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ABSTRACT

The increasing use of e-Health applications in clinical practices is pushing the limits of Health Information Technology. e-Health applications are often considered as integrated healthcare applications that are purposely developed to not only support electronic health information exchange but also to improve the quality and safety of healthcare delivery. However, even as these applications continue to evolve and remain widespread in use in many clinicians' offices, the applicability of proper Information Technology (IT) governance structure for their utilization remains a big challenge in the healthcare industry. In this paper, a literature review is used to explore the applicability of IT governance in e-Health applications. The practical and research implications for establishing IT governance structure in e-Health applications are also discussed.

Keywords

IT Governance, e-Health, healthcare applications, strategic alignment.

INTRODUCTION

The concept of Information Technology (IT) Governance has been defined by many researchers to encompass the governing of IT strategic alignment by the management team of a given organization. Peterson (2004) defined IT governance as the "distribution of IT decision-making rights and responsibilities among different stakeholders in the enterprise, and defines the procedures and mechanisms for making and monitoring strategic IT decisions" (p. 7). This definition posit IT governance in the context that is of decision-making process which involves different stakeholders in the IT industry. IT governance structure ensures that strategic alignment between IT and business is achieved in a managed environment.

To ascertain a concrete definition, Webb, Pollard, and Ridley (2006) defined IT governance as the "strategic alignment of IT with the business such that maximum business value is achieved through the development and maintenance of effective IT control and accountability, performance management and risk management" (p. 7). Through the use of content analysis, Webb et al. (2006) identified five elements to be essential in IT governance: strategic alignment; delivery of business value through IT; performance management; risk management; and control and accountability. These five elements are critical when it comes to the adoption and use of e-Health applications such as the Electronic Health Record (EHR) and Personal Health Record (PHR) (Reti, Feldman, & Safran, 2009).

Hence, establishing appropriate IT governance for e-Health applications is essential not only in managing the strategic alignment and performance of e-Health systems but also in minimizing the security risks and vulnerabilities associated with the use of e-Health applications in the healthcare domain (Adler-Milstein & Bates, 2010; Kahn, Aulakh, & Bosworth, 2009; Luftman & Kempaiah, 2007; Reti et al., 2009; Vitacca, Mazzù, & Scalvini, 2009; Webb et al., 2006). This paper aims to explore the applicability of IT governance in e-Health applications. The first part of the paper gives an overview of e-Health applications. In the second part, the focus is on the applicability of the key elements of IT governance in e-Health applications. The third part discuses the practical and research implications for establishing IT governance structure in e-Health applications.

METHODOLOGY

A literature review, based on research articles from 2000 to 2010, was used to explore the applicability of IT governance in e-Health applications. The methodology involves a systematic review of relevant publications, found and accessed with the help of ProQuest (with multiple databases option) and EBSCOhost databases. Additional sources were retrieved using the ScienceDirect, PubMed and ACM digital libraries. The targeted search terms consisted of the combination of keywords and/or phrases including: (a) e-health, (b) IT governance, (c) e-health applications, (d) strategic alignment, (e) risk management, (f) performance management, and (g) data control AND accountability. Studies were included in the analysis if they reported on e-Health applications and IT governance.

OVERVIEW OF E-HEALTH APPLICATIONS

e-Health technologies have the potential not only in empowering and enlightening patients about their health status but also in promoting improved self-management skills of the population at large (Cashen, Dykes, & Gerber, 2004). In many healthcare organizations, e-Health applications are often considered as integrated healthcare applications that are purposely developed to support healthcare delivery (Vitacca et al., 2009). According to Vitacca et al. (2009), e-health applications refer to electronic tools that facilitate the interaction between patients and physicians for health related purposes. e-Health applications consist of technologies such as Electronic Health Record (EHR), Electronic Medical Record (EMR), Personal Health Record (PHR), Telemedicine, Laboratory Information System (LIS), Radiology Information System (RIS), and Clinical Decision Support Systems (CDSS).

e-Health applications are regarded as the most appropriate technologies to improve the quality and safety of healthcare delivery with the use of up-to-date healthcare information and communication technology to meet the need of citizens, patients, healthcare professionals, and healthcare providers (Adler-Milstein & Bates, 2010; Vitacca et al., 2009). e-Health applications have emerged as integrated healthcare information systems that provide consistency of data and are necessary to serve patient-centered care, where healthcare information exists with many healthcare providers (Watkins et al., 2009). Moreover, there is growing evidence that e-Health applications are increasingly gaining popularity in the healthcare domain because of their capability to support legacy systems to operate seamlessly in an integrated healthcare environment (Cavanaugh, Garland, & Hayes, 2000). Accelerating the adoption of e-Health applications will provide "caregivers with all relevant information about every patient; encourage the sharing of medical knowledge through computer-assisted clinical decision support; facilitate computerized order entry among providers for tests, medicine, and procedures; and ensure secure, private, interoperable exchange of health information" (Agrawal, Grandison, Johnson, & Kiernan, 2007, p. 36).

APPLICABILITY OF IT GOVERNANCE

According to Ingram et al. (2006), healthcare information infrastructure consists of a coherent and comprehensive set of information systems and services that are essential and sufficient to support the goals of healthcare services and their IT governance. Management of IT governance is therefore essential in ensuring successful implementation of healthcare IT systems and services. Luftman and Kempaiah (2007) also noted that IT governance has emerged as a strategy to identify and prioritize projects, resources and risks. The following sections describe how the five elements of IT governance, proposed by Webb et al. (2006), can be applied effectively to e-Health applications.

Strategic Alignment

Current perspective on strategic IT-business alignment in the healthcare industry is very confusing and has missed reactions. There seems to be no critically defined IT-business alignment strategy in use in many healthcare organizations (Zacharia, Preston, Autry, & Lamb, 2009). Findings from the study conducted by Zacharia et al. (2009) indicated that healthcare organizations have the potential to achieve superior performance through the strategic alignment of business and IT. Correctly and successfully aligning business with IT is a critical decision for many healthcare organizations (Zacharia et al., 2009). Glaser (2009) also highlighted the importance of strategic IT-business alignment in the healthcare industry. These two studies reinforce the need for strategic alignment between business and IT in the healthcare industry.

According to Peterson (2004), IT governance serves as an "enterprise management system through which an organization's portfolio of IT systems is directed and controlled" (p. 8). IT governance, therefore, provides a toolkit for business executives and IT leaders to identify and prioritize projects, resources and risks associated with IT investment (Luftman & Kempaiah, 2007). Strategically aligning business goals and objectives with IT will enable IT leaders to manage projects and resources effectively without being intrusive to subordinates. For example, the ability of an IT leader to distribute IT decision-making rights and responsibilities to different divisions or work groups within an organization will be seen as way of not only establishing role clarity among team members but also embracing all subordinates in the decision-making process of the organization.

Recognizing the fact that achieving alignment between IT and business is not an easy endeavour, Luftman and Kempaiah (2007) proposed six measurable constructs for assessing IT-business alignment maturity. Luftman and Kempaiah (2007) posited that alignment capabilities can be gauged by measuring communications, value, governance, partnership, scope and architecture, and skills. Applying the maturity model to e-Health applications will enable healthcare providers to assess the strategic alignments of business values with the IT solutions provided by the e-Health technology. This will enable the leadership team to evaluate the effectiveness and efficiency of the tool in meeting the needs of healthcare delivery.

Delivery of Business Value through IT

According to Lutchen and Collins (2005), the institution of an appropriate and well-managed IT governance structure that promotes investment in IT in the healthcare delivery process has the potential to revolutionize the healthcare system in supporting patient safety, quality of care, medical records keeping, and billing and reimbursement processes. Aligning these business values with IT is very crucial in the healthcare IT community. Glaser (2009) emphasized the importance of the business value by asserting that investing in critical infrastructure and maintaining efficient and effective IT governance is necessary to maximize business values in e-Health applications.

Many healthcare organizations are now seeking ways to deliver these business values through the use of interoperable data standards that are developed for the purposes of enhancing the business values of e-Health applications. Interoperable data standards are needed to explicitly specify how data is represented, captured and conveyed in the healthcare domain (Halley, Sensmeier, & Brokel, 2009; Hammond, Bailey, Boucher, Spohr, & Whitaker, 2010; Watkins et al., 2009). The *Interoperability* business value of e-Health applications aims to resolve connectivity issues surrounding legacy systems. Interoperability is defined as the "ability to communicate and exchange data accurately among different IT systems, software applications, and networks" (Hammond et al., 2010, p. 284). This definition calls for the development of network-based applications that has ability to seamlessly exchange clinical information in integrated healthcare information systems.

The idea of achieving interoperability in e-Health applications resonate very well with many healthcare providers and has accounted for the increasing use of EHR, EMR, and PHR in the healthcare settings. Halley et al. (2009) emphasized the importance of the business values of interoperability in healthcare delivery by asserting that it is through the "interoperable exchange of health information that expected decreases in costs will be realized, such as eliminating duplicate tests, improving administrative efficiencies, increasing access to patient clinical results, and providing information to decrease repetitive input" (p. 310).

Performance Management

Performance management offers a mechanism for (a) aligning work and development efforts; and (b) providing feedback so people and information systems can continuously improve performance (Williams, 2001). Performance management of e-Health applications is crucial in ensuring that information systems in use are working with ultimate performance. Systems with low performance will not be of great asset to the healthcare industry. According to Nankervis and Compton (2006), the "success or failure in performance management depends on organisational philosophies, and the attitudes and skills of those responsible for its implementation and administration" (p. 84). Recognizing healthcare information systems as marketplaces where information is traded, Maynard and Bloor (2003) noted that the market for healthcare is characterized by exchange of information and uncertainty, and thus the need for external performance management cannot be ignored.

Healthcare information systems are faced with strong pressures to improve clinical quality, enhance service, expand access, minimize errors, and reduce costs (Curtright, Stolp-Smith, & Edell, 2000). According to Curtright et al. (2000), competitive pressures in the marketplace require healthcare information systems to measure, monitor, and report system performance to maintain and expand a market base. Hence, those healthcare information systems capable of articulate, demonstrating, and providing the value of health services enjoy a competitive advantage (Curtright et al., 2000).

Technology use in the healthcare domain is seen as an enabler. Healthcare information systems are supposed to improve the performance of providers and not hinder the workflow of clinicians. Wilkin and Riddett (2009) asserted that the mismatch between performance expectations and reality can be achieved by aligning IT projects with defined organizational strategies. Addressing this mismatch in the healthcare industry has been the goal of many healthcare providers in ensuring that the use of e-Health applications does not constrain the workflow of physicians in the healthcare settings. One way of managing performance in e-Health applications is the establishment of performance assessment framework that utilizes performance indicators within supportive conceptual frameworks (Tawfik-Shukor, Klazinga, & Arah, 2007).

Risk Management

Risk management in e-Health applications is a very daunting task that requires proper policies to ensure that the integrity and privacy of patient and personalized health information contained in these applications are not compromised (Myers, Frieden, Bherwani, & Henning, 2008). In the healthcare industry, protecting the privacy and confidentiality of personalized health information is one of the primary concerns of most healthcare providers. It is, therefore, not very surprising that Barlas, Queen, Radowitz, Shillam, and Williams (2007) identified information security management as still the number one technology concern on the list of the AICPA's annual top 10 technology initiatives. According to Barlas et al. (2007), information security management is a "systematic approach to encompassing people, processes, and IT systems that

safeguards critical systems and information, protecting them from internal and external threats" (p. 21). This systematic approach is of great need when it comes to managing risks associated with data security and identity protection of personalized health information.

Unauthorized access to personalized health information could lead to serious consequences and liabilities of IT vendors. Electronic health data formats can improve performance of healthcare delivery and core public health functions, but potentially threaten confidentiality and privacy because they can be easily duplicated and transmitted to unauthorized people (Myers et al., 2008). In the e-Health platform, Myers et al. (2008) identified several physical and electronic security threats to patient and personalized health information that require risk management from the part of healthcare providers' management team.

Part of managing risks in e-Health applications require proper establishment of rules and regulations that restrict employees access to these systems. Acknowledging the fact that security breaches is common and do occur, Myers et al. (2008) noted that electronic health data can be better secured than paper charts, "because authentication, authorization, auditing, and accountability can be facilitated" (p. 794). Several security protocols such as cryptographic techniques and biometrics solutions have been proposed by researchers to be effective in handling the security issues/vulnerabilities associated with the use of e-Health applications (Chandra, Durand, & Weaver, 2008). Although these technologies are gaining momentum in the healthcare domain, the cost of their implementation remains a huge bottleneck in the healthcare domain. Kahn et al. (2009) noted that widespread consumer acceptance and adoption of healthcare information systems is not possible until all issues relating to data security, identity protection, and consumer satisfactions are resolved by dedicated national bodies.

Control and Accountability

Maintaining control and accountability of e-Health applications is essential and a good practice in establishing confidence among healthcare providers that the systems in use have protocols that can be audited at any point in time to identify misuse and inappropriate accessibility by unauthorized users. Information accountability continues to remain an interesting topic in the IT industry as there are several security loopholes associated with the use of technology (Furnell, 2009; Weitzner et al., 2008).

According to Weitzner et al. (2008), the ease of information storage, transportation, aggregation, and analysis have paved way for many security threats to technology usage. Weitzner et al. (2008) noted that the use of access control and encryption are no longer capable of protecting the privacy of personal information, whether public or secret. However, using effective laws and accountability systems will help hold people accountable for the misuse of personal information. Weitzner et al. (2008), therefore, proposed an information accountability framework that involves three basic architecture features: Policy-aware transaction logs; Policy-language framework; and Policy-reasoning tools. Specifically, Weitzner et al. (2008) recommended the need for accountability systems to not only exhibit accountability reasoning in human-readable formats but also serve as proxies to data sources, mediating access to the data, and maintaining provenance information and logs of data transfers.

In the healthcare domain, development and maintenance of effective IT control and accountability can only be achieved with the institution of proper audit trails, policies and regulations regarding the accessibility of personalized health information. Healthcare providers and public health agencies can improve accountability by "establishing the capacity to create a precise audit trail that determines who has accessed a record, when the record was accessed, and what changes if any were made to the record" (Myers et al., 2008, p. 794). Myers et al. (2008) also recommended the implementation of preventive measures including policies, education, and engineering controls to protect data integrity and security. Tightened physical and electronic controls can also prevent misuse of data, thereby minimizing the risk of security breaches of e-Health applications (Myers et al., 2008).

PRACTICAL AND RESEARCH IMPLICATIONS

The practical and research implications of IT governance in e-Health applications are enormous. Acknowledging the fact that good IT governance is no longer a "nice to have", but a "must have", Webb et al. (2006) noted that failure to adequately govern IT within an organization can result in heavy financial losses; low productivity gains; and increase risk of legal actions. This is evidently true when it comes to the use and adoption of e-Health applications such as EHR, EMR and PHR. Many healthcare practitioners remain reluctance to use healthcare information systems because of the perceived privacy concerns and the security vulnerabilities associated with the use of electronic health information (Kahn et al., 2009).

Part of physicians' resistance to the use of e-Health applications could be attributed to poor IT governance structure that fails to identify proper strategic alignment, performance and risk management that are needed to support efficient healthcare

delivery. Avison, Gregor, and Wilson, 2006) attributed failures in IT systems to IT governance. In a similar assessment, Reti et al. (2009) noted that lack of properly defined governance structure tend to limit the broad use of PHR.

In order to facilitate the communication between clinicians and patients, Reti et al. (2009) proposed a governance structure that recognizes clinicians and patients as key stakeholders of PHR and include them as members. It is in this regard that Avison et al. (2006) asserted that IT project success largely depends on applying appropriate and prudent management controls to the development and deployment of information systems. Acknowledging the fact that the use of e-Health applications and their related decision-support algorithms alone cannot make a patient better, Parente & Van Horn (2006) noted that IT investments need to be coupled with clinical and administrative staff practices within a hospital to produce a return on investment. Moreover, findings from the study by Parente and Horn (2006) indicated that whereas for-profit hospitals invest in IT to maximize profits and minimize costs, not-for-profit hospitals invest in IT systems to maximize volume (p. 39).

CONCLUSION

This paper has explored the applicability of IT governance in e-Health applications. Stakeholders in the healthcare industry are all impacted by IT and must all be considered regarding IT governance issues. Successful implementation of IT governance by healthcare IT leaders will stimulate an environment in which creativity and technological innovations could flourish among healthcare IT professionals in the healthcare industry. It is, therefore, recommended that an e-Health governance framework is established for not only managing the strategic alignment and performance of e-Health systems but also minimizing the security risks and vulnerabilities associated with the use of e-Health applications. The establishment and appropriate utilization of e-Health governance framework will ensure that the business value of e-Health systems is properly delivered with appropriate IT solutions.

The pervasive nature of e-Health technologies in the healthcare industry has forced many government agencies to enact regulations so as to help protect the integrity, privacy, and confidentiality of personalized health information. Although federal regulations such as Health Insurance Portability and Accountability Act (HIPAA); and Personal Information Protection and Electronic Document Act (PIPEDA) have been enacted to protect the privacy and security of personalized health information, the actual implementation of these acts in the digital platform is very difficult and complex (Myers et al., 2008). Many healthcare practitioners remain reluctance to use healthcare information systems because of the perceived privacy concerns and the security vulnerabilities associated with the use of electronic health information (Kahn et al., 2009).

IT governance holds the promise of ensuring that regulations such as HIPAA and PIPEDA are appropriately aligned with e-Health applications. The governance framework also guarantees that the delivery of business value (i.e. interoperable exchange of clinical information) is achieved within e-Health applications. It is important, therefore, that future research focus on identifying empirical findings that will facilitate proper acceptance of IT governance in the healthcare industry. Perhaps, developing best practices documentation will highlight the definitive steps for implementing IT governance in the healthcare domain will be beneficial to healthcare providers. Furthermore, future research should focus on developing methods and/or models for assessing the effectiveness of an implemented IT governance structure in the healthcare industry.

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