Successful Implementation of eRx Systems: Creating Technology-Organization Alignment using the Strategy-Map Approach

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The adoption rates of eRx systems continue to be low and their implementation remains uneven. Rooted in the theories of technology–organization alignment and strategy maps, this article develops a framework for successful implementation of eRx systems. The proposed strategy map outlines the key strategic processes that would make implementation of eRx systems not only feasible and successful, but also a profitable venture for healthcare organizations.

Keywords e-Prescription systems; eRx systems, technology adoption; technology organization alignment; systems implementation; eRx implementation strategy map; eRx strategic alignment

INTRODUCTION

Despite tremendous advances in healthcare, harm to patients from medication errors is unfortunately still common (Aspden, Wolcott, Bootman, & Cronenwett, 2007). While such harm from adverse drug events (ADEs) is often from side effects associated with the drug itself (i.e., from adverse drug reactions [ADRs]), human errors in the drug prescription process account for roughly one-third of all ADEs (Aspden, Wolcott, Bootman, & Cronenwett, 2007). Such errors occur in the decision-making process, prescription writing and transcription, and administration of the drug. Among hospitalized patients, ADE’s are fatal in 1% and life threatening in 12% (Bates et al., 1995).

A 1998 meta-analysis found that, conservatively, ADRs (which are a subset of ADE’s) were the sixth leading cause of mortality in hospitalized patients (Lazarou, Pomeranz, & Corey, 1998). Despite efforts to reduce harm from medications, the number of ADEs reported to the United States Food and Drug Administration (FDA) more than doubled between 1998 and 2005, as did the number of deaths associated with ADEs (Moore, Cohen, & Furberg, 2007). These alarming statistics clearly indicate the need to significantly modify the existing healthcare delivery system, and particularly the drug prescription management system. Prescribers need effective information systems to replace the current, predominantly paper-based systems. Among various information systems, Electronic Prescription (eRx) system is designed specifically to address the above issues by facilitating the drug prescribing process, reducing errors in and cost of prescribing, assessing patient drug compliance, and improving the overall safety and quality of healthcare for patients (Grossman, Gerland, Reed, & Fahlman, 2007).

However, like other information systems used in healthcare industry, eRx systems face several obstacles, including a low adoption rate and an even lower success rate. Compounding the problem, limited studies address issues of successfully transferring the eRx technology from software development labs to hospitals and physician offices (Simon et al., 2007; Smith, 2006). To date, there have been few, if any, academic studies presenting a comprehensive model of the enablers and barriers of eRx adoption and implementation. Studies that have been done tend to apply general models of diffusion and technology acceptance from the information systems and communications literatures to the Health Information Technology (HIT) and eRx contexts.
to understand adoption barriers and enablers at an individual level (i.e., from the perspective of individual physicians, nurses, etc.; e.g., Holden & Karsh, 2010; Hu, Chau, Sheng, & Tam, 1999). Based on these general theoretical models, researchers make a priori assumptions about individual-level enablers and barriers and then set out to locate and measure those factors. However, health information systems vary from other information systems. First, a healthcare information system has multiple stakeholders, including healthcare providers, patients, labs, pharmacies, insurers, and policy makers, which makes its adoption and implementation more complicated (Ammenwerth, Gräber, Herrmann, Bürkle, & König, 2003). Second, physicians, the primary users of healthcare information systems, usually have more autonomy and shown resistance to IT than other users. For example, Kane and Labianca (2011) found that IT resistance is particularly problematic in healthcare settings and IT use is less likely to be mandatory because physicians have more freedom to resist. Jha, Chitkara, and Gupta (2000) found physicians’ resistance is one of the major barriers for HIT adoption, and it affected around 36% hospitals they surveyed. Third, the implementation of health IT including eRx is heavily affected by the policies (such as the Health Information Technology for Economic and Clinical Health [HITECH] Act and laws (such as Health Insurance Portability and Accountability Act [HIPAA]; Miller & Tucker, 2009). Fourth, the domain knowledge and workflow is unique in health information systems compared with other systems. Fifth, the healthcare industry is a highly institutionalized environment due to the high degree of isomorphic pressures that emanate partly from federal and state regulation (coercive forces), partly from the highly professionalized nature of the various jobs and professions in this industry (normative forces), and partly from the desire to “mimic” competitors’ practices rather than become innovative and take risks (mimetic pressures), as risk-taking in this industry can result in huge losses, including serious injuries and even life-threatening and fatal losses and failures. As a result, HIT has been slow to diffuse within the healthcare industry, which tends to link the adoption of new technology to uncertainty, change, and risk.

In addition, to our knowledge, there have been no studies of systemic organizational and institutional barriers to adoption of eRx systems. As a result, our understanding about the issues surrounding technology transfer and implementation of eRx systems by physicians and hospitals remains nascent, and there is an urgent need to understand the challenges involved in implementation of eRx solutions. Therefore, previous adoption and implementation models need to be substantially enhanced to not only better fit the eRx adoption context but to also account for higher-level organizational and institutional factors such as changes needed in managerial processes and practices, changes needed in workflows within hospitals and physician offices, changes needed in organizational culture and climate, the role of institutional norms, and so on.

To address those issues, in this article, we intend to answer the following question: How can we improve the implementation of eRx by accounting for organizational and institutional factors and aligning with healthcare providers’ strategy? Rooted in the notion of technology–organization alignment that suggests that changes to processes, workflows, and control systems may be needed to successfully implement and assimilate an IT innovation, we develop a framework for implementation of eRx systems based on Kaplan and Norton’s strategy-map approach (Kaplan & Norton, 1992). The article is exploratory in nature and based on interviewing with professionals in the healthcare community. This framework was developed based on real problems faced in the healthcare domains and provides healthcare providers a guideline of how they can coordinate and improve the success rate of their eRx implementations.

The article is organized as follows. First, we provide a general discussion about the stakeholders, processes, and workflows associated with eRx systems. We then review literature on adoption and implementation of eRx systems. Next, we discuss key theoretical underpinnings that provide the basis for the development of a eRx implementation framework in this paper. We then present the methodology of how we conducted this study. Finally, we discuss our proposed eRx implementation framework using a strategy-map approach that incorporates various recommendations drawn from the theoretical literature and interviews in terms of processes and practices that will help in successful implementation and usage of eRx systems. The implications and limitations of our study are also discussed.

**BACKGROUND**

**Adverse Drug Event**

Errors in the prescription process account for the majority of preventable ADEs across all healthcare delivery settings. Fifty-six percent of preventable ADEs occurred due to errors in the ordering process in the inpatient setting, compared with only 4% of errors due to transcription (Bates et al., 1995). Similarly, the use of inappropriate drugs (errors in medical decision making) accounted for 42% of events in the outpatient setting (Thomsen, Winterstein, Søndergaard, Haugbølle, & Melander, 2007). Factors that account for such provider-related errors include handwritten prescriptions, reliance on memory, and inadequate access to patient data. In addition to prescribing errors, ADEs can also be caused by pharmacy staff misunderstanding prescriptions (largely due to handwriting misinterpretation) and dispensing wrong drugs to patients (Devaraj & Kohli, 2000; Lazarou et al., 1998). Studies reveal that about 150 million calls are made annually to physician practices by pharmacy staff for prescription clarifications, alternative medicines for insurance coverage, and renewal authorizations (ISMP, 2000). This represents a tremendous inefficiency. Despite this huge effort, a number of prescriptions still slip through the watchful eyes of the pharmacists and cause ADEs in patients. This presents a need for a system that could check patients’ insurance plans and formulary details and then efficiently and accurately transmit prescriptions to pharmacies.
Electronic Prescription (eRx) Systems

ERx systems have attracted a great deal of attention in the healthcare industry for the past several years because of their potential to transform the prescribing process, leading to reduced prescribing and dispensing errors and thereby improving patient safety and reducing inefficiencies and costs. An integrated-systems approach constitutes an eRx system that is part of an overall electronic health record (EHR) system. Indeed, implementation of eRx is considered the first essential step in implementing EHR systems (Halamka, 2006; J. Halamka et al., 2005). An integrated eRx system, as part of an EHR, could provide the following:

- Access to a medical knowledgebase and internet resources that provide physicians with clinical evidence, thereby potentially reducing ADEs (Bates et al., 2001; Lazarou et al., 1998; Lipton, Miller, & Wimbush, 2003).
- Information about drug–drug interactions and allergies that would otherwise not be known or not reach the attention of the physician (Teich et al., 2005).
- Decision support that could make use of the knowledgebase and make recommendations to physicians about a prescription (Teich et al., 2005).
- Information exchange with other systems at other hospitals and physician practices so that a patient would be able to receive the same quality of care from other practices as well (Ekedahl & Månsso, 2004; Fischer, Vogeli, Stedman, Ferris, & Weissman, 2008; Lapane, Dubé, Schneider, & Quilliam, 2007; Rupp & Warholak, 2008).
- Secure electronic transmission of prescription and prescription-related information between the prescriber, pharmacy, benefit manager, and health plan, either directly or indirectly through an intermediary including an e-prescribing network (Simons et al., 2006). This will help in reducing dispensing errors due to handwriting, reducing costs incurred in clarification call backs, and enabling doctors to authorize renewals electronically (Crosson et al., 2008; Edelstein, 2006; Fischer et al., 2008b; Kraljewski et al., 2008; Schectman, Schorling, Nadkarni, & Voss, 2005).
- Formulary review to improve compliance with insurance formularies, thereby minimizing co-pays and further reducing the need for pharmacy call-backs to the physician.
- Overall, these features are expected to reduce prescription errors, thereby reducing the number of ADEs and also bringing about cost savings. These features would also lead to more evidence-based treatments and better coordination between the key players—the patient, the physician, the pharmacist, and the third party payer.

eRx Stakeholders

ERx systems provide a physician details about a patient’s medical history, pharmacy eligibility, formulary and benefits, drug-drug interactions, drug allergies, and evidence-based guidelines at the point of prescription. Physicians have strong incentives to implement eRx systems due to reasons of regulation and competitiveness. The federal government is using IT to transform the healthcare industry and encourage healthcare providers to adopt HIT by providing incentives and posing penalties through legislations such as the HITECH Act. For example, the Centers for Medicare & Medicaid Services (CMS) has announced an incentive of 1% of the total Medicare reimbursements for physicians using eRx for the years 2011 and 2012. Physicians who fail to adopt eRx systems will have to face a 1% cut in their Medicare payments from 2012 onwards, increasing to 2% in 2014. Competition is another reason why doctors and healthcare providers would choose to implement eRx systems. First, implementation of eRx system could reduce the cost and improve the efficiency of healthcare delivery. Second, an eRx system makes it convenient for patients to fill their prescriptions and is, therefore, an attractive service for them. Third, as an increasing number of health information systems get adopted in the healthcare industry, eRx systems also broaden healthcare providers’ communication channels by allowing them to process prescriptions and payments electronically.

As a result of all the above, physicians as end users are an important stakeholder of eRx systems. Additionally, patients are an obvious stakeholder of an eRx system, as they ultimately benefit from the improved quality of care that results from eRx systems (Devaraj & Kohli, 2000). Pharmacy Benefits Managers (PBMs) are the primary source of information on patients’ medication history, health insurance plans, and formulary details and are, therefore, another important stakeholder of eRx systems. In the United States, the federal and state governments are also active and important stakeholders of eRx systems, because they are not only the largest payers for patient prescription medication, but they also use eRx systems as an important tool to implement regulatory and reporting requirements. Further, IT vendors are also important stakeholders, as they provide the technology and the expertise for implementing eRx systems in physician offices and other healthcare settings.

eRx Business Model

In addition to the direct benefit of increasing healthcare quality by reducing ADEs, financial gain remains one of the foremost reasons that brings together various entities that would need to be involved in the successful implementation and use of an eRx system (Fischer et al., 2008a). PBMs come together to create an information repository. It is in their own interests to do so, as information retrieved by a physician from their system means there is a higher chance of a prescription falling within the patient’s formulary and coverage plan. Besides, hospitals
and other healthcare delivery settings will pay for every record that is retrieved from the central repository of an eRx system, as this would improve quality of care for their patients. Pharmacies also join the network of eRx service providers for the simple reason that an electronic prescription would reduce call back costs. It would also simplify the claims settlement process with the PBMs. This business model should be emphasized in all eRx implementations, as it highlights the benefits to all involved stakeholders, which is an important prerequisite in any successful project implementation.

**eRx Workflow**

Before exploring the reasons behind the lack of widespread adoption of eRx systems in the United States, it is critical to understand the process workflow required by an eRx system (Virk, Bates, Halamka, Fournier, & Rothschild, 2006). This is because one of the major difficulties in wider adoption of eRx systems arises from the changes that these systems bring about in the process workflow across the entire healthcare delivery value chain (Halamka et al., 2006). Further, whenever a new system is introduced, it initially requires more process time due to learning effects from changes to the normal workflow (Ramsay et al., 2000), and this can also become a major barrier for the successful transition to the new system.

Below, we closely examine the entire process of prescribing in an eRx system right from the moment a patient visits a physician until the prescription has been processed by the pharmacy and bills sent for claims processing. An activity diagram shown in Figures 1 and 2 was developed using the standard activity diagram notation contained in Unified Modeling Language (UML) version 2 to model the workflow typically required and

![Activity Diagram](image-url)
A physician’s interaction with an eRx system begins from the moment a patient visits the physician. The foremost information that is needed at this point of care is the patient’s benefit coverage information. The physician (or staff) pulls out this information from the system by submitting a request using patient information such as first name, last name, date of birth, gender, and zip code. This request is processed by the eRx system, which uniquely identifies the patient in the master patient index. An important requirement here is that no request should get turned down. For this to happen, eRx systems should cover as large a proportion of patient population as possible. Once the patient has been uniquely identified by the e-prescribing system, a request is sent by the prescribing system to the PBM’s system which checks for particular patient’s coverage plan validity. The PBM system provides complete information regarding patient’s eligibility, benefits, and complete medication history. It is critical that the medication history for a particular patient be retrieved from multiple sources accurately so that adverse drug related errors resulting from a lack of knowledge about previous medications be minimized. This information is passed on by the PBM system to the physician’s eRx system, which in turn directs it to the physician who made this request. This ensures that the physician has as much needed information as possible before prescribing.

The physician then evaluates the eligibility, formulation, and medication history information that he or she has received. Another important feature is the ability of the eRx system to suggest alternative lower cost drugs which the physician

<table>
<thead>
<tr>
<th>PHYSICIAN</th>
<th>RxHUB (System)</th>
<th>PBM</th>
<th>PHARMACY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Request for medication history/ drug interaction</td>
<td>Pass on to physician</td>
<td>Provide further details requested by physician</td>
<td>Identify list of relevant pharmacies</td>
</tr>
<tr>
<td>Redirect request</td>
<td>Redirect request</td>
<td>Validate prescription</td>
<td>Route prescription to identified pharmacy</td>
</tr>
<tr>
<td>Provide Clarification</td>
<td>Forward request to physician</td>
<td>Any Clarifications/ Renewals?</td>
<td>Process prescription</td>
</tr>
<tr>
<td>Prescribe electronically</td>
<td>Forward clarification to pharmacy</td>
<td>Yes</td>
<td>Process claims</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>File claims for payment</td>
</tr>
</tbody>
</table>
could prescribe, which would lower the cost for health insurance companies. The next step is for the physician to prescribe electronically, after which the eRx system sends the prescription to the pharmacy of patient’s choice. All this information gets transferred in a secure and a reliable manner.

One of the major costs associated with the processing of prescriptions by pharmacies is the number of callbacks that are made by a pharmacy to the physician who prescribed the drugs to a patient. An eRx system makes this clarification process simpler and easier. The amount of time spent phoning and faxing to clarify prescriptions and authorize renewal requests is minimized. All that a pharmacist has to do is to raise a request using the eRx system, which redirects it to the relevant physician. After the prescription has been processed, the pharmacies file for claims with the PBM system.

Barriers to Implementation of eRx Systems

Now we turn our attention to the barriers to adoptions of eRx systems. We first briefly reviewed the barriers examined in IS literature, and then we focused on factors more salient in healthcare settings.

Compared with studies investigating the enablers of IT adoption (such as the Technology Acceptance Model [TAM] model and IT success model), studies investigating barriers to IT adoption and implementation are less numerous and include a different set of factors (Cenfetelli & Schwarz, 2011). Those factors include lack of time, needs, and training (Kane & Labianca, 2011), lack of knowledge (Venkatesh & Brown, 2001), lack of resources (Mathieson, Peacock, & Chin, 2001), lack of supports (P. Y. Chau, 2001), anxiety (Brown, Fuller, & Vician, 2004), information quality and system quality (Cenfetelli & Schwarz, 2011), and organizational change (Keen, 1981).

In the healthcare setting, previous studies have found that financial factors have significant impact on the adoption and implementation of health information systems (Jha et al., 2009). Such financial factors stem from costs of software, training, and maintenance (Schade, Sullivan, De Lusignan, & Madeley, 2006), as well as concerns on productivity loss in the short term and payoff of IT investment in the long term. Peer influence could also affect healthcare providers’ decisions on IT adoption. At the individual level, Venkatesh, Zhang, and Sykes (2011) found that network positions in a hospital, such as central-ity among doctors and administration personnel, are associated with Health IT use. At the organizational level, Angst, Agarwal, Sambamurthy, and Kelley (2010) found social contagion could determine the adoption of health information systems by hospitals. In addition, as healthcare industry is highly regulated (Agarwal, Gao, DesRoches, & Jha, 2010), privacy, security, and related regulations may slow the rate of health IT adoption. For example, Miller and Tucker (2009) found that state privacy regulations could restrict hospitals’ share of patient information and inhibit the EMR adoption by hospitals. Some other barrier studies in healthcare settings include the functionality available to doctors (DesRoches et al., 2008), loss of power and control (Doolin, 2004), improper requirements specification, lack of top management support and strategic IT planning (Anderson, 2007), and dramatic changes to workflow (Grossman et al., 2007).

THEORETICAL FOUNDATIONS

In this section, we first review literature on HIT and eRx adoption and implementation and discuss gaps in our understanding with respect to successful implementation of eRx systems. We then review the theories of technology structuration, technology–organization alignment, and strategy maps as they form the foundation of the strategy map developed in this study. We use the term “implementation” as opposed to “adoption” in this article, as it is a more encompassing process and follow the widely accepted definition for IT implementation proposed by Cooper and Zmud (1990). This definition characterizes the IT implementation process as comprising of six stages: Initiation, adoption, adaptation, acceptance, routinization, and infusion.

HIT and eRx Implementation

Previous studies on HIT adoption have applied prevalent IT adoption models and their variations such as the TAM (Holden & Karsh, 2010), Unified Theory of Acceptance and Utilization of Technology (UTAUT) (Azoglidis & Chatzoglou, 2009), Theory of Planned Behavior (TPB) model (Chau & Hu, 2002), innovation diffusion model (Lee, 2004), and IT success model (Van Der Meijden, Tange, Troost, & Hasman, 2003). Recent studies have begun developing and using models focusing on unique characteristics of health IT such as the Contextual Implementation Model (Callen, Braithwaite, & Westbrook, 2008), which includes factors at organizational level, clinical level, and individual level, as well as Readiness for Implementation Model (Wen et al., 2010), which includes factors such as organizational motivation and meeting user needs. However, most of these studies examine the HIT adoption and implement from the users’ perspective. As health information systems, particularly eRx systems, become more sophisticated and may affect interests from different entities, studying their implementation from the perspective of multiple stakeholders is critical.

In addition, researchers often subsume specific individual-level factors such as user resistance, cost, and so forth (Grossman et al., 2007) into higher-level constructs like perceived usefulness (Chisman & Patton-Wiley, 2003), or treat them as contextual factors, exogenous to the main model. These factors are, however, central issues in healthcare IT adoption. For instance, Vishwanath and Scamurra (2007) identified concerns over customization, perceived costs, logistics and regulatory issues, and return on investments as central barriers to the physician adoption of EHRs and found these barriers to be more important than diffusion-based and IS-theory-based factors. Clearly, knowledge about specific, and not...
general, high-level factors is needed from a healthcare policy perspective.

Researchers also often borrow measures from diffusion theory (Rogers, 2003) and directly apply it in the HIT context (e.g., Wu, Wang, & Lin, 2007). Diffusion theory focuses on a broad range of consumer innovations, while IS models focus on organizational adoption of a wide range of IT innovations. Measures derived from this research, hence, tend to lack content validity with respect to healthcare settings, particularly eRx systems. Because items in these measures do not reflect the healthcare IT domain, they further reduce the ability to measure clearly the enablers and barriers to eRx adoption and understand the content of each factor. Hence, there is a need for a unifying paradigm which is inclusive and comprehensive and reflects both the “big picture” and the subtleties of each enabler and barrier to eRx adoption and implementation.

Technology Structuration

The structuration theory of IT was developed by Orlikowski and Robey (1991) and has since been used to study IT adoption and use behaviors in organizations (e.g., Kishore & McLean, 2007; Orlikowski, Yates, Okamura, & Fujimoto, 1995; Purvis, Sambamurthy, & Zmud, 2001). Structuration theory posits that IT adoption and use as a form of human action within organizations both is shaped by and shapes institutional and technological structures of signification, domination, and legitimation (DeSanctis & Poole, 1994). The structures of signification provide interpretive schemes to human beings—essentially shared stocks of knowledge—that enable and constrain individual understanding about various aspects of their work environment. The structures of domination confer resources that both enable and constrain power of individuals within organizations. The structures of legitimation impose institutional norms upon individuals and also articulate the moral sanctions that may result if those norms are violated, thereby constraining human behavior within organizations (Jones & Karsten, 2008). This perspective is important in our context because we are concerned about how institutional structures of signification, domination, and legitimation that are embedded in various clinical processes, procedures, policies, rules, norms, and resource allocations impact the adoption and use of eRx systems within the healthcare settings considered in this study. Furthermore, an understanding about the various structural inhibitors also allows us to develop appropriate recommendations for changing relevant institutional structures within specific healthcare settings by way of the prescribed processes by using a strategy-map approach.

Technology–Organization Alignment

Organizational alignment—also termed as congruence, coherence, consistency, fit, harmony, and match in the literature—is essentially the extent to which various organizational components support each other in meeting their unique goals and requirements (Powell, 1992). The innovation literature has portrayed the innovation adoption and assimilation phenomenon as a mutual adaptation process and emphasized the need for creating organizational alignment with respect to the innovation under consideration for its successful implementation (Burn, 1996). This is because whenever a new technology is introduced into an organization, it changes the technological dimension of the organizational architecture (Mendelson, 2000), thereby disturbing the current state of its organizational alignment. Bringing the organization back into a desirable state of alignment to achieve optimal results requires changing the complementary organizational components in an appropriate manner. The components of the organizational architecture that need to be adjusted and aligned include managerial and work processes, procedures, tasks, and workflows, roles and responsibilities of individual employees, organizational structures of communication and coordination, control systems for measuring work and compensating employees, organizational culture that fosters trust and teamwork, and complementary technology infrastructure that will be in some way connected with the new technology being adopted (Reich & Benbasat, 2000).

Technology–organization alignment was recently argued to be a special type of technology meta-structuring action in a recent study of infusion (regular, consistent, and deep usage of all features) of software innovations within a large U.S. bank and was found to be a significant and important predictor of successful infusion of such technologies (Kishore & McLean, 2007). This theoretical perspective is critical to understanding the implementation and usage of eRx systems within healthcare settings, because the current literature, as discussed above, suggests that changes in workflows and processes (process and task alignment problem) and an increase in workloads (role alignment problem) are major barriers to successful implementation of eRx technologies in hospital and other clinical settings. Further, as also discussed above, it is crucial for eRx systems to work synergistically with other elements of the clinical organization, including workflows, processes, policies, roles and responsibilities, control systems, and culture, so these systems can be used effectively by physicians and other users. However, very little is known about specifics of these elements that will need to be adjusted and the issues of alignment that may arise during implementation. This article focuses on these implementation issues and challenges to develop a framework based on strategy maps (Kaplan & Norton, 2004) for successful implementation of eRx systems. This theoretical perspective also helps us develop strategies that address specific alignment issues for the most effective implementation and use of eRx systems in different healthcare delivery settings.

Strategy Maps

All organizations share the common goal of creating value for their stakeholder and customers (Freeman, 1984), and it
is only common sense that the decisions they make and the strategies they adopt contribute towards this ultimate goal. A strategy map seeks to establish a cause and effect relationship among various components of an organization’s strategy (Kaplan & Norton, 1992, 1996, 2004). It is based on the notions of a balanced scorecard which views an organization from four different perspectives—namely, financial, customer, internal business process, and learning and growth perspectives (Kaplan & Norton, 1992). The financial perspective looks at how an organization should appeal to its shareholders/stakeholders. The customer perspective looks at how the organization should appeal to its customers to achieve its vision. The internal business process perspective looks at what business processes the organization should excel at to satisfy its various customers and other stakeholders. The learning and growth perspective comprises of intangible assets of an organization, including its information and human capital, and looks at how the organization will sustain its ability to change and improve itself to achieve its vision. Each perspective starting from the bottom contributes to the perspective above it. All components are interlinked. It is not enough if the organization has an admirable vision and strategy but lacks definite and well-defined internal business processes to achieve them. Also, it is not sufficient to have well defined processes without the required IT infrastructure, systems, human resources, and so forth, in place.

In this article, we utilize the strategy-maps approach for developing a framework for successful eRx implementation. Strategy map was chosen in this article due to the following reasons: First, contrast to previous theories which most focus on one aspect of organization, strategy map provides a comprehensive view to examine the eRx implementation from the stakeholders’ perspective. For example, while hospitals and physician practices commonly view financial strains that eRx causes initially as the main barrier to eRx adoption, the strategy-map approach clearly points out that financial perspective, although a very important one, is only one of the four perspectives which need to be viewed for an organization to be successful. This approach makes it clear that financial goals cannot be achieved without achieving goals in the three other perspectives covered in a strategy map. Second, as a strategy map integrates all these perspectives in a coherent manner, it is being widely used to define and execute an organization’s strategy. ERx implementation has been considered as one of the strategic decisions which could impact the healthcare provider’s cost and care delivery quality, so the strategy map offers a suitable lens to examine all organizational factors associated with it.

**RESEARCH METHODOLOGY**

As an explorative study, we collected data primarily through interviews with various eRx implementation stakeholders. Interviews have been considered useful when the research question is broad and an in-depth examination is needed (Dubé & Paré, 2003). It helps researchers to understand an information system phenomenon in organizational contexts (Klein & Myers, 1999).

**Data Collection**

Our data collection included the following steps: First, we conducted a thorough literature review pertaining to HIT, and particularly eRx, adoption and implementation. Based on the gaps in this body of literature and guided by the theories discussed above, we identified a preliminary set of changes that would be required in the processes, workflows, organizational structures, roles and responsibilities, control and reward systems, and so forth, to enable successful implementations of eRx systems. Next, we conducted exploratory interviews with professionals within the healthcare community. In line with Lapointe and Rivard, 2005, we used snowball sampling (Patton, 1990) to select the interviewees for our study. Snowball sampling fits this study for two reasons: First, it facilitates access to major stakeholders of eRx systems who otherwise might not be available to us. Second, it ensures that all our interviewees have a certain level of knowledge on eRx so they can provide some new perspectives during interviews. Following snowball sampling procedures, the initial interviewees were asked to nominate a list of potential subsequent interviewees who are knowledgeable or have experiences of eRx and provide their contact information. The subsequent interviewees were then contacted and asked to participate in our interview. As a result, final interviewees for this study include four doctors, two nurses, two scientists/researchers in the public health domain, two pharmacists, and two health information system analysts. All of them have multiple-year experiences in the healthcare industry and have good knowledge of designing, implementing, and/or using eRx systems. All interviews lasted between 30 to 60 minutes. All the interviews were exploratory and unstructured in nature so we could understand stakeholders’ perspectives and develop a deeper emic view (native insiders’ view) of the eRx implementation phenomenon. However, we did develop and use an interview guide with broad topic areas to be covered during our interviewing based on theories of technology-organizational alignment and strategy maps so we could cover the gamut of issues that are germane to the context of eRx implementation. We asked interviewees’ views on eRx adoption and the difficulties they directly had in implementing eRx systems within their domains. We also asked them about challenges and difficulties they were aware of that their colleagues and other professionals may have faced in implementing eRx systems in their respective organizations. We also asked them about their ideas and suggestions for making eRx implementations successful. Extensive field notes were taken during the interviewing process, and we also confirmed our understanding of interviewees’ comments subsequent to the interviews. Any discrepancies in our understanding were clarified and reconciled.
Data Analysis

Our data analysis were guided by strategic map and conducted iteratively. We first went through all validated field notes and put them into one of the four categories of strategic map: Financial Perspective, Customer/Stakeholder Perspective, Internal Process Perspective, and Learning and Growth Perspective. Within each category, we examined, abstracted, and grouped field notes to identify initial themes. We then coded the field notes following the initial themes and at the same time decided if any new themes could be generated. The process of our data analysis is iterative to ensure that we fully understand the field notes and interpret them correctly (Klein & Myers, 1999). It stopped when we reached the point where no new theme emerges. All themes were then used to fill and construct a strategy map for eRx implementation. Finally, the proposed strategy-map model was refined based on further discussions with the interviewees who provided comments on the draft model. We present and discuss this proposed design theory in the following section.

A PROPOSED STRATEGY MAP BASED FRAMEWORK FOR SUCCESSFUL ERX SYSTEMS IMPLEMENTATION

We used the strategy-maps approach and the standard strategy-maps template (Kaplan & Norton, 2004) to develop our framework (Gregor, 2006) that encapsulates the processes and workflows that will be needed (or will need to be changed) for successfully implementing eRx systems. Given that eRx systems are expected to be a profitable venture in the long term, and given that they have the potential to improve the quality of healthcare, all hospitals and physician practices will have to eventually reevaluate their strategies regarding implementing eRx systems. In this section, we discuss how they can make their eRx implementations successful by discussing the framework that we developed in this study. The complete strategy-map framework for eRx implementation is provided in Table 1.

Learning and Growth Perspective

The learning and growth perspective in a strategy map is segregated into human capital, information capital, and organizational capital. These are the intangible assets of an organization and have been described as “knowledge that exists in an organization to create differential advantage” or “the capabilities of the company’s employees to satisfy the customer needs” (Kaplan & Norton, 1992, 2004, p. 202).

Human capital involves the availability of skills, talent, and know-how to perform activities required by an organization’s strategy (Kaplan & Norton, 1992, 2004). As far as the implementation of an eRx system goes, a lot of time and money would have to be invested in training physicians and other healthcare staff. Technology and application vendors can provide training programs that ensure that the physicians and staff who are going to use the system understand the process of preparing and sending a new prescription to the pharmacy electronically. The staff should also be trained to review and respond to prescription refill requests that are sent electronically by the pharmacy.

Information capital refers to the availability of information systems, knowledge applications, and IT infrastructure required to support the strategy adopted by the healthcare setting (Kaplan & Norton, 1992, 2004). Hospitals and physician practices should ensure that the eRx applications they propose to implement are certified by the central patient information and pharmacy health information network hub. By doing this, hospitals can ensure that the systems they seek to install and implement in their organizations are compatible with information providers’ systems. These organizations can look up lists provided by the information provider networks that indicate certified vendors who develop and provide eRx systems compatible with their systems.

In addition to being certified applications, hospitals and physician practices should also look for specific features in the application that would reduce the time required by physicians to prescribe electronically by minimizing the number of keystrokes to write, renew, and send prescriptions. The system should provide the prescriber maximum information as it possibly can. This could be medication history information from multiple history sources reconciled into a single view. The system could also provide pre-filled default fields, favorite medication list feature, easy pharmacy selection and clinical decision support systems that could point out drug-drug interaction and drug allergy alerts. Also, eRx systems should have the capacity to facilitate hospitals’ compliance with security- and privacy-related regulations and laws, including HIPAA. ERx systems should not only encrypt all patient-related information but should also provide authentication mechanisms which ensure that only authorized users have access to patient information and that all accesses are tracked. Changing the medication information may occur, although it is not common. In order to improve the reliability and reduce errors associated with outdated data, an eRx system should allow healthcare providers to manually update the medication information to accurately reflect the most recent developments on medication. Also, the eRx system should have the capacity to automatically update its medication information and remind the physicians of all allergies the patients have. An eRx system’s capacity to integrate with other systems is critical to ensure the completeness of patient information. Health Information Exchange (HIE) is being widely used to provide health information systems the capacity to consolidate patient information using standard formats. ERx system needs to ensure its compatibility and interoperability with HIE. Integration of patient information also depends on the maturation of overall IT infrastructure, cooperation from all healthcare providers, as well as related standards and regulation, which may have gone beyond the capacity and control of the focal health care providers. Adoption and implementation of eRx lays the foundations of integration of patient information and is, thus, one of the most important
<table>
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<tr>
<th>Financial Perspective</th>
<th>Improve Cost Structure and Asset Utilization</th>
<th>Expand Revenue Opportunities</th>
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<tr>
<td></td>
<td>Reduce costs associated with Adverse Drug Events</td>
<td>More patients seeking e-prescribing bring in more revenues to doctors’ offices</td>
</tr>
<tr>
<td></td>
<td>Reduce costs associated with refills</td>
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<td></td>
<td>Use physician time effectively</td>
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<tr>
<td></td>
<td>Reduce Claims Management costs</td>
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<tr>
<td>Customer/Stakeholder Perspective</td>
<td>Availability: Of patient, coverage plan info, formulary details, and pharmacy details 24/7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Price: Adherence to coverage and formulary plans, incentives to those seeking e-prescribing, Reduce out of pocket pay</td>
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<tr>
<td></td>
<td>Quality: Reduce Adverse Drug Related Events, reduce prescription errors, improve patient safety, simplify drug prescription and dispensing mechanism</td>
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<td>Internal Process Perspective</td>
<td>Operations Management Processes</td>
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</tr>
<tr>
<td></td>
<td>1. Streamline maintenance and support contracts with vendors</td>
<td>1. Validate prescriptions outside patient’s formulary</td>
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<td></td>
<td>2. Set up escalation hierarchies for production issues</td>
<td>2. Organize campaigns to increase awareness of e-prescription systems</td>
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<td></td>
<td>3. Manage technology vendors effectively</td>
<td>3. Increase percentage of formulary and coverage plan adherence</td>
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<td></td>
<td>Innovation Processes</td>
<td>Regulatory and Social Processes</td>
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<td></td>
<td>1. Collaborate with technology vendors on a continuous basis to tweak system</td>
<td>1. Secure patient information</td>
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<td></td>
<td>2. Involve physicians and staff in gathering requirements and suggestions for change</td>
<td>2. Establish stringent need-to-know policies</td>
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<td></td>
<td>3. Gather feedback from patients</td>
<td>3. Conduct periodic audits to review controls</td>
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<tr>
<td></td>
<td>Image: Going extra mile to improve quality of care with maximum patient information confidentiality</td>
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<tr>
<td></td>
<td>Partnership: With leading PBM and pharmacies instill confidence amongst the people</td>
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</table>
4. Transfer technology and infrastructure maintenance risk to technology vendors
5. Tune workflow for minimal prescribing time
6. Streamline prescription refill workflow
7. Implement pay per transaction business model
8. Manage information effectively

**Leaning and Growth**

**Human Capital**
1. Training physicians and other healthcare staff.
2. The training helps the physicians and staff to the system understand the process of preparing and sending a new prescription to the pharmacy electronically as well as prescription refill requests sent electronically by the pharmacy

**Information Capital**
1. Ensure the quality of eRx system by choosing an certified eRx to implement.
2. Ensure that the eRx system satisfies all user requirements including functionality, security, reliability, and interoperability.
3. Ensure support to eRx systems including hardware availability and network connectivity

**Organizational Capital**
1. The healthcare providers should have a clear vision of what they hope to accomplish through e-prescribing.
2. The healthcare providers should ensure all physicians and staff are committed to the implementation of eRx.
3. The benefits, barriers, and challenges of eRx should be evaluated and articulated.
steps toward the ultimate goal of sharing and exchanging patient information (including their medication information) in one system.

Hospitals should also consider the required hardware for the eRx systems that they seek to implement. A physician may prescribe at various locations and from different systems such as a desktop in the exam room, laptops that are wheeled around, and tablet computers as well. If the hardware does not support the workflow, then it is likely that physicians will revert to paper prescriptions. The hardware also includes establishing secure channels for communication between eRx systems and the central information providers. There are strict regulations regarding patient information confidentiality and integrity, and the hardware infrastructure should be in tune with these requirements. The network hardware in place should support information security and network security. The hardware should also ensure that the connectivity between systems is not compromised at any point of time, as it would affect patients’ waiting time which could undo the whole purpose of the system.

Organizational capital refers to the culture, leadership, alignment, and teamwork within a healthcare setting (Kaplan & Norton, 1992, 2004). It is very important that hospitals or physician settings have a vision of what they hope to accomplish through e-prescribing. The vision should encompass an understanding of the functionalities and benefits offered by e-prescribing. The leaders and the sponsors should ensure that physicians and staff using the system are willing to change the existing workflows to take full advantage of eRx systems. The benefits of e-prescribing should be stated explicitly in the planning phase, reinforced in the training program, and actively measured and pursued following implementation. The barriers and challenges in adopting e-prescribing should also be articulated so they can be planned for and addressed, allowing realistic expectations for the project’s progress.

**Internal Process Perspective**

Next, the internal perspective deals with establishing strategic processes that will help the organization to produce and deliver the value proposition for its customers and other stakeholders and reduce costs for the productivity component in the financial perspective (Kaplan & Norton, 1992, 2004). An organization has to manage its internal processes well to deliver the differentiating value proposition of its strategy. A strategy map classifies an organization’s internal processes into operations management, customer management, innovation, and social and regulatory processes, which we discuss next.

Operations management processes are the various day-to-day processes that an organization employs to produce and deliver goods and services to its customers (Kaplan & Norton, 1992, 2004). With respect to eRx systems, a hospital or a physician practice should have contracts in place with technology vendors that define all aspects of maintenance and support. The process should account for all kinds of discrepancies and issues that might creep into an IT system. The scope and the resolution time for various issues will have to be clearly defined. The process should establish escalation hierarchies. Since IT is not a hospital’s core business, it should establish processes to manage its technology vendors effectively.

The healthcare setting should also have processes in place to manage its customers (patients) so as to expand and deepen relationships with them. An eRx system would provide details about the patients’ formulary details and insurance coverage plans. Processes should ensure that physicians have a valid reason when they prescribe a medicine that falls outside the coverage plan. This would increase formulary adherence percentage by hospitals and physician practices, which is one of the key benefits that eRx systems offer. This would in fact bring down the out-of-pocket payments for patients. A hospital should also organize campaigns and awareness programs that elucidate the advantages and benefits of an eRx system. If the hospital could provide periodic statistics about the reduction in the number of ADEs after the eRx system’s implementation, the campaign would carry more weight. People would have hard facts with them to realize the benefits that an eRx system offers to the healthcare industry.

An organization has to constantly innovate if it has to stay ahead of its competitors (Teece, 2009). Hospitals should be able to achieve returns on their investment in eRx systems (Johnson & Weigle, 2009). In spite of having a state-of-the-art system in place, a hospital might realize that they would require some additional features to align the system with the workflows in the hospital. Processes should be in place that would allow physicians and staff to come up with suggestions on new requirements and changes in system features. Hospitals should also collaborate with technology vendors to continuously keep their systems up-to-date with new technology. Hospitals and physician practices using eRx systems should also use their leverage and press PBMs and insurance providers to reduce costs for patients.

Finally, regulatory and social processes help organizations continually earn the right to operate in the communities in which they produce and sell (Kaplan & Norton, 1992, 2004). In addition to complying with regulations laid down by the government for electronic prescription transmission, hospitals could go one step further to secure patient information. They should establish stringent need-to-know policies and secure communication channels to safeguard patient information. The hospitals should also establish processes that require periodic audits to enforce healthcare industry regulations and ensure that all controls are in place. Hospitals should also go the extra mile to advertise their policies so that people are aware of their concern for their stakeholders and communities. This would build confidence among the patients about their hospitals’ commitment towards protecting their privacy. These processes will only help the hospital to be one step ahead of other healthcare...
practices that do not have such processes in place. Thus, it is clear that it is not only the eRx system that is going to make the difference but a lot of internal processes as well that play a major role in helping these healthcare practices realize the full benefits of an eRx system.

**Customer and Stakeholder Perspective**

From a customer and stakeholder perspective, implementing eRx systems creates a number of value propositions. Implementation of an eRx system brings down healthcare costs dramatically for the patient. An eRx system ensures greater adherence to a patient’s formulary and insurance plan coverage. In addition to this, eRx systems along with appropriate internal processes would ensure that physicians provide a valid reason for prescribing medicines not in the patient’s formulary plan. PBMs and healthcare insurance companies are also expected to lower coverage costs for those seeking treatment in hospitals that prescribe electronically. All these reduce the out-of-pocket pay for patients. Doctors receive complete information about the patient’s medical history and, thus, easily avoid any drug-related allergies. Events related to drug–drug interactions are also minimized to a large extent. Patients will be able to understand that an eRx system simplifies the drug dispensing mechanism and almost completely eliminates prescription errors arising from misspelled drug names, unclear physician handwriting, and pharmacists misunderstanding drug names. Thus, improved quality of healthcare will ensure increased patient participation and indirectly increase revenues for the healthcare facility.

Additionally, implementation of an eRx system with other supporting hardware and infrastructure will ensure 24/7 patient information, pharmacy information, and formulary and coverage plan information availability. Bad experiences due to system failure can damage a hospital’s reputation and make the stakeholders averse to using the eRx system. By following the processes mentioned above, hospitals can minimize such incidents. The functionality that the system provides is also a drawing factor for patients. By engaging in partnerships with leading PBMs and pharmacies, a hospital can instill further confidence amongst patients with regard to their eRx system capabilities and the support that big stakeholders show towards its implementation.

**Financial Perceptive**

Successful implementation of eRx systems has the potential to reduce the costs associated with adverse drug events, claim management, and refills by increasing the accuracy and efficiency of prescription. Furthermore, implementation of eRx systems can also reduce costs for healthcare providers by facilitating their various processes required to comply with pertinent healthcare regulations and laws with regard to prescriptions and medications. On the other hand, eRx systems could also increase a healthcare provider’s revenue, particularly for smaller physician offices, by attracting more patients who realize the benefits of e-prescribing. Overall, if risks are properly controlled, implementation of eRx system could generate business value for all stakeholders.

The above discussion is concisely represented in the eRx implementation strategy map shown in Table 1. We believe that this theoretical framework can be used by hospitals and physician practices as an integrated strategy template for establishing effective technology–organization alignment, and thereby achieving success in their eRx implementations.

**CONCLUSION**

Costs and patient safety have become major issues in the healthcare industry. An eRx system has the potential to reduce prescription costs and errors, streamline the processes, and improve the efficiency and quality of healthcare. Therefore, it is important to understand the barriers to adoption and successful implementation of eRx systems with particular emphasis on the institutional factors that may have an impact on innovation implementation within the healthcare industry environment. This article proposes a framework, rooted in theories of technology–organizational alignment and strategy maps, to overcome the barriers in eRx implementation. The theoretical framework developed in this article could enable hospitals and physician practices to prepare their eRx implementation plans in an integrated manner by understanding the relationships between information capital, internal processes, benefits of eRx to various stakeholders, and financial gains that can accrue from the use of eRx systems.

**Implications for Research**

First, our study is one of the first, if not the first, that uses a strategy-maps approach to examine information systems implementation, especially in a healthcare setting. While the strategy map developed in this study focuses only on the implementation of eRx systems, it provides a comprehensive approach for future studies to examine the implementation of other health information systems, such as clinical decision systems and Computerized Physician Order Entry (CPOE) systems, or general information systems.

Second, to our knowledge, there are no studies about eRx implementation that have focused on institutional barriers and enablers. Findings from this study provide an excellent starting point for future studies about institutional factors and environment that impinge upon successful eRx implementation. For example, some constructs proposed the strategy map could be operationalized and their relationship to the eRx implementation success could be quantitatively examined.

Third, our work lays the foundation for the development of a normative theory, what Gregor (2006) calls a “Type V: Theory for Design and Action” that subsumes Hevner, March, Park, & Ram’s (2004) design science approach, for successful implementation of eRx systems. Such a theory would enable a deep
Understanding of the eRx implementation phenomenon from all important perspectives, rooted strongly both in theory as well as in fieldwork. It also should be both comprehensive and easy to understand and use. Our qualitative field study, which was rooted in the theories of techno-organizational alignment and strategy maps, is the first step toward that direction.

**Implications for Practice**

Our study provides guidance and a template for healthcare providers and their stakeholders to understand the value of eRx systems and to plan their eRx implementation efforts. Unrealistic expectations and lacking of understanding of implementation processes have been attributed to the failure of eRx implementation. The strategy map would mitigate those problems by presenting healthcare providers a comprehensive view of the outcomes of eRx implementation and the steps to achieve them.

Coordinated care has been emphasized in recent years as a critical way to improve quality of care. Our framework showed how part of coordination could be facilitated through the eRx implementation by considering and balancing all four aspects of the strategy map. Our study also showed that strategy map has potential to be applied in healthcare section, which usually involves multiple stakeholders, to improve the efficiency and quality.

**Limitations**

Our study is not without limitations: First, this article proposes a conceptual framework to implement eRx using a strategy-maps approach. While the conceptual model presented in this article was based on fieldwork, the effectiveness of the proposed model should be further empirically tested in future field studies. Also, while the proposed model is based on theories of technology–organizational alignment and strategy maps, the proposed theoretical model would have benefited from an examination of several actual eRx implementations based on which “best practices” can be garnered. Due to the nascent state of this phenomenon, this remains a task for future studies. Second, our study is focused on implementation of eRx systems. It is also worth studying the design of eRx systems from a features perspective as some features can facilitate the adoption and implementation of eRx systems. Third, an eRx system is only one of the sources for patients’ medication information, and how this system should be integrated with other systems (e.g., Electronic Medical Records) remains an area of further investigation. Fourth, the proposed framework for eRx implementation in the form of a strategy map developed in this article was based on a limited number of interviews and fieldwork, so the generalization of this framework should be cautious. Future studies should carefully validate this model, and enhance wherever necessary, with more in-depth case studies and field research.

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