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Standardizing Implementation of a Surgical Information System in Danish Hospitals – A Comparative Study

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Abstract

Implementation of IT-systems in modern healthcare organizations is associated with large, complex, and expensive projects. Purchase of the system is costly, but resources used to implement the organizational changes that follow, can be extensive. In an attempt to reduce costs, and at the same time to provide a thorough basis for local implementation, Corporate IT in The Capital Region of Denmark developed a standardized system-specific implementation concept for use by the hospitals´ local implementations of a Surgical Information system. The system has been implemented in five hospitals within the Capital Region. Through document analysis and interviews with the local project managers, we investigated the use and effectiveness of the standardized implementation concept across five hospitals involved. The study shows that total resource requirements and duration of projects are difficult to compare due to different constructions of the project organizations. We conclude that the implementation concept supports local IT-implementations, but parts of the concept are difficult to translate into practice, while other parts are directly operational.

Keywords:

Standardization, Implementation, Surgical information system, Organizational innovation, Change management

Introduction

Implementing new IT-systems is an activity which modern healthcare organizations have to manage alongside day-to-day operational tasks. These implementation projects are often large, complex and expensive, since they include not only costs related to the purchase of the IT-system, but also resources concerning the associated organizational changes that are required. A detailed plan that is driven by both capacity for change and context of change [1] is required, which includes change management, training, workflow analysis, and configuration of the IT-system [2].

One way to control IT implementation costs in large organizations is to standardize the implementation process. However, such a top-down approach can be problematic when viewed from a sociotechnical perspective, which argues that the specificities of the local work practices are essential and need to be taken into account for the setup and use of a new information system [3]. In an attempt to standardize the implementation processes and thereby reduce costs, while simultaneously facilitating the local adoption of the IT system, Corporate IT in the Capital Region of Denmark developed a Standardized System-Specific Implementation Concept (SSSIC) for use in the local implementation of a Surgical Information system in the Region´s thirteen hospitals. Development of the SSSIC is based on recommendations from selected literature on implementation [4], which divides implementation into five key activities: communication, workflow analysis, project organization, education, and configuration.

The Capital Region of Denmark has 36,000 employees and is responsible for providing healthcare to the region's 1.6 million inhabitants. Corporate IT is responsible for IT acquisition, maintenance and operations. The local hospitals and their IT-organizations are responsible for implementing new IT systems in the hospital wards. The typical lifecycle of IT-projects in the Capital Region is as follows: Corporate IT is responsible for the acquisition of the system; this phase of the project includes two pilot projects that involve the clinical utilization of the system in two different hospital wards. The aim of the pilot projects is to validate the suitability of the system in real-life work situations, as well as to estimate change requirements and training needs. An impact evaluation of the system is also performed in the pilot projects.

After completion of the two pilot projects, the project manager from Corporate IT and the local project manager in the pilot hospital produce a report that documents experiences gained during conducting the pilot projects. This documentation forms the basis of the SSSIC, which consists of guidelines and templates for use in the different implementation activities such as project organization, workflow analysis, education, configuration and communication. During a collaborative workshop, the SSSIC is presented to the local project managers from the hospitals which are due to implement the system. An overview of the SSSIC is presented in Figure 1 below.

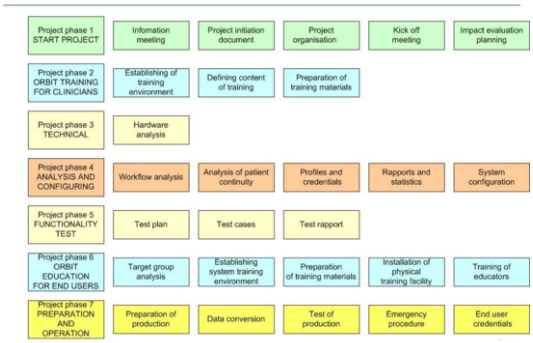

Figure 1- Overview of the Standardized System-Specific Implementation Concept

The first SSSIC was produced in relation to the ORBIT pilot project (OpeRation planning By Intelligent Technology). The purpose of providing the standardized implementation concept to the hospitals is primarily to simplify the implementation process and reduce time consumption for each of the hospitals and thereby reduce cost. Furthermore, the objective is to provide a point of departure for the local implementation projects, identify better practices, and to prevent repetition of mistakes that occur during the pilot projects.

ORBIT is a standardized surgical information system used for planning and documentation of surgical procedures in surgical departments. In addition, ORBIT is based on templates that are configurable by each surgical ward [5]. The system helps to secure effective use of resources needed for each surgical procedure e.g. the operating theatres and manning [6]. The clinicians' real-time documentation provides a constantly updated view of planned, on-going, and completed surgeries. Furthermore, ORBIT provides a graphical overview of the surgical schedule, which is available from multiple locations in each department and allows the ward staff to follow the actual status of ongoing surgeries.

By the end of 2009, ORBIT will be implemented by nine out of thirteen hospitals within the Capital Region and used by 16.000 clinicians. At the time of our study, the system had been implemented in a total of five hospitals. This paper investigates the implementation of ORBIT across these five hospitals with focus on the use and effectiveness of the SSSIC. The structure of the paper is as follows. First, we introduce the methods utilized for data collection and analysis. Second, we present the results of our study. Third, we discuss the findings in relation to the overall aim of the study, and finally, we conclude on the use and effectiveness of the SSSIC.

Materials and Methods

In order to assess the ways in which the SSSIC supports implementation, we conducted a study in early spring 2009, including local projects and their respective project managers in the five hospitals. This comparative study is a simple approach used to extract quantitative and qualitative data concerning the implementation activities [7]. Through document review, we identified and compared similarities and differences related to time utilization and costs in each of the respective projects. Furthermore, we aimed to elaborate on areas of special interest, importance, and unforeseen discoveries. The study focuses on the elements contained in the SSSIC and on the general use of implementation activities. To understand the scale of each project, we extracted quantitative data from local project documentation from each implementation activity in order to objectively compare time and resource consumption in detail.

On the basis of the listed activities in the projects documentation, we developed a semi-structured interview guide to provide direction with regards to the interviews with the project managers of the local implementation projects. Each semi-structured interview guide was further refined with the quantitative data from the document review [8]. The project managers received the interview guide a week prior to the interview in order to validate the questions and to prepare them regarding the issues we wished to discuss. Furthermore, we interviewed the project manager from the Corporate IT pilot project and the Coordinating System Administrator (CSA) who is also employed by Corporate IT.

The aim of the interviews was to validate and elaborate on the information extracted in the document review according to the actual performed implementation activities and use of resources. The interviews enabled us to identify and elaborate on issues unique to the specific hospital and project activities that were carried out differently than stated in the project documentation. We transcribed all interviews, and for analysis we thematized the data according to the elements in the SSSIC, condensed, and construed meaning.

Results

The results from our study are structured according to the listed implementation activities in the SSSIC with focus on similarities and differences between the hospitals. However, the data extracted from the quantitative analysis proved impracticable to compare, due to profound differences in the organization of the local projects and variation in the recording of documentation.

Across the five hospitals, we found great variation in how the local projects were *organized*. This influenced not only the manner in which cost of resources utilized and project duration were documented, but it also affected the duration of the project. In order to optimize new work processes in ORBIT, one hospital decided to introduce Lean as a parallel project with shared resources. Another hospital shared the Executive Group and the administrative tasks with two other projects. In two hospitals, ORBIT was introduced to all of its surgical wards as one, single, all encompassing implementation project. The other three hospitals conducted the project as a sequence of smaller sub-projects with each of the individual surgical ward following one other consecutively. Influenced by the manner in which the local projects were organized, the duration of implementation varied from 32 to 85 weeks across the five hospitals. Ensuring sufficient resource allocation for the im-

plementation project as proposed in the SSSIC, proved a significant challenge for two of the local implementation project managers. The project manager of the pilot project and the CSA acknowledged this challenge, and expressed frustration due to lack of authority regarding the resource availability.

All five project managers emphasized the importance of *communication*; that communication to managerial level, as well as to general staff, is important for consolidating the project in the organization. However, only three of five hospitals had an actual written communication strategy in their project plans, and none of these were in accordance with the guidelines provided by the SSSIC. None of these three hospitals kept to their plans regarding communication to end-users and surrounding context. Furthermore, communication activities were down scaled as soon as concrete operational activities pressed the project. In all five hospitals, the clinical managers were responsible for distributing information about implementation to hospital staff, and in two of the hospitals, the project managers followed-up on this task. The project manager of the pilot projects found it challenging to stress the importance of communication enough in the SSSIC.

The third element we compared was *workflow analysis*, which is used as basis for configuration of ORBIT. An external specialist consultant developed the method proposed in the SSSIC for analyzing workflows. Three of the five hospitals used the consultant to analyze the workflows in their wards. One project manager was critical to the fact that the workflow analysis was confined to only one of the initial phases of the project. She argued that the analysis should be iterative, as it is her experience that project members gain valuable knowledge throughout the entire project. Another project manager was not aware of the importance of introducing the participants to ORBIT before the workflow analysis. As a consequence, several dilemmas surfaced as it became clear that the outlined new workflows were not aligned with the possibilities provided in ORBIT. The project manager in the fifth hospital did not use the recommended method, but chose to observe and interview ward staff as basis for the workflow analysis. Although four of five projects used the method suggested in the SSSIC, local resources in only one of the projects performed the task. The project manager in the pilot project stressed that the method presented in the implementation concept is merely a guideline, including templates, which can be altered or substituted according to local needs.

The fourth element in our analysis is *education.* Training in ORBIT is twofold; a thorough training of the clinicians who partake in the implementation project in order to equip them to configure the system to the needs of the department. And end-user training for ward staff, adapted to the system tasks specific for each profession. An external consultant, who for the most part also produced the training material during the pilot project, performed the training for the project participants in system configuration. In addition, one of the hospitals used the same consultant to facilitate the training of end-users. The training of the staff in the other four hospitals was conducted either by the IT-department or the clinical project members in the ward. The training material produced in the pilot projects and published in the SSSIC had been adapted and used in all five hospitals. In addition, one hospital produced a small educational video as a supplement to the SSSIC.

Configuration is the fifth element of our analysis. System configuration is a comprehensive activity in the implementation of ORBIT. The system must be configured according to the outcome of the workflow analysis (e.g. set up to support the local work practices in each individual ward). First, a test version of the system is installed to run tests according to workflow. Then, the configuration is repeated in the production version of the system including any necessary changes. Optimally clinicians perform this work as it involves items of clinical documentation. Due to pressure in maintaining schedule in the ward, the project manager in one hospital configured the system despite project contracts with clinicians. Consequently, the hospital decided that the future configuration was to be performed by IT-staff. The clinicians configured the system in the other four hospitals, with the support of the project manager.

None of the five project managers used the SSSIC to its full extent, although the training material was widely used. Four of the project managers possessed vast knowledge of the content of the material and the scale of implementation in ORBIT, so they merely used the material as reference and to some extent substituted some of the proposed standardized methods with others. When implementation at the fifth hospital was started, the material had not yet been distributed, but to accommodate this, the pilot project manager from Corporate IT assisted in drafting the project plans for the hospital and accessing the undistributed material. The local project manager with no prior experience in implementing ORBIT, kept close to guidelines, methods and templates recommended by Corporate IT, and did not exhibit the same autonomy as the project managers with prior hands-on experience.

All five project managers found the material useful, but all expressed that a complex implementation project, such as ORBIT, cannot fully rely on written material as distributed in the SSSIC. They shared the opinion that greater use could be made of the coordinating system administrator (CSA) in supporting the local projects at the outset as well as being the carrier of experience between the hospitals. However, they believed that a distributed pack of materials would be adequate for less complex projects.

The Corporate IT project manager involved in the pilot projects, as well as the CSA agreed on this point of view. They strongly suggested involving the CSA as early as possible in the pilot projects, preferably in the test phase in order to gain a thorough knowledge of the system, which (s)he will be administrating. Thus, for projects as complex as ORBIT, they suggested a taskforce to be formed in order to collect and share experience between the hospitals, and to provide assistance in the early stages of the local projects. One of the experiences obtained over time is that the local project managers request implementation concepts for new projects to a greater extent. On these grounds the project manager in the pilot expressed a wish for a much stronger collaborative effort between the hospitals in the production and maintenance of the individual parts of the SSSIC. For example, when a local project substi-

tutes a method with another, elaborates, changes or extends material, they should publish guidelines, templates, and results for use in the other hospitals.

Discussion

The present study examined the use of a Standardized System-Specific Implementation Concept (SSSIC) for use in implementation of a complex IT-system in five Danish hospitals. Due to variation in the organizational construction of the five local projects, the study rendered it impossible to extract comparable objective values for *use of resources* and *project duration* and thereby costs. As a consequence, we omitted the planned comparison of costs and duration of implementation. Furthermore, the study shows that compliance and utilization of guidelines and templates provided by the concept varied across the five hospitals and was primarily related to the local project managers' prior knowledge of the pilot projects. This suggests that both thorough knowledge of the local context and understanding of the technology which are to be introduced, are critical skills for the project manager. This is supported by Lorenzi and Riley who found, that failure to succeed in implementation can be outlined in four major categories: technical shortcomings, project management shortcomings, organizational issues, and the continuing information explosion [2].

Communication is essential to change management, especially managers taking responsibility for change. The clinical management was responsible for end-user communication activities in all five implementation projects. However, the study showed that the concrete tasks in the project and the daily clinical practice often lead to a downgrading of planned communication activities. The organization requires a change owner who constantly demands the implementation of the change [2], and failure to do so, poses a great risk for resistance to the project. For all of the local projects, the IT departments inhabited the role of change owner, performed by the local project manager. For all of the five projects, the local project managers communicated on a regular basis with the Executive Group and clinical managers, but delegated the task of end-user communication to the clinical management. For three of the hospitals, this left the change owner out of touch with the actual level of information provided to the end-users. In two hospitals where the project managers followed up on communication, they were able to instigate further activities for change management.

Most of the local project managers were unable to conduct *workflow analysis* based on the guidelines and template provided in the SSSIC, and three out of five hospitals hired a consultant to perform this task. Workflow analysis is an essential activity when implementing IT systems in clinical wards, but the form and content of the analysis vary widely and depend on the participants and the purpose of the IT system; i.e. Business Process Reengineering (BPR) [9], Use Cases [10], or Computer Supported Cooperative Work (CSCW) [11] is often used. The challenges with workflow analysis are many; including the users' expectations of the IT system being tailored to their workflows and not vice versa. Such a desire can be problematic when implementing standard systems like ORBIT. In addition, it is questionable to what extent it is possible to model clinical workflows, characterized by numerous interruptions and complex decision making [12]. However, for ORBIT projects, workflow analysis is performed in order to enable clinicians to configure the system to best fit local practices. Thus, the need to hire an external consultant to perform the analysis, suggests that the local project managers were not confident in performing the task even with the method presented. The complexity of the method, the managers lack of prior experience of performing a workflow analysis, and for one of the project managers; lack of understanding of how in fact, the result should be brought into effect, are all possible reasons the project managers did not perform the workflow analysis independently supported by the method presented in the SSSIC material.

Thorough *education* of the clinical project members roots the project in the ward; it also transfers the responsibility for system maintenance from the IT-staff to the ward staff, which has the local knowledge needed for configuration and thereby to render a successful implementation possible [13]. The training material and tools included in the SSSIC were used extensively, suggesting that this part of the concept is easier to reuse across the organization. The core functionality of the system is the same and the local project managers can, with few resources, customize the training material to local practice. Nevertheless, one hospital supplemented the existing teaching methods with an educational video. This finding suggests the need for a broader range of training methods to accommodate the different needs for IT training among clinicians.

As ORBIT requires *configuration* according to local practices, it is essential for the quality of the future workflows and surgical documentation that the clinicians configure the system. For all five hospitals, contracts for devoting clinical resources to the projects were agreed upon. However, as the organization failed to substitute resources, the pressure of surgical schedules pressed the projects, as clinicians' commitment is primarily to their clinical work. Characteristic for all the hospitals is that the IT department holds ownership of the project through configuration and system maintenance. The advantages of ownership by clinicians are that it roots ownership of the system and system knowledge on location as argued by Pries-Heje et al. who state that ownership held by the ward secures the clinicians' commitment to the project and subsequent use of the system [14].

The SSSIC proved useful as a reference for methods and plans for implementing the specific system, and four out of five project managers exhibited great independence as how to put it into use based on their prior knowledge of the methods and the system. Only in the case of training material did the project managers kept very close to material and guidelines from the SSSIC, which also proves to be a most time consuming activity. However, as one hospital chose to produce a supplementing educational video, it is worth considering a broader selection of educational material for future projects.

The SSSIC for ORBIT was the first of its sort in the Capital Region of Denmark, and for this particular project, the local system implementation projects proved to be unable to rely on

written material alone. The complexity of the system implementation is one reason, but also differences in organizational constructions according to local culture played a role. However, as the local project managers presently request SSSIC for new projects, we reason that although a standardization of the implementation processes did not occur, the study showed that standardization of the implementation documents, methods and guidelines, establishes a framework of best practice from which the local projects draw valuable information and material. Furthermore, an earlier and deeper involvement of the CSA would be a valuable carrier of knowledge across the hospitals.

Conclusion

The standardized system-specific implementation concept (SSSIC) has not led to the standardization of the implementation process but contributes to the efficiency in the project through references to methods, and especially through the reuse of training materials. The SSSIC must be designed according to the complexity of the system implementation and the experience of the project managers. However, at the same time, it must be possible for the project managers to customize the content to accommodate local practices. The study exposed the varied ways in which the different local projects planned and performed the implementation of ORBIT. This influenced the possibility of comparing project duration and expenses.

For implementation projects as complex as ORBIT, the project managers request the CSA to play a larger role from an early stage of the project, in order to share and distribute experience between the hospitals.

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