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ABSTRACT

The increasing complexity of information systems development (ISD) projects calls for improved project management practices. This, together with an endeavor to improve the success rate of ISD projects, has served as drivers for various efforts in process improvement such as the introduction of new development methods. An ISD method may be perceived as a means for managing projects. Commercial development methods are typically combined with in-house methods for managing parts of the development process. In this paper we investigate in what way in-house methods and commercial methods are combined and used in an ISD project. In order to get a better understanding for how these issues are actually dealt with in the daily work, we have followed a project with a focus on how the group and the individuals implement the managerial decision to introduce a new development method.

Keywords

Development methods, project management practice, method use.

INTRODUCTION

The increasing complexity of information systems development (ISD) projects call for improved project management practices. This, together with an endeavor to improve the success rate of ISD projects (Lyytinen and Robey, 1999), (Cooke-Davies, 2002), and (White and Fortune, 2002) has served as drivers for various efforts in process improvement such as the introduction of new development methods (Fitzgerald, 1997), and (Iivari and Maansaari, 1998). An ISD method can be perceived as a means for managing ISD projects and most methods contain some kind of project management workflow. This has made it feasible to study and analyze current ISD project management practice. One problem with commercial development methods is their complexity, i.e. they are too large and too complex to be evaluated as a whole (Iivari, 2002). Hence we should evaluate a limited set of their essential features at a time. The project management aspect of a development method may be one such limited aspect. This paper focuses on how the project management workflow in a commercial development method coexists with and is complemented by an in-house project management method.

According to Mustonen-Ollila and Lyytinen (2003) the fourth generation of IS process innovation is characterized by administrative innovations concerning project management and control procedures, including development methods. The two most important factors which were identified are the innovation (the artifact) and individual factors. The limitation of Mustonen-Ollila and Lyytinen's (2003) study is that it does not cover aspects such as how the new knowledge was taken into use.

A former study, presented by Backlund et al. (2003), focus on how organizations adapt and introduce methods. In this paper we aim to extend that study by *investigating the actual use of the ISD method in an empirical setting*. We do this in order to build a more holistic view of IT project management. Such studies have been called for by e.g. Iivari and Maansaari (1998), Iivari (2002), and Mustonen-Ollila and Lyytinen (2003). The aim of this paper is twofold. To provide an analysis of:

a) How n-house methods and commercial methods are combined and used in an ISD project.

b) How project, individual, and method aspects affect this combination.

We aim to capture the richness of method use in a real systems development project. In order to achieve this we employ an ethnographically inspired research method that allows us to study a phenomenon in its context of use.

We view the development method as an innovation of a cognitive artifact. A cognitive artifact is an external object that helps the user to decrease the cognitive load in performing a task, i.e. representing knowledge in structures that are external to the human mind. The artifact is used by individuals in their work. We emphasize the context and the fact that it is a dynamical process rather than a fixed set of surrounding conditions. This view, see Figure 1, is inspired by Hutchins (1995) and Rogers

and Ellis (1994) who all accentuate the need to study an artifact in its context of use. Hence, we end up with three aspects: the project aspect, the individual aspect, and the method (i.e. artifact/innovation) aspect.

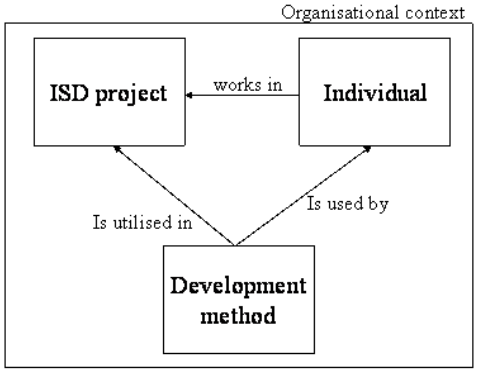

Figure 1 Method use in its organizational context.

The remainder of the paper is organized as follows. In the background section we introduce the theory which is used to build the framework of analysis. Then we present the research set up and introduce the setting in which the study was carried out. In the following section we describe and analyze the case. We close the paper with a concluding discussion.

BACKGROUND

Project management is an essential issue in ISD. Since it is the case that some ISD methods actually contain a separate project management module we have chosen to restrict our study to that area. According to Cooke-Davies (2002) and Turner and Muller (2003) the two most important elements of project performance are communication management and risk management. Risk management is also put forward as an important issue in many ISD methods (Cadle and Yeates, 2001). Furthermore, Cooke-Davies (2002) emphasizes the human dimension of project success factors since it is humans that carry out every process and thus determine its adequacy.

Turner and Muller (2003) claim that the traditional definition of a project is incomplete and propose one which states that a project is a temporary organisation which can be used as a production function, an agency for change, and an agency for resource utilization. The view of a project as production function has its limitations in that it does not recognize the project organization as a construction to deliver a coherent set of change objectives. We interpret this as a conflict between two types of goals: *product* goals and *process* goals. In relation to these different types of goals a survey of current practice in project management showed that the three most critical success factors are: clear goals/objectives; support from senior management; and, adequate funds/resources (White and Fortune, 2002).

In order to be able to discuss method use we start by characterizing the concept of an ISD method. There are several definitions of the term method. We adopt the definition of Avison and Fitzgerald (2003) since it explicitly mention project management. A method has a number of components which specify how a project is broken down into stages and what is carried out in each stage. They also specify how projects should be managed, which people should be involved, and what support tools may be utilized.

Commercial methods are typically products including manuals, education and training, consultancy support, CASE tools, and different types of templates (Avison and Fitzgerald, 2003). The Rational Unified Process (RUP), see e.g. Jacobson et al. (1999) and Kruchten (2000), is an example of a commercial method in the above terms. Project management in RUP focuses on providing a framework for managing software-intensive projects; providing practical guidelines for planning, staffing, executing, and monitoring projects; and, providing a framework for managing risk. The management artifact[1] set includes a software development plan, a business case, and various plan and assessment documents.

There are different ways in which a method may influence the development process. The broad scope of development methods implies that there are different roles involved in using them, e.g. analysts, developers, future system users, and

[1] In RUP an artifact is defined as a piece of information that is produced, modified, or used, i.e. it is a tangible product of the project.

project managers. The method may serve different roles in systems development (Iivari and Maansaari, 1998). It may serve as: a rule to determine or regulate action; a resource to support action, or; a reminder of actions to be taken. The results of e.g. Russo et al. (1996), Fitzgerald et al. (2002), and Middleton (1999) indicate that a majority of method users tailor the methods to meet the specific needs of the organization and the situation of each project. We would also like to highlight the individual, since it is people not methods that develop systems.

Finally, in order to be utilized the method has to be diffused in the organization. Rogers (1983) define diffusion as a process by which an innovation is communicated throughout an organization. An innovation may be an idea, an object, or a practice which is perceived as new by the individual or the group of users. There are several aspects to this process, of which we focus on the content of the innovation since it corresponds to the content of the new method. The degree to which a new idea is better than the one it supersedes is described as *relative advantage.* The term *compatibility* is used to describe the degree to which the new idea is consistent with existing values in the organization.

RESEARCH SET UP AND CASE INTRODUCTION

The study was made at the IT department of a car manufacturer. In order to study how the development process knowledge embedded in a commercial method was utilized we followed a development project for six months. The general aim of the project is to replace the numerous system registers in use with one general register, which will aid in making system maintenance more efficient. Apart from the *product* goal the project also has two *process* goals. The first one: to give the team members an opportunity to *use* RUP in a real project setting; and the second one: to *introduce* new technology and a new development tool.

The project is staffed by the following roles: one project manager, one architect, four analysts, four developers, five implementers, and one test designer; with a total number of eight people involved. The project is planned to comprise one iteration in the inception phase and two iterations in the elaboration phase. The construction phase and the deployment phase are not yet planned in detail.

Data was collected by observing project meetings and work sessions taking detailed field notes, (Table 1). Furthermore, the observation data was complemented by informal discussions after each project meeting. The meetings typically lasted between one and three hours and the workshops lasted one day each. We also had access to different versions of the project documentation. In order to validate the field notes we carried out interviews (60 to 90 minutes) with the core group of the project. The interviews were tape recorded and transcribed. The different objects of observation provide different views of how the development method was used in the project. Moreover, the different sources cater for source triangulation (Williamson, 2002).

Object	**Instances**
Development team meeting	11
Stakeholder meeting	3
Tool workshop	2
Interviews	4
Project documentation	2 (versions)

Table 1 The situations in which data was collected.

The data was analyzed using a combination of qualitative analysis (Patton, 1990) and inductive analysis (Hartman, 1998). The first part of the analysis work is the analysis of content, which aims at identifying, coding and categorizing the primary patterns in the data. We sorted statements and quotations using the aspects and indicators presented in Table 2.

CASE DESCRIPTION AND ANALYSIS

Our analysis will examine the interacting aspects introduced in the Background chapter. Table 2 presents the aspects which we looked for in our analysis of the data. The different aspects were derived from the literature study and serve as a means for characterizing and analyzing method use in its context.

ISD project	Individual	Development method
Risk management	Perceived effect on work situation	Role of method
Goals product/process	Personal experience	Relative advantage
Resources		Compatibility

Table 2 An overview of the relevant indicators.

Project aspects

According to White and Fortune (2002) the consequences of a project are also important (besides the traditional criteria) We refer to this in terms of *product goals* and *process goals*. The product goal of the project is to build the system, whereas the process goal refers to the introduction of a new processes and new technology. The project we analyze is meant to be an example for future projects. The intention is to use the experiences gained to set a future standard for how the new ISD method should be used. The project participants formulated the process goal in terms of: this is a project which will set the standards for future projects. The goal to introduce a new development tool was stressed from the beginning. The developers stated that if we are to use this tool in the future we might just as well learn it now. The project manager, on the other hand, tended to focus more on the product goals of the project.

Using RUP was not explicitly mentioned among the goals and the risks of the project. Hence it may have become a hidden process goal for the project manager. For example the project manager claimed that it was hard to see the benefits of using RUP and proposed that all the project management features from RUP should be suppressed for the benefit of the in-house method. However, this would be counterproductive if the intention is to introduce iterative planning, which is an important feature of RUP. The main drawback from a project management point of view was the overlap between RUP and the in-house method for project management. To some extent we can also interpret these problems in terms of a conflict between product goals and process goals, similar to what is described by Turner and Muller (2003). Later in the project the focus shifted towards the introduction of the new tool at the expense of the other process goals.

Risk management is an essential part of software project management. The project identified five risks, which will be discussed in this paragraph. The first risk (the introduction of a new tool) caused some problems associated to the fact that parts of the new tool were still under construction. The team members decided that they were not willing to take the risk of having to deal with future difficulties if it was to be the case that those problems persisted and the tool should not become company standard. Eventually the risk was resolved by abandoning the tool in this project. However, this happened only after a considerable effort had been spent on tying to align the team's work according to it. For example, the team spent a two day work shop on the new tool. The second risk (scope of the product calculation module of the system) was handled by moving it to another project. The third risk (lack of resource) had made everyone aware of the occurrence of delays, which also became the case. The fourth risk (introduction of a new language) and the fifth risk (delimitation to existing systems) were both dealt with and did not cause any problems.

Although the in-house method for project management includes a risk management module, risk management turned out differently in the five cases. All five risks were identified and planned for (to various extent) in the documentation. However, there was one difference in that the second risk was the only one for which an action plan was set up. This action plan provided a clear way of dealing with the problem in the project meetings. The solution was to reduce the scope and move some parts to another project, which was successful from the project's point of view. As stated by one of the interviewees: we handled it in a good way, but perhaps not according to the customer's wishes. Concerning the introduction of the new tool the project was less successful. There was no clear action plan in the documentation and the measures taken at the meetings were rather passive. The project manager stated (in the interview) that the group should have been more proactive in this matter. We find that this problem is partly due to the fact that the introduction of the new tool was also a process goal of the project. Hence, the possibilities for dealing with the problem were limited. However, there was no plan for dealing with the risk, which caused a lack of actions to solve the problem. By this example we see a link between the method as such and how it is used in a certain situation.

The lack of resource became closely intertwined with the tool risk. Much resource was spent on the new tool without any evident pay off, according to the project group members. However, the links between these two risks were not identified. Our interpretation is that risk management in the in-house method does not support the identification of links between risks; neither do the risk management activities in RUP. We propose that the introduction of such a concept would make it easier to identify and deal with situations in which the project risks affect each other.

Individual aspects

Professionalism has, to some extent, been discussed in Smith and McKeen (2003). We would like to extend the concept presented there by adding abilities in analysis work and the understanding of iterative development as important aspects. We observed that the developers experienced an *effect on their work situation* in that they spend more time on doing deskwork in the planning stages before they go on to actual construction. Some of this time is spent on more thorough analysis work, which the developers perceive as an effect of the new development method. There is also an opinion that too much time is spent on analyzing what is already known. We would like to contrast this to a statement made by one of the developers: we used to build what we thought the users wanted instead of finding out what they needed. One of the developers also stated that it is sometimes hard to focus on analysis when you can see what the relational table must look like from the beginning. These statements may indicate that there is actually a point in pushing the efforts put into analysis, especially if there is a process goal which is about introducing a new way of working. There are indications of a positive interest in object oriented analysis, which are most clearly manifested by use case modeling as a technique for elicitation of user requirements. The object oriented analysis was perceived as a positive feature even in situations when it was obvious that the group was working on applications that would run on relational data bases. Hence, the critique stating that there is a tendency to over administrate is only partly true.

Iterative development is a cornerstone in RUP and can also be considered as an important aspect of professionalism. According to the developers it is important to end an iteration with some sort of release, i.e. iterative planning is product driven. If only time periods are used for planning iterations, there is a risk of keeping on working in a more traditional 'waterfall' way of planning. This is a challenge for the project manager in terms of planning with a push for releases rather than time slots. One of the developers described the focus on iterative development by saying that we used to work in a similar way. The good thing about the new method is that those ideas have been made explicit and it has been made clear that this is the way we should work. From this statement we conclude that the iterative way of working is more comprehensible from a developers' perspective than from a project management point of view.

Cadle and Yeates (2001) distinguish between different ways of estimating time. The main claim is that the IS discipline can learn from engineering when it comes to estimating. The first lesson to learn is that we need to identify the known, rather than the innovative, components of ISD projects and base our estimates on them. The senior developers typically based their estimations on prior similar projects. Cadle and Yeates (2001) refer to this as the analogy method. The analogy method is reliable but it depends on a knowledge base to draw from. The developers described how *personal experience* from a certain environment or platform is used when making such estimations. We also found direct estimation based on project breakdown. This approach was suggested by the less experienced developer. This may be due to the fact that experience leads to more responsibility which in turn calls for more holistic estimation techniques, whereas direct estimation is more suitable for a small scope.

Method aspects

Compatibility issues become especially important in situations where an in-house method is to be combined with the new method. One important aspect of the in-house project management method is the system of 'gates' (G0, G1 in Table 3). It is a system of checklists, which are used to decide on how to proceed. The so called road map, between two gates, roughly corresponds to the idea of phases in RUP. This fact has caused a problem in terms of compatibility between the in-house method and RUP, which in turn has lead to a perception of the RUP project management set as superfluous. This becomes obvious in small projects with no or few iterations within each phase. The problem can be illustrated by the statement that there is an iteration plan which is more on paper than actually in use. The extent to which the RUP project management artifact set is complemented by the in-house method is further indicated by Table 3. The document study shows that only a limited part of the management artifact set from RUP is used (as indicated by Table 3). The iteration plan is perceived as the part of the management artifact set that created the most value. One opinion is that the project management artifacts in RUP should be used internally in the project, whereas the in-house method is more suitable for reporting outside the team. According to the project manager the RUP management artifact set did not have a large impact on project management. This statement is supported by the fact that only a few of the RUP project management artifacts were used. A closer inspection of the artifacts in use gives at hand that a large part of the development case was duplicated from another project, which led to that it had to be revised throughout the project.

RUP management artifact set	RUP management artifacts in use	Complementary artifacts from in-house method
Change request report	Vision document (originally in requirements artefact set)	Templates and macros for time calculation
Software development plan	Iteration plan (for inception and first iteration in elaboration)	Project charter (3 versions) including instructions for templates.
Risk list	Development case	Time estimation for inception phase and forward
Measurement plan		Review record (project mgmt.)
Project plan		Presentation of elaboration
Iteration plan		Time calculation report
Status assessment		Checklist G0, G1 (used before phase transition)
Iteration assessment		Road map report (project summary for the steering committee)
Business case		Agenda G1
Change request		Risk management plan
Test plan		
Development case		
Dev. organisation assessment		
Configuration mgmt. plan		

Table 3 Only parts of the RUP management artifact set were used. There are several indications of overlapping document types.

The process goal to launch a new tool affected the analysis work. The new tool introduced a concept called a platform independent model (an intermediate model used in the new tool). This concept was not identified in the new method, which in turn led to a gap between these two process goals. This gap became clear in the expected input for the tool workshop where the work shop leader had expected a set of class models as input. On the other hand, the need for these models was not clearly communicated to the project team.

The major *relative advantage* of the new method, as perceived by the team, was use case modeling. Use case modeling has had the largest impact on the way of working in terms of going from data oriented modeling to a focus on the users and their work. Furthermore, the developers also find use case modeling an easy way of communicating with the customers. The new method has also directed attention towards risk management, according to the developers. This has had an impact on the work habits even though it is not traced in the explicit use of RUP artifacts (Table 3). One important *role of the method* is, as expressed by one developer, to make the way we used to work explicit. Hence we can view the method as a means for making the development process more professional by acknowledging parts of the more craft-like knowledge of the developers.

CONCLUDING DISCUSSION

We have analyzed how development methods are used in an organization by showing how the three aspects of analysis together form the use of an ISD method. In relation to *the first aim*, we have shown that the organizational impact from the new method is not immense from a project management point of view. The main contribution is internal to the project, mainly in terms of iterative planning. We have also shown how the combination of an in-house method and a new commercial method affect the work of the project group. This combination has sometimes led to conflicts which were either resolved or had an effect on the project outcome. We have discussed how the individual experiences and perceived effect on the work situation can be mapped to the project factors and the new development method. In relation to *the second aim* we conclude that the new method has had an impact on the work situation of the team. The impact is lower from a project management point of view than from a technical point of view (in terms of how new tools and programming environments affect work). We have shown that the new method has had an impact on both the project and the individuals working in it.

In our analysis of the material we found that one of the major process goals, to introduce a new tool, was closely associated to the risks of the project. Eventually the new tool was dropped from the project in order to handle the risk and be able to continue work. This action, which was necessary to go on with the project, can also be perceived as counterproductive in

terms not fulfilling one of the major process goals of the project. This is a clear illustration of the tension between process goals and product goals (Turner and Muller, 2003).

RUP did not seem to have a large impact on project management issues in this project. One reason for this may be that the few iterations in the project did not motivate much resource being spent on iteration planning. Another reason may be the tight correspondence between the in-house project management method and the phases in RUP, which made parts of RUP project management set redundant.

To summarize our most important findings we form a set of consequence descriptions of the experiences that can be drawn from our study.

- Links between risks can bring valuable information to project planning if they are identified at an early stage. We found that the risks were intertwined and affected each other. None of the risk management techniques used in the project we studied did make this explicit.
- Draw attention to the relation between process and product goals, as well as between how the process goals affect each other. The primary goal type may differ between project members in a project with both types of goals and this can affect the work priorities.
- Iterative work is problematic from a project management point of view since it involves the introduction of other metrics for project estimation. In order to resolve these problems project planning needs to become more product oriented than time focused. This is an inherent conflict since release dates are important in IS project planning.
- The method is important as a means of making professionalism explicit. This is emphasized by the fact that the developers perceive the ideas from RUP as positive and as a support for how they wish to work. When it comes to project management the in-house method is still predominant.

Obviously there are limitations to a single case study made in one organization. Hence we do not aim at making statistical generalizations from our material. We rather aim at a contribution of rich insight (Darke et al., 1998). The largest limitation is perhaps the low priority of the project since it may have an effect on the involvement of the developers. However, we do not judge this effect as severe since the motivation for using new tools and learning the new process have been high.

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