organizations such as the Illinois Hospital Association.

Measures

The survey comprised of a demographic section followed by validated instruments adapted to measure organizational product and process innovation and EMR implementation success. The authors adapted a scale previously validated by Ju et al. (2006), to measure organizational product and process innovation. EMR implementation success was comprised of two constructs – user satisfaction (Seddon and Yip, 1992), and system functionality success (Do Carmo-Caccia-Bava et al., 2006). For each item a seven-point Likert scale was used, ranging from "strongly disagree" to "strongly agree". A list of all the constructs and measurement items is provided in Table IV.

Table 1. Respondent organization type

Organization Type	Distribution of Respondents
Single Hospital/Multi-Hospital System/Integrated Delivery System	83.5%
Public Health organization	42.1%
Community Health Center	30.0%
Long-term Care Facility	21.9%
Ambulatory Clinic (Hospital Owner)	15.2%
Government Institution (Federal/State/Local Government)	14.6%
Ancillary Clinical Services Provider	12.1%
Payer/Insurer Managed Care Organization	9.6%
Academic Medical Center (affiliated with a college or university)	6.3%
Physician's Office	4.4%
Ambulatory Clinic (independent)	1.3%
Other (please specify)	0.8%

Data Analysis Strategy

Structural Equation Modeling (SEM) was used for the data analysis due to the presence of latent variables in the research model (Hoyle, 1995). Reliability of a measurement instrument is the extent to which it yields consistent results when the characteristic being measured hasn't changed (Leedy & Ormrod, 2015). The most often used measure for internal consistency reliability is Cronbach's Alpha, with Cronbach's Alpha values higher than 0.70 speaking to good instrument reliability (Streiner, 2003; Nunnally, 1967; Cronbach, 1951). Multicollinearity was tested using the variance inflations (VIF). VIF value exceeding 10 suggests severe multicollinearity (Freund et al., 2006; Hair et al., 1995; Kutner et al., 2005; Mason et al., 1989). VIF thresholds of 5 are common in research literature (De Jongh et al., 2015). In addition to this, the tolerance estimates for each variable must be greater than 0.20 to verify the absence of multicollinearity (Darlington, 1990).

RESULTS

Descriptive Statistics

A total of 476 usable survey responses were obtained. Approximately 63% of respondents had between one and three years of experience with EMR implementation, use, or maintenance, and about 37% had between three and five years. With respect to the organization type in which the respondent EMR experience took place, about 84% of respondents stated that their EMR experience was in a single hospital/multi-hospital system/integrated delivery system. Multiple responses were allowed for this question due to the possibility that the respondents' organizations fell into more than one category. Table 1 summarizes respondent's organization type.

With regards to the primary occupational area of the respondents, the distribution of responses is shown in Table 2. A large proportion of respondents (43%) had technical (IT/IS consultant, programmer, systems developer) as their primary occupational area. The distribution of the professional societies that the respondents' belonged to is shown in Table 3. Multiple responses were allowed for this question since it is conceivable that the respondents belonged to more than one professional society. From the responses, the highest percentage of respondents (92%) belonged to the Health Information and

Table 2. Primary occupational area

Occupational Area	Distribution of Respondents
Technical (examples: IT/IS consultant, programmer, systems developer)	42.9%
Health Professional (examples: doctor, nurse, physician's assistant, pharmacist, physical therapist)	31.3%
Project Management (examples: project manager, project assistant)	16.0%
Business (examples: business manager, operations manager)	9.2%
Other (please specify)	0.6%
Social (examples: social worker, volunteer)	0%

Management Systems Society (HIMSS), followed by the American Health Information Management Association (AHIMA) (45%) and the Project Management Institute (PMI) (24%).

While 26% of the organizations the respondents belonged to had 3,001 to 6,000 full time direct employees, 21% of the organizations had 1,001 to 3,000 full time direct employees. 9% of the organizations had as high as 6001 to 10,000 direct employees, while 9% of the organizations had as low as 101 to 500 direct employees. A majority of the respondents were associated with relatively larger organizations such as hospitals (84%), public health organizations (42%), and community health centers (30%) rather than with relatively smaller organizations such as privately owned physician's offices (4%) and ancillary clinical services providers (12%).

With respect to annual revenue, about 27% of the organizations had a total annual revenue of greater than \$3 Million but less than \$5 Million, and 21% of the organizations had greater than \$5 Million but less than \$10 Million. Approximately 17% of the organizations had a total annual revenue between \$1 Million and \$3 Million, and between \$0.5 and \$1 Million. Only 3% of the organizations had a total annual revenue exceeding \$1 Billion, while 5% of the organizations had a total annual revenue of \$0.5 Million or less. Assuming that annual revenues exceeding \$3 Million could be considered to be substantial, 56% of the organizations the respondents were affiliated with had substantial annual revenues.

Table 4 shows the items, reliability, and the variance extracted. The criterion of Fornell and Larcker (1981) has been commonly used to assess the degree of shared variance between the latent variables of the model. According to this criterion, the convergent validity of the measurement model can be assessed by the average variance extracted (AVE). AVE measures the level of variance captured by a construct versus the level due to measurement error, with values that are 0.7 and above being considered very good and a value of 0.5 being considered to be acceptable. The Cronbach's Alpha and AVE values for all constructs in this study was greater than 0.7 as shown in Table 4. For the data

Table 3. Membership in professional societies

Professional Society	Distribution of Respondents
Health Information and Management Systems Society (HIMSS)	92.3%
American Health Information Management Association (AHIMA)	45.0%
Project Management Institute (PMI)	23.9%
American Society for Quality (ASQ)	12.5%
Other (please specify)	4.0%
American Medical Association (AMA)	1.3%

Table 4. Items, reliability, and variance extracted

Construct and Items	Loadings
Product Innovation (adapted from Ju <i>et al.</i> , 2006) Cronbach's Alpha = .930; AVE = .84	
The degree of product innovation in the organization is high.	0.948
The degree of product innovation relative to the competitors is high.	0.871
The potential applications of the product innovation in the organization are high.	0.907
Process Innovation (adapted from Ju <i>et al.</i> , 2006) Cronbach's Alpha = .940; AVE = .77	
The degree of process innovation in the organization is high.	0.835
The degree of process innovation relative to the competitors is high.	0.515
The potential applications of the process innovation in the organization are high.	1.00
EMR Implementation Success – System Functionality Success (adapted from Do Carmo-Caccia-Bava <i>et al.</i> , 2006) Cronbach's Alpha = .720; AVE = .70	
EMR provides or will provide good payback for cost.	0.758
EMR is reliable and problem free.	0.755
EMR facilitates an improved turnaround or response time.	0.765
EMR creates a competitive advantage.	0.750
EMR increases employee satisfaction overall.	0.767
EMR reduces effort or costs.	0.790
EMR Implementation Success – User Satisfaction (adapted from Seddon and Yip, 1992) Cronbach's Alpha = .890; AVE = .70	
How adequately do you feel the EMR system meets information processing needs?	0.855
How efficient do you feel EMR is?	0.863
How effective do you feel EMR is?	0.883
<i>Construct and Items</i>	<i>Loadings</i>
Overall, how satisfied are you with EMR?	0.911

set under consideration, VIF values obtained were under 5 and the tolerance ratio was greater than 0.20, thereby demonstrating the lack of multicollinearity.

Hypotheses Testing

A series of confirmatory factor analyses (CFA) were performed using the Lavaan package in R before testing the model for structural relations. Due to non-normality of the indicators, the Huber-White robust estimator (Huber, 1967; White, 1982) was used to estimate model parameters and standard errors. First, a one-factor model was fit with all indicators loading on a single general factor. This model fit very poorly, TLI = .78, CFI = .81, RMSEA = .17. This showed that the simplest structure (i.e., a model with just one factor) was not tenable. Next, a two-factor measurement model was fit by combining the product innovation and process innovation into a single “innovation” factor, and the user satisfaction and system functionality items into a single “implementation success” factor. While improving on fit compared to the one-factor model, the two-factor model still did not fit adequately, TLI = .87, CFI = .89, RMSEA = .13. The next model split the innovation factor into its two constituent parts—namely, product innovation and process innovation—and fit the resulting three-factor model. This model significantly improved upon the two-factor model, while also fitting quite well, TLI = .96, CFI = .97, RMSEA = .07. Finally, the three-factor model was compared to the four-factor model. By

Figure 3. Structural Model

Table 5. Hypotheses results

Hypotheses	Result
H1: The level of process innovation existing in the organization will positively correlate with EMR implementation success.	Supported
H2: The level of product innovation existing in the organization will positively correlate with EMR implementation success	Supported

further looking at information criteria, the three-factor model was preferred with AIC and BIC both lower for the three-factor model (three-factor: AIC = 14364.51, BIC = 14509.93; four-factor: AIC = 14365.54, BIC = 14523.42). Here, we found that the four-factor model did not fit significantly better than the three-factor model. Subsequent analyses used the three-factor measurement. The loadings of the questions (items) on their respective constructs were between 0.74 and 0.92 with most being > 0.8, indicating strong relationships (all were statistically significant $p < 0.01$).

An SEM model was fit regressing implementation success onto product innovation and process innovation utilizing the three-factor model. It was found that the model fit well, TLI = .96, CFI = .97, RMSEA = .07, $\chi^2(101) = 274.80, p < .001$. Figure 3 shows the structural model. Results showed that process innovation ($\beta_{Proc} = 0.75, p < 0.001$) and product innovation ($\beta_{Prod} = 0.12, p = 0.02$) both significantly predicted implementation success. All factor loadings shown as standardized parameter estimates Figure 3 were significant. Results regarding support of hypotheses is summarized in Table 5.

DISCUSSION

This section discusses the findings along with implications for both, the healthcare practitioner and researcher. From the practitioner's standpoint, this study has surfaced a vital finding. It is a widely accepted fact that unlike in other industries, successful implementation and adoption of IS systems in the healthcare industry requires acceptance from one major stakeholder group, namely the physicians. As physicians are the significant user-group supporting patient care, their intention to adopt EMR determines the overall success of its implementation (Dutta & Hwang, 2020; Gewald & Gewald, 2020). Previous studies have revealed that physicians would not be interested in using a system that interferes with their workflow and modifies the way in which they care for their patients (Dutta & Hwang, 2020). Physician's resistance to EMR systems has often been linked to factors such as reduced productivity, (perception of a) lack of usefulness, (inability of the EMR to easily accommodate) workflow changes, lack of interoperability, increased stress (resulting from EMR use), and lack of training and support acting as barriers (Hamamura et al., 2017; Jawhari et al., 2016b; Kruse et al., 2015; Or et al., 2018; Raglan et al., 2014; Reardon, 2009; Wager, 2008; Wallace et al., 2010). Per research literature, these are the very challenges that innovation-savvy organizations have overcome in order to successfully adopt other innovations (Dougherty & Hardy, 1996; Hackler et al., 2007; Waarts et al., 2002). Mature organizations are known to: i) make resources available for newer products/processes, ii) provide collaborative structures and processes to solve problems creatively and connect innovations with existing businesses and, iii) incorporate innovation as a meaningful component of the organization's strategy (Dougherty & Hardy, 1996). Therefore, healthcare industry leaders would be well-advised to follow these best-practices. Planning and budgeting to foster an environment conducive to organizational product and process innovation will pay itself forward by establishing collaborative structures and paving the way for HIT/EMR (and other innovation) implementation success.

According to Applebaum (1997), adopting an STS perspective can assist organizational executives with developing intervention strategies from the environment, structure, leadership procedures, people, and technology standpoints. Westbrook et al. (2007) stated that the introduction of HIT is prone to be at best indefinite and contradictory, and at worst, impossible to resolve satisfactorily making it a *wicked* problem to solve. The findings of this study should provide a direct and straightforward message to the managers and executives of healthcare organizations to focus on improving on the ability of their organizations to continuously innovate, both, in terms of product innovations and in terms of process innovations. To this end, they should plan and budget with a view to procuring the human resources and other resources which would allow their organizations to continuously innovate and build their innovation capability. This investment will, no doubt, pay itself forward in a multi-fold manner while proving time and again the complementary and symbiotic nature of these forces.

The results of the statistical analyses also provide valuable insights for researchers. This study has empirically validated that the product and process innovation capability of healthcare organizations is a significant antecedent to EMR implementation success. This is one of the first studies in HIT research literature to establish such a direct association. This association is of value because HIT scholars have emphasized that while technological functionalities are crucial in getting an initiative off the ground, system design needs to consider the accompanying social and organizational transformations which are invariably required to ensure that technologies deliver the desired value for a variety of stakeholders (Cresswell et al., 2020). Simply automating current paper-based manual processes by implementing EMRs would be an exercise in futility (Porter, 2009). This study extends the research finding from other domains that organizational innovation is a necessary precondition for technological innovation to be fully implemented and exploited to the healthcare domain, and thereby provides guidance to the industry practitioner with respect to creating an appropriate environment for successful implementation and adoption of technological innovations (Azar and Ciabuschi, 2017; Damanpour & Evan, 1984; Damanpour et al., 1989).

Disruptive technological innovations in healthcare offer a unique opportunity to understand and evaluate the changing inter-relationships between technology and human/organizational factors (Cresswell et al., 2012). Challenges to successful EMR implementations include the lack of robust organizational processes and structure, which acts as a significant barrier (Adler-Milstein, 2017; Cresswell et al., 2020; Lorenzi et al., 2008). According to Cresswell and Sheikh (2013), it is important to pay attention to the reciprocal relationships of technical, social, and organizational aspects at different stages of HIT implementation. Research literature states that the exact nature of the relationship among these dimensions is less clear, thereby highlighting the paucity of adequate research in this area. We believe that this study has contributed to research literature by identifying an important finding pertaining to inter-relationships between technology and human/organizational factors, by way of empirically identifying organizational innovation capability as a significant predictor for EMR implementation success.

A growing body of healthcare literature has identified the need to examine HIT implementations from a socio-technical perspective (Ash et al., 2012; Castro et al., 2016; Craig & Kodate, 2018; Cresswell et al., 2012; Cresswell et al., 2020; Cresswell & Sheikh, 2014; Hameed et al., 2012; Hsiao et al., 2011; Larisch et al., 2016; Sittig & Singh, 2015; Singh & Sittig, 2020). The nature of the healthcare field necessitates the study of processes associated with introduction of a new technology in social and organizational settings especially because a number of technological functionalities are often incorporated across varied implementation contexts (Cresswell et al., 2012). For example, Westbrook et al. (2007) characterized the delivery of safe and sustainable HIT systems for the future as a *wicked problem* due to its ill-defined and ambiguous nature which is associated with strong moral, political and professional issues. This study leveraged two socio-technical theories (STS and tri-core model) as a foundation to explore the impact of (healthcare) organizational process and product innovation capability on EMR implementation success. It has therefore examined HIT (EMR) implementations from a socio-technical perspective, and thereby made a contribution to research literature.

LIMITATIONS

As with any research study, this study too has some limitations. The first limitation relates to the data collection. The survey respondents (who met the required respondent profile) were drawn from those with memberships in professional associations such as the Healthcare Information and Management Systems Society (HIMSS), the American Healthcare Information Management Association (AHIMA), and the American Society for Quality (ASQ). The demographic profile of the respondents shows that a majority of the respondents were affiliated with single hospital/multi-hospital integrated delivery systems. Such organizations are likely to be relatively bigger in size with substantial annual revenues and a large employee headcount. There is the possibility that data collected from a different demographic may have yielded different results.

Secondly, this study was conducted in the United States and therefore it is reasonable to assume that the respondents were residents of the United States. If this study were to be conducted in other countries/cultures with the respondents being residents of those countries/cultures, it is possible that the findings may have turned out to be different as it is likely that different countries and their people will have different attitudes towards and different perceptions regarding organizational innovation and HIT/EMR implementations. A third limitation of this study is that the survey design and data collection focused on EMR implementations only. EMR is, but one kind of HIT innovation. There are several other HIT innovations such as Mobile Health, (mHealth), Telemedicine, and Electronic Health (E-Health) which are not the focus of this study.

Research literature discusses multiple dimensions of organizational innovation including innovation leadership, organizational innovative culture, organizational learning, and knowledge management (Crossan & Apaydin, 2010; Liao & Wu, 2010; Yazhou & Jian, 2013). Prior research studies have discussed the impact of one or more dimensions in particular IS contexts (Fay et al.,

2015; Roberts et al., 2016; Soto-Acosta et al., 2016). These dimensions were not incorporated in the current study considering the specific focus of this study. Further, adding many additional dimensions would have resulted in a substantial increase of the length of the questionnaire which would likely have increased the response burden and consequently reduced the response rate. Response burden is known to result in lower response rates, reduced completion, and reduced data quality (Diehr et al., 2005; Rolstad et al., 2011; Snyder et al., 2007). Future studies in this domain could consider incorporating the dimensions which were not considered by this study.

CONCLUSION

Successful HIT implementations could have multiple benefits for the healthcare industry including improved healthcare quality at a relatively lower cost, and efficiency and effectiveness in healthcare delivery. However, adoption of innovations in the healthcare industry has been much slower than in other industries. The inherent complexities involved in HIT innovation implementations have been cited as a major barrier to their successful implementation and adoption. Researchers have argued that the healthcare system is unique owing to its complexity and the involvement of people at all levels ranging from healthcare professionals to patients, and hence it is appropriate to study HIT implementations from a socio-technical perspective. All of the above, and additional aspects discussed in this article influenced the problem statement and hypotheses development this study.

This research study focused on uncovering the statistical association between organizational innovation capability based on past innovation implementation successes, and the ability of the organization to successfully implement HIT innovations such as EMR. Successful EMR implementations are expected to contribute to making healthcare operations efficient and effective leading to cost reduction and healthcare quality improvement, which is particularly important in the United States due to the ever-increasing cost of healthcare in the country, and also because there is an increasing focus on evidence-based medicine and on improving healthcare quality. As discussed in the article, this research study has important implications for both, academic researchers and practitioners. Future avenues of research can attempt to address limitations of this investigation.

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