

DEVIATIONS, AMBIGUITY AND UNCERTAINTY IN A PROJECT-INTENSIVE ORGANIZATION

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ABSTRACT

This article analyzes deviations in an automation project. The article develops a more holistic view of the project organization, focusing on how deviations are managed. The case study demonstrates that the tools and methods suggested in the literature are rarely used, and shows the importance of the context of the project in terms of gathering information and sharing knowledge that is required to manage deviations. Furthermore, the case shows that there are a number of deviation-management tactics that are applied to different deviations, dependent on whether they are uncertain and/or ambiguous.

Keywords: project management; deviations; uncertainty; ambiguity

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Introduction

Unnecessary time spent on contract issues due to preplanning problems, discussions with clients due to an inadequate initial contract, and the historic dependency of the project are all sources of deviations causing uncertainty and ambiguity that must be resolved in any project. Research on deviations in projects has shown that deviations are prevalent and unavoidable (Lindahl, 2003). Even the best project managers will face unexpected occurrences (Pavlak, 2004), and deviations, contrary to common perceptions, can in fact be quite positive for the project (Alsakini, Wikström, & Kiiras, 2004). However, mostly they are seen as negative as they may cause changes to project plans and goals (Dvir & Lechler, 2004). Due to these negative impacts, different control methods are emphasized in the project management literature (e.g., Nicholas, 2001).

However, when comparing deviations from the project plan and the control methods, there is a gap between what actually happens in a project and what is traditionally found in project management literature. This paper seeks to address this gap by presenting an exploratory case study of a rolling mill upgrade project, and thereby contributing to the contemporary debate around controlled changes vs. deviations. Furthermore, the uncertainty and ambiguity that deviations cause lead to different actions, dependent on various knowledge, aimed at resolving the situation. In this process, a knowledge arena is created, and knowledge is shared between the project and its context (Scarborough, Swan, Laurent, Bresnen, Edelman, & Newell, 2004; Maaninen-Olsson, 2004). A particular contribution of this article is thus that it addresses the context of the project, where not only one perspective is of interest but where *both* the intra- and inter-organizational perspectives are taken into account. The aim of this article is to capture and deepen the understanding of deviation-management tactics. The goal is not to present a finished framework that covers all tactics. Instead, it is to be seen as an embryonic theory that requires further development before deviations are seen in the light we feel they deserve.

The paper is structured as follows. After the introduction, a review of the literature is presented in order to frame the problem to be studied: how project plan deviations are managed. Next, a comparison with mainstream risk- and change-management literature is made to highlight possible shortcomings and make a distinction between risk, changes, and deviations, and how the last is influenced by its familiarity. In the next section, the methodological considerations are pre-

sented, followed by the empirical section exploring the case and the various deviations. The discussion and conclusion section starts with a comparison between the control methods described in the literature and how the deviations were managed in the case study. Thereafter, the analytical model of deviation management tactics found in the case study is presented, suggesting four different kinds of tactics. The final section, implications, suggests some thoughts for both practitioners and academics.

BACKGROUND

Project Management and Project Plan Deviations

In project management literature, it is argued that risk management is project management (Nicholas, 2001, pp. 307-326). This view is also reflected in the Project Management Institute's recognition of risk management as a cornerstone of project management and control and change management as a denominator between the different Knowledge Areas of *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)* (Project Management Institute [PMI], 2004). It is, however, necessary to differentiate between risks, changes, and deviations (See Figure 1). A *risk* is a known, yet unrealized situation (Nicholas, 2001, p. 307). The identification and management of a risk is, therefore, dependent on a trigger to initiate the appropriate actions (Pender, 2001), while the methods describing the actions are proactive. That is, they describe and/or are initiated to a yet-unrealized situation. *Changes*, sometimes called "variances", refer to realized situations with a significant divergence to the project plan. In contrast to risks, changes are not addressed in advance (Nicholas, 2001, p. 341), meaning that changes are managed when a situation has materialized, being reactive in nature. It is important to recognize whether the methods are proactive or reactive, as this implies how a realized situation is prepared. The difference between risk, change, and deviation is that the first two only recognize major happenings and leave out situations with pre-

sumably less consequence on the iron triangle of cost, time and scope (Barkley, 2004), including a majority of the situations in a project. Thus, an analysis of deviations recognizes a larger amount of situations than a normal risk or change analysis would do. However, changes and deviations share at least one characteristic—they are both identified in relation to a plan. While a change focuses on the major project plan, deviations recognize the importance of all plans in the project, from operational day-to-day plans to the main project plan. A *deviation* is, therefore, recognized as "a situation, regardless of consequence—positive or negative, large or small— that deviates from any plan in the project."

that the management of deviations is dependent on the limits of project resources (Barkley, 2004). Consequently, the literature does not reflect what is happening within the project. It is neither the plan, nor the methods or tools, that solve deviations. The solution requires the project members to focus on interpreting the situation and, if necessary, initiating required actions.

Management of Deviations

Nicholas (2001) argues that the management of deviations in a project is a continuous process. The process itself is described as:

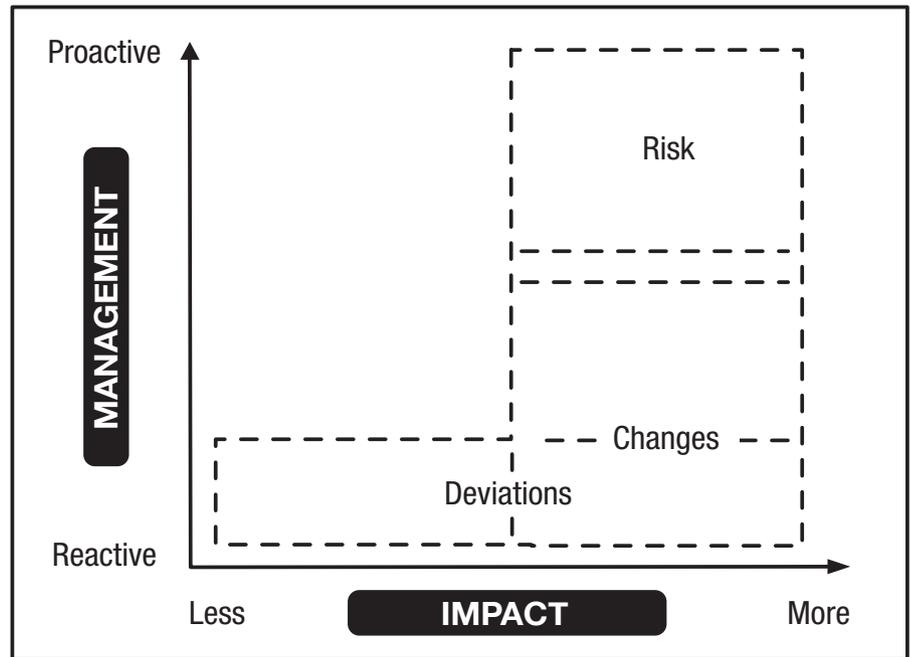


Figure 1: The relation between risk, change and deviations

According to project management literature, risks, changes, and major deviations should be managed through the application of different methods and tools (i.e., risk planning, Earned Value or PERT). However, although tools and methods are usable, the methods neglect important issues, including the potential positive effects of deviations (Alsakini et al., 2004), and the facts that deviations might be small with limited impact (De Meyer, Loch, & Pich, 2002) and

- (1) Setting performance standards (e.g., goals, the project plan(s), etc.),
- (2) Comparing the standards to the result (i.e., Earned Value), and
- (3) Applying corrective actions.

The control process focuses on a number of areas, including scope, quality, schedule, and cost control, which is assessed through different sys-

tems and procedures. The *PMBOK® Guide* (PMI, 2004) recognizes four main techniques:

- (1) Project management methodology, which consists of formal and informal procedures,
- (2) Project Management Information Systems,
- (3) Earned Value technique, and
- (4) Expert judgments.

Some of the main tools are a project statement, Work Breakdown Structure and dictionary, plans, reports, change requests, work performance information, variance analysis, project management software, Earned Value analysis, charts, inspections, sampling, trend analysis, audits, and reviews. While the methods might be effective under perfect conditions with unlimited resources, they are not likely to be applied to all situations, since resources, by definition, are limited. Barkley (2004) argues that all risk cannot be attended, as it would demand too many resources. Reasonably, the same applies to changes. As Pavlak (2004) notes, deviations will inevitably occur, regardless of how the project is planned and executed. He argues that some deviations are best managed in a firefighting mode with qualitative tools, reacting to occurring problems rather than the proactive risk management.

Deviation Prevalence and the Perceived Level of Ambiguity and Uncertainty

To resolve deviations, different information, knowledge and interpretation are needed. This knowledge needs to be shared and created while working through the uncertainties and ambiguities of the project. This means that knowledge is understood as something that is context-dependent, situated, and shared and created collectively, where the notion of practice is a point of departure, compared to more instrumental and cognitive notions of knowledge (Gherardi, 2000). Interactions and communication between the project team and its context contributes to the possibility to share knowledge and enhances the understanding about the phenomenon, hence disseminating and acquiring knowledge internally

and externally to the project (Scarborough et al., 2004).

In the deviation-solving process, matters are discussed in a context that is relevant for the involved parties, creating a knowledge-sharing arena. In this knowledge-sharing arena, different interpretations of the situation are created, and new solutions emerge, which, if the project allows, may create a better solution than was originally conceived. (Kreiner, 1995). In the knowledge-sharing arena, the concepts of participation and action are important elements, as they are important to the boundary-spanning activities that are likely to disseminate knowledge in what could be called the network of the project-intensive organization (Hislop, Newell, Scarborough, & Swan, 2000). Through participation, but also reflection, communication and transparency—where actors from a wider group and not only the project *per se* are involved—a reflective practice is created, enhancing the knowledge base for the project (Cicmil, 2005).

The discussion of the need for boundary-spanning activities to manage deviations can be further elaborated when taking into account the prevalence of a situation. Ekstedt, Söderholm, and Wirderius (1999) point out that recurring projects tend to build brackets in order to protect the project from environmental disturbances. Unique projects, on the other hand, tend to open up the boundaries between the project and the environment. For unique projects, new knowledge must be created, whereas for repetitive projects, the existing knowledge base can be relied upon. The same argument could be used for more or less prevalent deviations. Routines, for example, develop as an answer to knowledge about repetitive situations (Levitt & March, 1988), while less prevalent situations are managed in a more expeditious manner. Hällgren (2004) argues that the latter situations require an interpretation of the situation rather than pure information. Thus, whether a situation is more or less recurrent will influence the level of perceived uncertainty and ambiguity. Considering this, uncertainty and

ambiguity call for different knowledge processes, which can be compared with March's (1991) concepts of exploration and exploitation of knowledge. While exploration refers to experimentation, innovation, and flexibility—exploring ambiguities, exploitation alludes to refinement, production, and efficiency—reducing uncertainty. The former refers to the creation of new knowledge and experimenting with unfamiliar alternatives, the latter to the use of the organization's existing knowledge and the use of already-achieved interpretations.

Methodology

The chosen method for this study is an exploratory longitudinal, in-depth case study (Yin, 1989). This method gives insights into the studied phenomenon and an understanding of the interaction between the project and the surrounding context. According to Eisenhardt (1989), the case method is a relatively open method that is suitable when the aim is to explore new fields or to further develop existing theories. The case chosen was a project (Gamma) within a multinational company (MillCorp).

The chosen project was to be executed within a year; hence presenting an opportunity to follow the project in real time. The data was gathered between May 2002 and January 2004, while the Gamma project was executed during the period of September 2002 to December 2003. During the case study, the project manager, project members, department managers, and consultants were interviewed, some of them several times. In total, 29 interviews were made. All interviews were of semi-structured nature, and an interview guide was used (Bryman, 2001) in order to not forget important issues and to get data about these issues. During the interviews, the interview guide was updated (Taylor & Bogdan, 1984, p. 105) and new questions that arose in-between were answered. Normally, an interview lasted between 45 and 120 minutes, during which notes were taken and tape recordings made. The recordings were transcribed, and to verify the accuracy, the tran-

scriptions were thereafter sent to the interviewees (cf. Merriam, 1988; Bryman, 2001). In particular, the questions asked concerned how deviations arising during the project were dealt with, whom the participants communicated with, and how and in what different arenas the problem-solving took place. Apart from interviews, company documents were consulted. To increase the reliability and credibility of the interviews and the written material, observations were also made during project, customer, and various functional meetings.

EMPIRICAL FINDINGS

MillCorp

MillCorp, the permanent organization of which the Gamma project is a part, is a global technology and engineering company. The company offers new automation and drive systems, and

upgrades of existing systems. About 50% of the project consisted of engineering and software solutions, and 50% of it involved hardware. MillCorp is ISO 9001 certified. At the time of the study, MillCorp had 90 employees and 43 projects in different stages. MillCorp could be characterized as a matrix organization, with five departments and cross-functional project teams. This multi-project organization, therefore, presents possibilities to communicate and interact with other parallel projects, as most of its activities are executed within different projects and no "regular production" takes place. The projects are of a repetitive nature, but due to the different demands of the customer, unique solutions have to be constructed. During the execution of the projects, the project manager had irregular monthly or quarterly meetings with top manage-

ment, in which the latter were informed of opportunities, risks, changes, and deviations. These meetings were primarily information exchanges rather than knowledge-sharing opportunities, as the communication mostly went in one direction—from the project manager to the top management. Within MillCorp, it was usually not the project department that had difficulties with the budget and time scheduling. Rather, it was a problem for the engineering department. Since the project was evaluated against time, budget, and in accordance with technical specifications of *all* the work put into the project, the problems of the engineers also affected the project.

The projects within MillCorp were divided into five phases, which were more or less overlapping: start-up, design, installation, commissioning,

DEVIATION	DESCRIPTION	THE WAY THE DEVIATION WAS MANAGED
Deviation No. 1 Communication Routines	Discussions with the persons involved in the sales phase, except the sales manager, were not held. This caused insufficient transfer of information and knowledge from the sales phase to the project team.	Search for formal documentation, but also several informal meetings to fill gaps.
Deviation No. 2 Hydraulic Drives 1	Knowledge about the hydraulic drives was insufficient. This created a need to interact with consultants who had supplied it.	The project team insisted the original supplier of the hydraulic system should be hired as a consultant to the project.
Deviation No. 3 Hydraulic Drives 2	Deviations concerning the hydraulic drives occurred during the planned test of the hydraulic system.	Additional tests were held and issues resolved in spontaneous discussions with colleagues (within the department).
Deviation No. 4 Scope Change 1	On several occasions, it became clear that what was promised during sales was not what was written in the contract.	These deviations were handled in formal and informal meetings. Often the situations were managed after the meeting when the project manager or the main engineer asked the sales manager about what had been sold.
Deviation No. 5 Consultants	The consultants that were planned to be used in order to ease the workload at MillCorp did not have sufficient knowledge about routines and standards within MillCorp.	Some project members, particularly the lead engineer, used valuable time to coordinate the work, guide and assist some of the consultants.
Deviation No. 6 Scope Change 2	Due to promised customization, new demands and requests came up during the project.	Discussions were held with the customer. This was facilitated through the already established relationship.
Deviation No. 7 Resource Allocation	The personnel of the project team were needed in other projects, which prolonged the project.	Mill Corp finally ended up with drawing necessary expertise from another functional department and using external consultants.

Table 1: Summary of the studied deviations within the Gamma project

and closeout. The design phase included basic and detailed design plus a home test and a factory acceptance test. The sales phase was not included in the project. The deviations are summarized in Table 1.

The Gamma Project

The purpose of the Gamma project was to modernize certain parts of a rolling mill. The first stage, the Beta project, was already finished, and the customer had decided to proceed with a second stage, the Gamma project. The scope of the Gamma project was to replace the existing control system. Compared to the Beta project, the Gamma project was more challenging, as the rolls this time were driven by hydraulic motors instead of electric motors.

Facing Deviations within the Gamma Project

During the first six months of the Gamma project, the project group of MillCorp consisted of four people: the project manager, lead engineer, plant engineer, and developer. After the official start-up, the project proceeded with the design phase. During the startup phase of the project, the basic design documentation from the sales phase was handed over to the project manager. Due to other projects taking place simultaneously, the documentation created in the sales phase was shared through routine documentation, but also in informal meetings between the sales and project managers. However, the documentation had some shortcomings because the persons responsible for submission of the Gamma order did not have all the required knowledge about the hydraulics. The people involved in the sales phase, except the sales manager, were not consulted during the project execution, as the project members were not informed about who had been involved. This caused problems during the execution of the project that had to be solved through numerous informal meetings with the sales representative, and through interaction with the customer and other actors.

At the beginning of the Gamma project, the project team insisted that

the original supplier of the hydraulic system should be hired as a consultant, since this supplier had the required knowledge. The contact was reached through the customer who knew the supplier. According to the project manager, the project team probably had not taken into consideration certain technical issues without the supplier's input. The contact with the supplier increased the project costs, but the project members did not need to gain the needed knowledge themselves, but rather in interaction with the supplier, which in turn reduced the time spent on the issue. In the end, it was the project manager who made the decision to hire the consultants.

A demand from the customer was that practical tests should be done at the site. While planning, the project team agreed to include one test, but during the execution of the project, two additional tests were added. This was negotiated between the project manager and the customer, and an agreement was reached. The additional tests helped reduce existing uncertainties about the hydraulic issues that could not be captured by simulations. In order to manage the deviations during the simulations and practical tests, there was a need for interaction with experts within MillCorp. The interaction was facilitated by the way the MillCorp personnel were organized. The project members were sitting in an open-plan office where the people from respective departments were seated together (not project-wise). This allowed the person responsible for the simulation to talk to his colleagues (within his department) in a spontaneous manner. Deviations that arose due to difficulties with the software at the site tests were later further tested at MillCorp by the project members and by personnel within the focal organization.

Informal and formal meetings were held at regular intervals. In the formal meetings, especially customer meetings, questions often arose regarding the plan, structure of the system and the content of the contract. The differences in opinions were commonly managed after the meetings, where the project manager or lead engineer

informally discussed with the sales people what actually had been promised. Communication and interaction with the sales manager and the different suppliers and consultants was, therefore, crucial. Often the technical tasks (i.e., software and hardware) were changed during the project execution, as it was difficult to anticipate the challenges inherent in software development, including changes required by the customer, and who should be responsible for what. In order to keep the project on budget, on time, and on quality, the project team used standardized software and hardware where it was suitable. These standards and tools were developed by MillCorp and were updated continuously, and served to reduce the risks, changes, and deviations during the project execution.

The allocation of the consultants was planned for November 2002, but due to the heavy workload within MillCorp that had consumed most of the internal and external resources, the consultants did not arrive until February 2003. The allocation of consultants for the software was, however, not primarily an issue for the project manager, but rather an issue for the engineering department manager. The project manager could ask—and negotiate for—certain people, but was not in the position to decide when and where the consultants would be allocated. Rather than being an issue about using different methods, the solving process thus included communication, negotiation, and political skills. The difficulties with the allocation of resources nevertheless resulted in some of the consultants not having sufficient knowledge about the specific routines and standards used within MillCorp. As a result, some project members, particularly the lead engineer, spent valuable time coordinating the work and guiding and assisting some of the consultants for a rather long time which increased the time pressure. The time frame was essential, as the rolling mill planned to shut down the production for a few weeks for holidays. The starting date of the commissioning and installation that was planned for this time window was already agreed

upon. Thus, the time window meant overtime for those involved in order to be ready for the installation and commissioning on time.

Due to customer demands and requests, changes in the scope of the project were common during the entire project. These changes were negotiated between the project manager and the customer, and later on approved by top management. The final occasion where the customer was able to comment and change wanted issues was during the factory acceptance test. The test was held before installing the automation system at the site. At this session, the customer's project team was present and had the opportunity to ask questions and give some final comments on the design. The interactions with the customer's project team were in particular facilitated through the lead engineer. He had been active in the Beta phase, and therefore already had an established relationship and had acquired knowledge and an understanding about this particular rolling mill.

Following the design phase of the automation system, the installation and commissioning phases began. The project was supposed to end in late summer 2003, but was delayed by the final test and some remaining problems with the hydraulics. By this time the consultants and project members got other assignments and were involved in other projects, leaving the Gamma project to a few persons. Through a constant interaction and negotiation between the project manager and the responsible people for resource allocation, new personnel were allocated to manage the remaining issues. In late fall of 2003, the time of the last observation and last interview, there were still some remaining items to be solved. During the entire project, only one formal change request was filed, which came from the customer and was redirected to the person in charge. The rest of the deviations were managed as described more or less ad hoc.

Analysis

What emerged from the data were insights that highlight a need for a

more complex and holistic understanding of the project. This is in contrast to the traditional project management literature, where everything can be planned for and changes are made according to a recipe. That is, the deviation is treated like it can be managed according to a certain, static procedure. The case shows that deviations, uncertainty, and ambiguity were natural parts of project life, so natural that their occurrence was not seen as a surprise. "We just act" was a common response to questions about deviations and their management.

The case suggests that there is a need for interaction and networking, where the communicational skill cannot be dismissed. This could be seen in the interactions between the project group and its context. However, the case also suggests that it is possible to have standards and tools that facilitate the execution of the project. These routines and rules must be in accordance with the way the project managers are *actually* working, and not with the way they would like to work. There is, thus,

DEVIATION	CONTROL METHOD	APPLIED TACTIC
Deviation No. 1 Communication Routines	Search for formal documentation	Formal documentation and informal communication
Deviation No. 2 Hydraulic Drives 1	–	Involving the necessary resources (consultants)
Deviation No. 3 Hydraulic Drives 2	–	Informal communication and additional tests
Deviation No. 4 Scope Change 1	No formal written change request. Minutes of meetings recorded the reached agreements.	Formal and informal meetings and discussions
Deviation No. 5 Consultants	–	Learning-by-doing and on-site training
Deviation No. 6 Scope Change 2	No formal written change request. Minutes of meetings recorded the agreements.	Formal and informal meetings and discussions
Deviation No. 7 Resource Allocation	–	The project had to be managed with overtime and "firefighting" since the time schedule was set.

Table 2: Deviations, control methods, and applied tactics

a need for both a loosely coupled organization where networking and communication is emphasized, and at the same time a need for formalization (Bengtsson, Müllern, Söderholm, & Wählin, in press).

The Use of Control Methods

In neither of the observed deviations were formal routines of change management used. The needed change was instead communicated to the parties concerned in an informal manner, concurrently, or after the management of the deviations. When the deviations were actually reported, they were reported as “has beens”; that is, they used to be a problem, but not anymore. Indicative is also the fact that there was only one formal change request in the entire project, even leaving out both scope changes (Deviation 4 and 6). In Table 2, we have compared the control methods suggested in the theoretical section with the deviations found in the case.

Obviously there was a lack of the traditional and established control method procedures in the mentioned deviation management, even though the company was used to working with projects (and was ISO 9001 certified). This lack of control method procedures

cannot, therefore, be attributed to non-existent routines or lack of knowledge. Instead of the established methods, the project used both formal and informal communication and interaction to solve deviations. The formal meetings with top management also functioned as a control mechanism, where future risks and already-occurred deviations were reported. The emphasis was mainly on information sharing and not formal decision-making.

The time dimension could explain the way the deviations were managed. Due to the heavy workload, time was extremely valuable, and formal methods were more time-consuming than the use of informal communication and interaction with the parties concerned. There was also a sense that the use of the methods should have a clear purpose, not just another method that had to be filled and filed. For the methods to be considered purposeful, they would have to be requested by someone other than the person who wrote it. When formal reports were written, the deviations seemed to be already a part of the past, and therefore no further action was thought necessary. Furthermore, the most prevalent change control was formally written minutes of meetings with the cus-

tomers. These meetings were characterized by discussions and negotiations, without any set procedure.

The case thus shows the need for a complementary view of the control mechanisms. The focus should not only be on the established method, but also be complemented with the social dimension of the project. In the social dimension, communication and interaction skills are important—not just the skill to fill in a report. Communication is, thus, integral to knowledge sharing (Cicmil, 2005), whereby deviations can be managed. Instead of formal mechanisms, the case shows that the project members use different tactics to manage the deviations.

Tactics Used

This section aims to show how the tactics used to manage deviations were dependent on the need of exploring new knowledge or exploiting already existing knowledge. In Figure 2, the deviations are empirically divided into whether they occur often or more seldom in comparable project settings. The other dimension in the figure is divided into whether the solution that is used explores or exploits previous knowledge based on the arguments of March (1991). Figure 2 illustrates how different strategies are applied to different deviations and solutions, where the problems that had to be handled can be categorized into four groups.

Instead of simply viewing the deviations as something negative for the project, the deviations in studied projects could be viewed as something positive, where knowledge was shared and created. Through the different interpretations, new solutions emerge (Kreiner, 1995), and the cases showed that interaction and communication in a knowledge-sharing arena were important elements for the management of deviations and for the exploitation and exploration of knowledge that followed.

Type 1: Evident Solution Tactics

What is found in Type 1 situations is that the ambiguity and uncertainty of the deviation were rather small and the

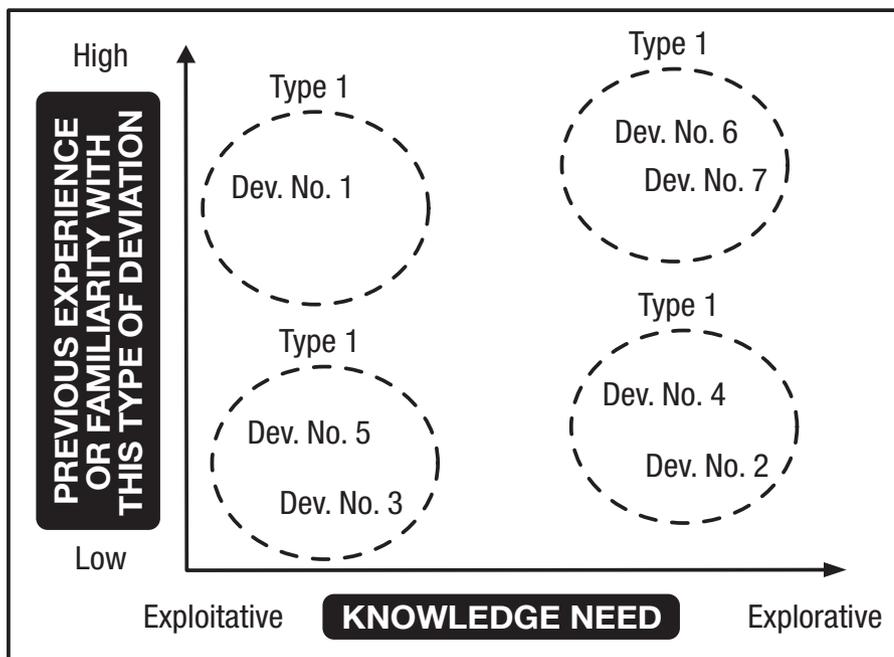


Figure 2: Tactics and deviations

KNOWLEDGE NEED			
PREVIOUS EXPERIENCE OR FAMILIARITY WITH THE TYPE OF DEVIATION	Exploitative	Explorative	
	High (Repetitive)	Type 1 Situations where the ambiguity and uncertainty of the deviation were rather small, while the solution was to use experiences from similar situations in the process of finding a solution.	Type 2 A situation where the ambiguity and uncertainty of the deviation were rather small, but the solution and knowledge needed was not clear and had to be developed during the process.
	Low (Unique)	Type 3 Situations where the deviation was unknown, which created more ambiguity and uncertainty in comparison to type 1 situations. Still the solution of the deviation was sought for in experiences of similar situations.	Type 4 Situations where the deviation was unknown, which created such ambiguity that the solution of the deviation could not be sought among previous knowledge.

Table 3: Deviations and Tactics

solution was to use experiences from similar situations. The actors involved in the situations were aware of what knowledge to use, the understanding was thus rather simple and the appropriate solution could be put into play. The chosen tactic to use previous experience is found in the learning and routine literature (e.g., Levitt & March, 1988). In the case, there was a need for the actors to learn about the situation that was rather familiar to them but could not that easily be transferred, hence they learned from each other what the proper solution was.

In situations where the ambiguity was considered great, for example where the consultants did not have the proper knowledge about the solution, there was a need for the project team to train these persons. There was no time to waste; hence, the apprentices were trained by an experienced person who could teach them during the process. The senior people who already had a deep knowledge about the technology could therefore teach the apprentices. The use of informal interaction between the actors was crucial for the problem-solving process.

Type 2: Controlled Solution Tactics

There were some situations where previous knowledge was not enough, or where the solution was not easily implemented. The solution was an

adjustment of wills as well as exploration of the counterparts' experiences, will, and perspectives. These deviations were fraught with ambiguity that needed to be discussed and the perspectives shared in order to be able to proceed with the project. Some of the discussions were easy while others were difficult, depending on the deviation on hand. For example, a situation where a question of who should pay a change order was likely to be tougher to agree upon compared to a situation where it was a matter of what kind of design was best. The difficult deviations needed to be discussed back and forth in order to reach an understanding of the problem and to be able to reduce the ambiguity.

Type 3: Diffuse Solution Tactics

Within this category, we see deviations where the solution was quite clear, as previous knowledge was thought to solve the riddle—although the deviation as such was occurring rather infrequently. The process was a question of aligning the correct resources to the problem in order to find a quick solution, while using the resources as well as possible. The use of personnel from one project to another, particularly if the project was of a repetitive nature, enhanced the possibility to transfer knowledge. Not much information or interpretation had to be made regarding the situation; the solution was

straightforward, utilizing previous experiences and the organizational structure.

Type 4: Development Solution Tactics

Some of the deviations were more reliant upon the exploration of knowledge than others. Due to the character of the deviations, they could not be identified until the deviation was a fact. There was not enough knowledge to identify possible glitches in the knowledge, hence the need for testing and exploration. The deviations were based on ambiguity rather than uncertainty, and prior knowledge was difficult to exploit. Full knowledge about all situations is, thus, difficult to achieve in the initiation phase of the project. Instead, learning is taking place throughout the entire project (Engwall & Westling, 2004). The use of tests enhanced the understanding and knowledge about the situation at hand. Based on the exploration, the proper solution could be identified and the ambiguity reduced, replaced by some uncertainty about the proper solution, which then could be reached within the project team or in cooperation with actors with whom the project team was involved. The case shows that knowledge was created, in particular when knowledge was shared with actors outside the organization.

Boundary-Spanning Activities

To be noted is that the reported deviations were not the only ones occurring in the studied projects—these deviations were specifically chosen to make a point. The deviations are examples of different tactics used, enacting the situations the project teams were facing. The deviations highlight the fact that the studied project was from one point complex, where both situations of uncertainty and ambiguity were present. Somewhat in contrast to Ekstedt et al. (1999), the case shows that projects of recurrent nature also seem to have a need to open up the boundaries to handle deviations. The interactions in the studied projects were taking place with both actors and structures within the focal organization and with the external context, where customers and suppliers were important for solving deviation. The surrounding environment was therefore used to enhance the understanding and to transfer knowledge to the project. Furthermore, the case shows the importance of boundary spanning within (Scarbrough et al., 2004) and outside of the project organization.

The quarterly reviews with the management were a matter of evaluating the project. It was not so much about control as about interacting, communication, reflection, and reaching a consensus about what the deviation was about and how it was managed in the project, on one hand, and the management on the other. Reflections that were made about what was to be done with the deviations could rather be seen as an opportunity for learning, rather than simply overruns in time, budget, or failed requirements. This is concurred by Alsakini et al. (2004), who argue that deviations may very well be positive from a learning and better-solution perspective.

Conclusions

In this paper, we have analyzed the influence of deviations, ambiguity, and uncertainties on one project. We took departure from the traditional project management literature, where the use of methods and tools are emphasized. The case shows that the

managing of deviations is only done, to a limited extent, according to the way the traditional project management literature prescribes. The deviations were, rather, managed through a combination of information, experience, and networking. Although planning and change are important issues to a project, it is neither the plan nor methods or tools as such that solve different deviations. The solution is instead found in actions within the project, putting focus on the interpretation of a situation and sequential actions or non-actions.

We have argued for an inter- and intra-organizational perspective to be able to fully understand how the managing of deviations is carried out in the empirical setting that is presented. The results and the analysis of the project shows that projects should be understood as embedded in its surrounding context. The project is, not very surprisingly, affected by the context in which it is executed, and it also, in turn, affects the surrounding context. The case study shows that the project was dependent on knowledge not only from the members of the project team, but also from the permanent organization, other projects, suppliers, and consultants. The involvement of actors outside the project has been shown to have not only positive consequences but also negative consequences, mainly due to the allocation problems and the deviations and uncertainties arising from customer involvement.

The case highlights the need for empirical research to enhance the understanding and the knowledge on how deviations are managed in day-to-day activities of projects. There is a need to understand the complexity of projects and that all the different deviations that arise cannot be planned for in advance. This is in contrast to the traditional project management literature that emphasizes planning and control in order to handle deviations. The deviations occurring are based on uncertainty or ambiguity. Depending on the deviation, different strategies to manage the deviation are needed. The analysis of the case thus shows the need for different tactics, where the

tactic depends on the prevalence of the deviation and the knowledge needed. The repetitiveness and uniqueness of the deviation creates different needs of interactions. To take this a step further, it is argued that deviations could be seen as a means for knowledge transformation. This also means that what has a negative impact on the specific project could be positive in the long run, as it contributes to the knowledge pool of the organization.

Implications

There are a number of implications for practitioners as well as academics in this paper. First of all, it is evident that communication and interaction play a vital part in the management of deviations, while formal change and risk management play a lesser role. The focus should thus be put on developing the communication and interaction skills of the project team members. Most of the communication in this case was of informal character, which implies that the most efficient communication and interaction probably goes through informal channels, those that emerge spontaneously due to a personal network. The theoretical implication is that the management of deviations is not that formal as suggested in common theory; instead it has the shape of emergent tactics constantly changing in accordance with the situation. There is, thus, a need for a more holistic understanding of the project. The use of formal routines has to be complemented with a more ad hoc way of managing deviations, since formal routines run the risk of being neglected if they are considered not to be flexible and sensitive enough.

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