

# A NEW MODEL FOR SUCCESSFUL CPOE DEPLOYMENT AND IMPLEMENTATION IN HOSPITALS

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Abstract: In spite of the importance of information technology (IT) for many health organizations to help manage the enterprise daily transaction, IT project failure rates still remain high. This suggests continued exploration of new process model and organization structure to nurture strong project performance. In this paper we propose a new model for successful implementation of IT projects. The proposed model calls for the establishment of a program management office (PMO) to implement corporate strategy for project management and to transform the organization into a learning one. The model is explained in details using an example of a Computerized Physician Order Entry (CPOE) implementation.

## 1 INTRODUCTION

Between 50,000 to 100,000 Americans die each year due to medical errors and about 1 million people are injured (IMO, 1999). In response to these shocking numbers reported by the Institute of Medicine (IOM), some healthcare organizations embarked on computerized physicians order entry (CPOE) systems.

Health care organization leaders are becoming well aware of the potential value of advanced clinical information systems such as Electronic Medical record (EMR) or computerized patient record (CPR) to improve outcomes, reduce medication errors, increase health care efficiency, and eliminate unnecessary costs. Many health organizations have invested significantly to plan, procure, and implement these advanced systems, including the current focus on computerized physician order entry (CPOE) (Haux, 2006). However, despite their knowledge, investments, and best intentions, most healthcare organizations have not realized a return on their investments (Berger, 2004). One probable reason for this problem is that the key users – physicians and other clinicians – are not using the technology to its greatest potential or, in too many cases, have not begun to use the technology at all. CPOE represents a monumental

step forward for healthcare organizations because it embodies a shift from traditional, paper-based care coordination activities to automation of the order entry processes. This shift can be an agent for change, eliminating confusing or illegible handwritten order documentation, minimizing transcription errors and fundamentally reducing clinical mistakes (Snyder, 2006).

In this paper, a new model for successful implementation of CPOE project in hospitals. The model consists of three main components; the first component is concerned with the stages taken by organization to deploy new technology innovations which is in turned composed of four stages: visioning, matching vision, deployment, and evaluation and improvement. The second component deals with the main knowledge barriers to IT innovation diffusion as suggested by literatures. The third component is concerned with the critical success factors of IT innovation implementation as suggested by various literatures.

## 2 CPOE SYSTEM OVERVIEW

CPOE is a process of electronic entry of physician's orders and instructions for the treatment of patients. These orders are communicated over a CPR to the

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medical staff (nurses, therapists or other physicians) or to the departments (pharmacy, laboratory or radiology) responsible for fulfilling/documenting the order.

CPOE is not a technology, rather it is a workflow design (or redesign) of clinical processes that integrates technology to optimize physician ordering of medications, laboratory tests, etc. (AHRQ, 2001). CPOE uses clinical decision support systems and links to hospital systems to generate prompts and alerts during the ordering session to notify of potential errors such as contra-indicated medications or routes or duplicate orders. Integration with other hospital information technology systems including electronic patient records, pharmacy, laboratory, and other services provides the physicians with all information necessary to develop and transmit an effective, error-free order (Metzger, 2003).

In May 2001, thirteen CPOE experts from around the world gathered at a 2-day conference for the purpose of developing recommendations for CPOE implementation (Ash, 2003). A list of high-level considerations was generated to benefit organizations thinking about implementing CPOE as follows:

- Motivation for Implementing POE
- Vision/Leadership/People
- Costs
- Integration/Workflow/Health Care Processes
- Value to Users/Decision Support Systems
- Technical Considerations
- Management of Project
- Training/Support/Help at the Elbow
- Learning/Evaluation/Improvement

### 3 PROJECT MANAGEMENT OFFICE

In this context, we adopt the PMO's definition proposed by PMI (PMI, 2004): "An organizational body or entity assigned various responsibilities related to the centralized and coordinated management of those projects under its domain. The responsibilities of the PMO can range from providing project management support functions to actually being responsible for the direct management of a project". A PMO focuses on the activities with relation to projects including training, process standardization, consulting, identifying of best practices, project prioritization, and reviewing project progress (Bolles, 2004).

## 4 INFORMATION SYSTEMS SUCCESS

DeLone and McLean in 1992 conducted a comprehensive review of IS success literature and proposed a model of IS success (Delone, 1992). It suggested that the success can be represented by the system quality, the output information quality, consumption (use) of the output, the user's response (user satisfaction), the effect of the IS on the behavior of the user (individual impact), and the effect of the IS on organizational performance (organizational impact). An updated model was proposed in 2003 (Delone, 2003) as shown in figure 1. The primary differences between the original and updated models included:

- The addition of Service quality category to reflect the importance of service and support in successful e-commerce systems,
- The addition of "intention to use" to measure user attitude, and
- The merging of individual impact and organization impact into one category concerned with net benefits.

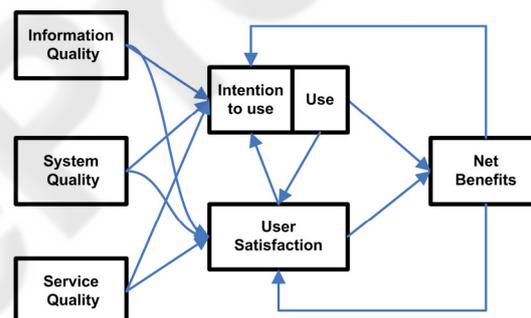


Figure 1: Updated Delone & McLean model of IS success.

## 5 KNOWLEDGE BARRIERS

Various study researches highlighted several barriers to innovation (Attewell, 1992; Tanriverdi, 1999; Nambisan, 1999). The adoption and implementation of complex IT solution is influenced by the organization's ability to lower or remove the various knowledge barriers. Knowledge barriers associated with the adoption of larger-scale IT solutions can be categorized into four categories: project/economic barrier, technical barriers, organization barriers, and behaviour barriers (Pare, 2007).

- Project/Economic barriers: This category is concerned with the financing and project management issues faced when acquiring innovation.
- Technological barriers: This category is concerned with the lack of knowledge required to carry out technical tasks needed to adopt new innovations.
- Organizational barriers: This category is concerned with the difficulties of deploying a new technology into existing practices and processes.
- Behaviour barriers: This group is concerned with the resistance to change among individuals affected by the implementation. It is also concerned with organizational power dynamics.

## 6 THE PROPOSED MODEL

Figure 2 shows a new model for successful implementation. The model consists of three main components; the first component is concerned with the stages taken by organization to deploy new technology innovations which is in turned composed of four stages: visioning, matching vision, deployment, and evaluation and improvement. In visioning phase, institutions define the corporate mission, objectives, and strategy. This phase is mainly concerned with identifying and prioritizing the organizational problems and opportunities that form the basis of the need to acquire innovations (Rogers, 1995). The second phase is concerned with the fit between a need identified in the first phase and the innovation proposed. In this stage we should determine whether the innovation will truly solve (or at least solve) one of the problems identified in the first phase. At the end of this phase, the organization decides weather or not to approve the innovation project.

In the event that the project is approved, the third phase of the process, deployment, begins. This phase includes all decisions and actions related to the deployment of the innovation. It includes also the assimilation and the integration of the innovation within the organization. At the end of this phase, the IT innovation solution is deployed within the organization. Evaluating performance is an important step for ensuring the quality of the innovation deployment. This phase emphasizes process flow optimization and continuous expansion of the system to gain competitive advantage.

The second component deals with the main knowledge barriers to IT innovation diffusion. The

third component is concerned with the critical success factors of IT innovation deployment as suggested by various literatures (Ash, 2003).

After the successful deployment of innovation, the list of benefits and lessons learned feeds a knowledge base which in turn feeds all three components described in the model. Knowledge sharing behaviours facilitate learning among Project team members and enable them to resolve problems similar to situations encountered by others in the past, thus enabling more successful projects.

The proposed model calls for the establishment of a program management office to implement corporate strategy for project management. The main goal of this office is to translate the organization's strategic plan into projects and programs. The PMO is accountable for enterprise-wide distribution of project management best practices. Therefore, for the model to work properly, Organizations should invest in project management training for the staff working in the PMO.

The main advantages of this model is the strategic alignment of projects which bears on the synergy created by the management of relations between projects, and the ability to develop a better understanding of the challenges faced in carrying out information systems projects, the factors for success, and the strategies required to take advantage of IT. The acts of sharing are very important since a project's knowledge will not have much impact on the organization unless it is made available to other projects. Such learning organizations would be aware of the repeated knowledge barriers to innovation adoption and a well defined plan to address these barriers would be developed. Moreover, the knowledge base will help these organizations refine their strategies and prioritized plans. This allows for focusing on preparation for future projects which is rarely covered in literature.

## 7 APPLYING THE MODEL FOR CPOE DEPLOYMENT

Figure 3 shows the detailed model for CPOE implementation as explained in the following sections:

### 7.1 Visioning

Institutions should align the strategic vision process with the budgeting process to produce a realistic prioritized strategic plan. The strategic plan will be used as an input to the IT strategic plan in order to ensure that the IT plan is closely integrated with the

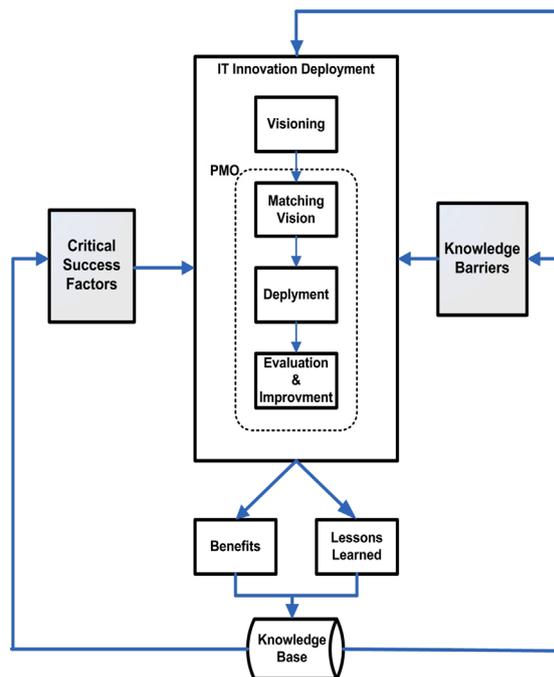


Figure 2: The proposed model for IT diffusion.

organization's strategic initiatives and business directions and provides the opportunity to use IT as a tool to enable systems integration as well as deliver information as a strategic resource. The visioning phase should address the Economic barrier. Moreover, there are some strategic CSFs related to this phase such as top management support, business plan and vision, and cost/benefit analysis.

### 7.1.1 Addressing the Economic/ Project Barrier

Organizations deploying CPOE solutions should address the financing issues faced when acquiring the solution. These barriers include barriers associated with project management skills. Moreover, multi-site implementation of CPOE presents special concerns. Firstly, each site had its own processes which may not be consistent with other sites. Secondly, multi-site organizations need to choose whether the implementation is done simultaneously in all facilities or in one facility at a time.

### 7.1.2 CSFs for the Visioning Phase

- **Motivation for Implementation:** The IT strategic plan along with the organization's strategies should provide a clear

communicated business plan and vision to steer the direction of the CPOE project and other IT projects. This factor influences the funding, the political support, and the clinical leadership.

- **CPOE Vision, Leadership, and Personnel:** Successful deployment of IT innovation requires strong leadership, commitment, and continuous support by top management. A shared vision about the CPOE project should exist throughout the organization.
- **Cost/Benefit Analysis:** This analysis is instrumental for organizations in order to secure fund. This analysis would act as the basis for defining the success criteria for the CPOE project.

## 7.2 Matching the Vision

The PMO office plays an important role in matching the fit between projects, proposed by departments, and the organization vision and strategies. In this phase the organization should decide if the projects proposed match the vision or not. In case there is a match, a decision is made to invest on the proposed solution. If there is no match, the PMO office should update the organizational knowledge base and record the reasons. In some cases, the project proposals need further research before a decision is made. This phase is affected by the same barrier and CSFs as in the previous phase.

## 7.3 CPOE Deployment

### 7.3.1 CPOE Package Selection

Organization should make an extensive review of available CPOE Systems to select the package that has the best match of the organization's vision and strategies. The decision should be based on several factors including price, supplier support, ease of implementation, closeness to fit to organization's business, technological risks, and local experience.

### 7.3.2 CPOE Project Life Cycle (PLC)

Organizations implementing CPOE systems usually modify business processes (as reasonably required) to conform to "best practices" discovered during the implementation of the CPOE project. These opportunities for process improvements would be identified during Business Process and Fit/Gap Analysis workshops, consulting visits and by the project team members as they become familiar and comfortable with the software. Process change

proposals would be considered and approved by the project management, steering and policy committees as part of the governance of the project. This phase is concluded when the CPOE solution is deployed and is running within the organization.

### 7.3.3 Addressing Knowledge Barriers

- Technical barriers: These include the technical infrastructure readiness. Organizations might need to upgrade their network infrastructure, upgrade the data centre's servers, and recruit technical and functional analysts to support the project. Data migration from legacy IT systems to the new CPOE is an essential task in this project. Finally, a maintenance contract is required to ensure the availability of the CPOE solution.
- Organizational barriers: These include change management processes to align the CPOE with existing practices and processes.
- Behaviour barriers: These include end-users resistance to new innovations. Organizations should conduct a lot of training sessions to introduce the new innovation.

### 7.3.4 Critical Success Factors

- Integration: Organization should have a clear plan for integrating the CPOE into existing environments and workflows. This factor is also concerned with integrating the CPOE into other hospital applications and possible legacy systems.
- Value to Users: Organizations should have a clear change management strategy which includes analysis of the current business processes to identify the areas for improvement. Physicians must be shown CPOE benefits including the embedded decision support logic that helps to improve the quality of patient care.
- Project management: Organizations should appoint a dedicated full-time project manager. The management of the project covers the technical and functional aspects. A qualified project manager manages five main functions; managing scope, managing project team, managing quality, managing cost, and managing time.
- Technology: Organizations should make sure they have a good technical infrastructure before "Go-Live". The project team should

make a balance between customization and standardization; where physicians of the same specialty would have a common CPOE screen which might be different than screens for different specialties. Organizations should also have a comprehensive system testing plan to test the functionality of each module alone and in conjunction with other modules.

- Training and support: Organizations should have a comprehensive training plan which includes functional and technical aspects of the project. In large organizations, "train the trainer" approach is usually considered. Additionally, Organizations should consider proper support plan including 24\*7 support for at least several days post go-live.

## 7.4 Evaluation and Improvement

Finally, evaluation and improvement phase come into action after the CPOE system is already deployed within an organization. It is important that organizations define the success criteria of the CPOE project and use it to monitor the project. CPOE system should be monitored forever and should receive continuous improvement. Organizations usually assume that their operational performance will be improved immediately after the "go-live". Instead, due to the complexity of CPOE systems, organizations should expect an initial decline in their performance. Once the system is stable and users are more aware of its capabilities, improvements will take place.

## 8 CPOE BENEFITS, LESSONS LEARNED

After the CPOE system is already deployed, the PMO should measure the benefits realized by the project and tie them to the organizational strategic goals. It is also important that the PMO assembles a list of lessons learned from this project. The list of project benefits and lessons learned are then fed into the organization knowledge base. The knowledge base will provide projects information back to the organization visioning process and will be used to refine the list of CSFs and knowledge barriers for future projects. The feed back loop will transform the organization to becoming a learning one.

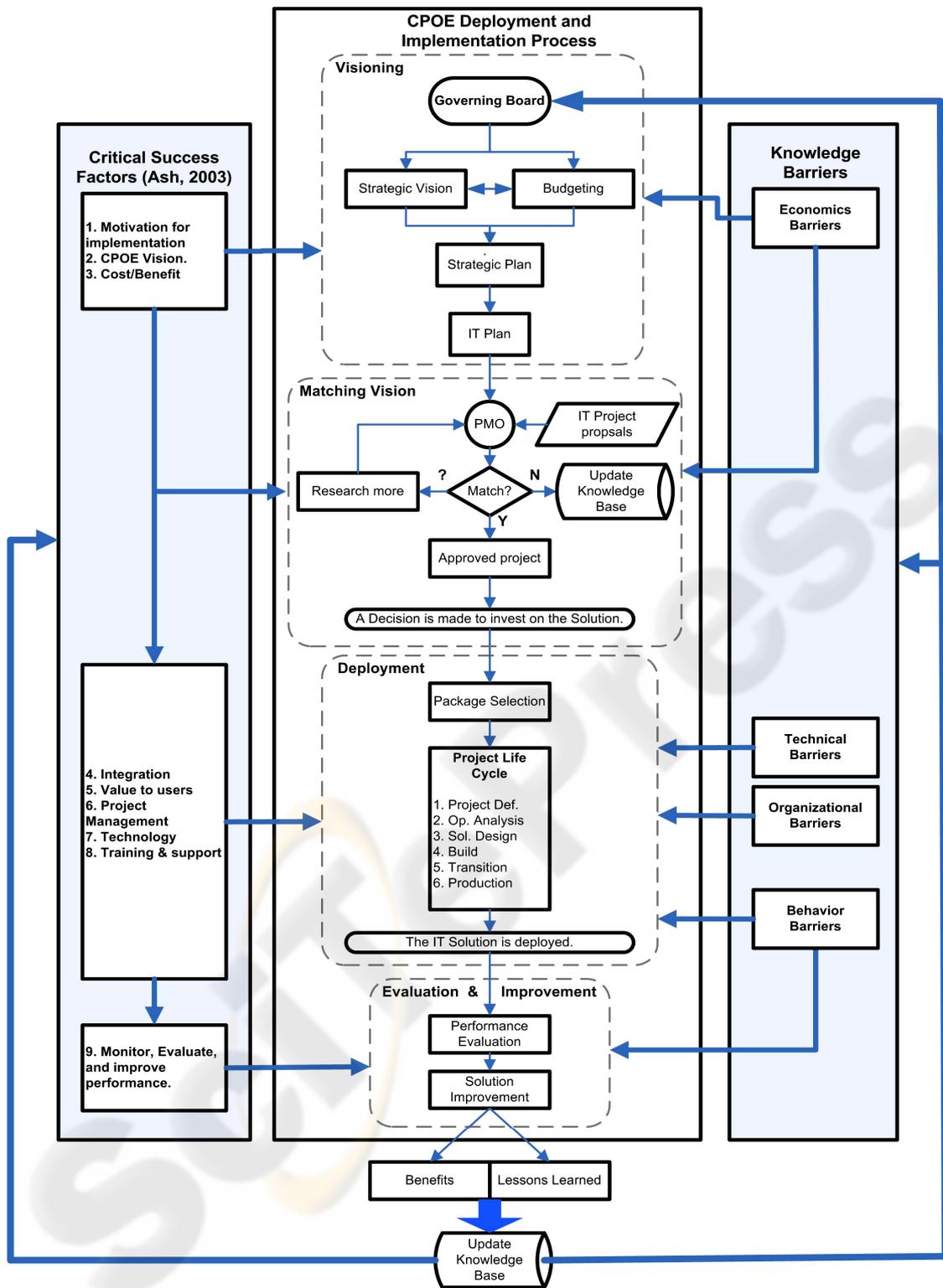


Figure 3: The proposed model for CPOE deployment and implementation in hospitals.

## 9 CONCLUSIONS

Enterprise-wide daily transactions are difficult to manage due to their complexity and scope in terms of rendering services to their clients. As a result, many organizations employ Information Technology (IT) to manage their enterprise-wide transactions and to ensure quality of services. IT, when properly selected and implemented, helps organizations increase their efficiency and capabilities which improves the organization's competitive advantages. In spite of the importance of information technology (IT), IT project failure rates still remain high. This suggests continued exploration of new process model and organization structure to nurture strong project performance.

In this paper we propose a new model for successful implementation of IT projects. The model consists of three main components; the first component is concerned with the stages taken by organization to deploy new technology innovations which is in turned composed of four stages: visioning, matching vision, deployment, and evaluation and improvement. The second component deals with the main knowledge barriers to IT innovation diffusion as suggested by literatures. The third component is concerned with the critical success factors of IT innovation implementation as suggested by various literatures. The proposed model calls for the establishment of a program management office to implement corporate strategy for project management and to transform the organization into a learning one. The model is explained in details thru an example of CPOE implementation.

The acts of sharing are very important since a project's knowledge will not have much impact on the organization unless it is made available to other projects. Although knowledge exists at different levels of an organization, for instance, at the individual, team, and organization levels, sharing of knowledge at the individual level is critical to an organization.

It is expected as organizations use this model for several projects; more knowledge would be gained and used towards more successful project in the future. Critical success factors would be refined more and be closely tied with organization culture. Such learning organizations would be aware of the repeated knowledge barriers to innovation adoption and a well defined plan to address these barriers would be developed. Moreover, the knowledge base

will help these organizations refine their strategies and prioritized plans.

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