Using SDLC Methodology to Implement HIT

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HIT failure rate has been estimated to be as high as 50 – 70 % and is considered a major barrier to adoption of IT by the healthcare industry. Factors like staff resistance to change and non-compliance, inadequate management, policies and procedures, and technical failures emerge as primary reasons for HIT implementation failure (Kaplan & Harris-Salamone, 2009). Strategies like interdisciplinary collaboration, open communication, staff training and support, and strong leadership could mitigate risk of failure due to above listed factors. Technological assessment of workflow and decision-making processes, and application of cognitive and human factor engineering principles are important for developing a system that would meet organizational and user needs.

The implementation of HIT significantly alters technical, social, organizational, economic, cultural, and political aspects of the work environment. Since healthcare is a very complex, highly dynamic and interactive environment, an iterative software development/ implementation process like System Development Life Cycle (SDLC) is one of the best suited approaches for successful implementation of HIT. SDLC is unique in capturing constantly changing system requirements through obtaining feedback from system users and integrating cognitive-social technical aspects into various phases so that both the organizational and user needs are met (Conrick, 2006).

The five steps of SDLC are:

- Process of planning and requirements definition
- Analysis
- Design of the new system
- Implementation
- Post-implementation support (such as maintenance and security).

The purpose of this paper is to use SDLC framework for successful implementation of HIT by incorporating these strategies in appropriate stages of SDLC.

Planning

The planning phase is the most critical phase of any project as it provides the direction to entire project. Any failure at this stage will negatively affect the outcomes of successive stages. The main tasks of this stage are defining the scope and problems, exploring possible solutions, selecting the solution by conducting feasibility tests, developing the project schedule, assimilating required resources for the project, and launching the project.

Identify and define goals.

Identifying objectives and establishing shared deliverables of the project is critical to contain the scope of the project and is also instrumental in gaining long-term commitment, support, and acceptance from the users. The patient should be established as the beneficiary of HIT to make sure that the objectives will not be altered frequently based on the dynamics of stakeholder relationships during project development (Lapointe & Rivard, 2005). To develop safe and acceptable systems, clinicians who understand the clinical workflow and processes should be actively involved in the selection and customization process.

Open communication and collaboration.

Open communication of the purpose and objective of the project is imperative for clinician engagement and early buy-in. Setting realistic expectations from the system provides opportunity to clarify objectives, formulate perception of outcomes and benefits, and give psychological ownership to all participants (Blake, et al. 2010). Establishing a robust communication plan is necessary for collaboration, synchronization, and transparency of developmental process. The feedback received from users is critical to the adaptive process of SDLC for customization and optimization of HIT.

Strong and visible leadership.

The leadership should reinforce the commitment to its vision and guiding principles at all levels to gain collaboration and acceptance from all stakeholders. It should help to resolve any conflicts and to create a sense of urgency for the need of new technology. For example, ineffective leadership at a recent client created a climate of conflict that resulted in complete implementation failure of the information system.

Feasibility determination.

Confirm the feasibility of the project from several different perspectives; technical, economic, and organizational. To mitigate the risk of going over-budget (besides the obvious costs of acquiring the technology and cost of human and financial resource required for implementation), training and support should be considered. Items that should be factored in feasibility and evaluation for budget allocation are: Compatibility and interoperability of a selected system with existing infrastructure, additional investment in infrastructure, additional staffing needs, training and support provisions, and resources for customization and redesign of the system (HIMSS, 2008).

Analysis.

Tasks of the analysis phase are prioritizing the requirements, generating and evaluating the alternatives, reviewing the organizational policies, and making recommendations for management. The systems developed or customized based on erroneous requirement specifications do not meet organizational and user needs and cause delays, data loss, errors, and breakdown of communication processes (Koppel et al. 2008).

Changes in communication.

Communication functions and patterns are embedded into the work processes and artifacts. The implementation of HIT drastically changes the communication patterns and processes, and reorganizes inter-departmental relationships. Since the process of clinical decision-making relies heavily on communication processes and information flow amongst members of interdisciplinary teams, to understand the functionality of the artifacts and identify user needs, analysts should use direct observations with interviews and surveys for process mapping and analyzing the workflow (Bisantz, 2008).

User needs and cognitive aspects.

Staff resistance usually originates from the fact that the system does not meet their needs or the design is not compatible with the workflow. Techniques like cognitive task analysis, cognitive engineering, ergonomic evaluation, and human factor engineering help in identifying concepts, contextual cues, goals, and strategies employed by users to understand cognitive processing of given tasks. This is important for user interface development (Weir et al. 2007).

Infrastructure and system requirements.

Analyzing technical requirements of the system is an important component of the analysis stage. It is imperative to analyze the additional demands made on ancillary departments for hardware, software, staffing and space needs, as well as policy changes required to accommodate new technology. Pilot testing for compatibility with existing infrastructure and technology should be done. Alternatives should be evaluated and matched with the needs of the organization, existing infrastructure, and the technology under consideration. Other system requirements, such as wireless connectivity and AC outlets for docking mobile units, should be analyzed to avoid surprises in implementation stage.

Reconfiguration of policies and processes.

The statement by David Liebovitz, "The conversion to electronic medical records shines a bright light on problematic paper processes," summarizes the importance of analyzing the workflow processes, communication, decision-making tools and organizational policies. Technology alone cannot overcome ineffective processes. Recommendations should be made to institute organizational policies and procedures that are compatible with new work processes and technology. To minimize interruptions to the process and workarounds, and maximize the accuracy and efficiency of the system, in-depth analysis should identify the functionality and constraints of each process in order to assign tasks to computer or humans to exploit their respective strengths (Pingenot et al. 2009).

Design.

The design phase determines the architecture and operation of the system with regard to processes, hardware, software, networking, data retrieval, archiving and use, user interface, etc.

Understanding purpose and system interactions.

The system is designed based on the purpose of the system, system requirements, and user needs determined in two earlier phases. It is important to reinforce that primary purpose of all tasks is to improve patient safety. A well designed system should assist the users, accommodate workflow, and support the cognitive processes. If the designer is not cognizant of user needs, the application of the system, system interaction with environment and barriers to its optimal utilization, the system could introduce unintended consequences that might jeopardize patient safety (Bisantz, 2008; Koppel et al. 2008).

Establishing communication pathways.

The system should be interoperable, have built-in communication pathways for flow of information, and a robust user interface to recognize and mitigate potential workarounds. The cognitive processes used by interdisciplinary team members for effective communication should be captured by design to avoid degradation of coordination. Users should be able to observe the reasoning of automatic processes performed by the system, and system design should require human involvement to validate the final action (Bisantz, 2008; Koppel et al. 2008). The user should be able to take manual charge using override functionality.

Avoiding workarounds.

Users circumvent the safety mechanisms of the system by omitting the steps that are perceived as time consuming and unnecessary, compromising the safety benefit of the function (Cochran et al., 2007; Koppel et al., 2008). Comprehensive screens should be designed to quickly scan, search and review the information at a glance. Users tend to develop workarounds if the system is inconvenient to use, has poor usability, and disrupts workflow due to poor system design.

Customization.

To eliminate the workarounds, off-the-shelf software should be customized to match the needs of users and organization. The system should be designed to stabilize the work processes and the environment. Screen flow and embedded clinical decision support in the system should be based on recommendations of cognitive task analysis. Customization to provide clinical decision support, alarms, and alerts should be carefully evaluated as excessive and difficult to override alerts cause the user to either ignore or bypass such checks or ignore alarms (Cochran et al., 2007). System design should maintain a critical balance between standardization and flexibility to accommodate practices in different specialties, and changing priorities especially in critical care settings to gain user compliance.

User interface.

User interface is the most visible component of the system design and most important determinant of user acceptance. An effective interface readily provides critical task information and ensures direct visibility of relevant information. Users seek workarounds if the system design fails to acknowledge human factors and ergonomic principles, such as poor placement and storage of equipment, limited access, poor screen design, etc. Principles of human computer interaction should be used as guiding tenets to design interface (Zhang et al., 2004). The user interface should be simple and include sufficient information to complete the task. The layout should be predictable, consistent, and the navigation should be easy. Minimal screen navigation to complete tasks, use of standardized terminology, appropriate color scheme and font sizes are some of the features that should be incorporated in design. The clinical decision support features, like alerts and reminders, should be easily noticeable, easy to override, and strategically used to avoid alert fatigue (Karsh, 2009). Besides ease of use, usability is a critical factor in achieving user support. Any factors that will diminish the usability, actual or perceived, will make the implementation process more complex and difficult, increase the possibility of workarounds, and training will be harder and more costly (HIMSS, 2009).

Work processes.

A new system has to be supported by policies and processes to be effective. It is important to design work processes that are aligned and integrated with technology for building effective, interoperable communication networks (Pirnejad, Bal, & Berg 2008). The organizational policies and procedures should be redesigned to be compatible with the changes brought about by BCMA implementation. System design should comply with security and confidentiality protocols required by organizational and regulatory bodies like JCAHO and National Committee for Quality Assurance (NCQA), and the design should be flexible to incorporate new regulations as they apply.

Implementation.

In this phase, the system is customized, tested, and installed. Staff training, system maintenance, and evaluation of outcomes are essential components during the implementation process. The system flaws are evaluated and redesigned. This phase culminates only with retirement of the system. Maintenance and support is a continuous process. The maximum amount of time, finance, and human resources are invested in implementation phase.

Implementing IT projects in any setting can be difficult, but healthcare presents even more challenges because of multiple stakeholders with individual sets of system requirements and several perceived or actual conflicting roles, interdisciplinary dependence, complicated communication patterns, and multiple regulatory and ethical constraints (McManus & Wood-Harper, 2007). A strong and visible leadership support is imperative to address all the complexities of healthcare and to facilitate effective communication and change management processes while seeking collaboration from all stakeholders.

Ensure two-way communication.

Communication process between the staff and management should be a feedback loop. Expectations from the system and the users need to be clear and punitive actions for reported errors need to be discouraged. Various organizations have found that the strategies like establishing focus groups, making safety rounds to identify workflow and system issues, and soliciting feedback have enabled them to gain staff acceptance, and redesign the system for better outcomes (Hook et al. 2008). Retrospective analysis of the system and a robust multidisciplinary quality monitoring system reveals the system flaws (Hidle, 2007). Based on this analysis, the organizational policies should be redrafted to make them compatible with the changes introduced by implementation of new technology.

Training and support.

Training and support is a vital strategy to achieve acceptance and compliance by the staff. Adequate training, continual support, and increased familiarity with the system improves user satisfaction and acceptance of new IT/IS technology, inculcates adherence to the best practices, and minimizes the negative effects of technical failures by providing understanding of the technology and its implications (Koppel et al. 2008). Though, one unintended consequence is over-dependence on technology. To mitigate this risk, it is important to stress to the users that technology is only a component of a comprehensive patient safety strategy and the technology should not be considered as replacement for clinical judgment of the nursing staff (Cescon & Etchells, 2008).

Establishing oversight committees and drafting non-compliance policies.

Since the objectives of patient safety, user satisfaction, efficiency, and cost savings could only be realized if staff is compliant with the new system/technology, policies and regulations have to be enforced to deal with non-compliance issues. Non-compliance incidents should be investigated to determine the root cause, maintain compliance and improve the processes to eliminate workarounds. Legal and quality assurance departments have to be part of this initiative. Strong and committed leadership is necessary to ensure compliance (Goldstein, 2007).

Evaluation and maintenance.

Project development of any information system in healthcare environments is a dynamic and iterative process that constantly needs to be adapted to contemporary practices. The changing roles of staff and interpersonal relationships, and ever evolving technology, environment, and organizational needs have to be constantly accommodated into system design. Constant evaluation of the system by a designated core multidisciplinary team should be administered to identify any issues that could undermine its functionality and utilization (Paoletti et al. 2009). Once a problem is identified, the entire process of planning, analysis, design, and implementation is repeated.

Constant upgrade and maintenance of databases to ensure viability of the system is also critical for a successful sustained system. Similarly, the policies and procedures should be updated to support the technology use.

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