

# COPING WITH DEVIATION AND DECISION-MAKING

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## ABSTRACT

Structured models, such as gated models, are used in order to manage the complexity of the multi-project environment. The aim in following these prescriptive models creates strong interrelationships of activities in the projects. The project system becomes sensitive to unexpected events that can influence the system negatively. When managing a project in a highly-interrelated project environment, it is not possible to anticipate every possible external influence on the project. Deviations from the planned operations are inevitable but teams rarely get credited for the skilled way in which they manage to cope with these unexpected events.

The research in this paper investigates how decisions are made in practice regarding managing these deviations. A project-as-practice approach has been used for studying praxis on a micro-level in a project and to capture contextual circumstances.

Results show how these praxes correspond to four different consequences of decisions and reveal the decision strategy used to manage the deviation. The characteristic of the decision-making process is described using the Garbage-Can model in order to highlight distinctive features of managing deviations.

*Keywords: Deviation, practice, decision-making, Garbage-Can model, and project-as-practice.*

## 1 INTRODUCTION

Many manufacturing companies with advanced product development implement increasingly structured development processes [1], with the aim to improve efficiency and effectiveness. They simultaneously aim to increase the predictability of the development processes. As a consequence, in large international manufacturing companies with multi-project environments, a single project is interrelated with several other projects, interdependent regarding inputs, goals, resources, and outputs. Engwall [2] also highlights how interrelated activities distributed in different projects' phases, experiences, institutional forces, and future aspirations make up the project context.

The nature of decision-making in projects involves cognitive, time, information, and resource limitations. It also occurs in an organizational context that often inhibits making informed decisions [3]. As described earlier, there are many interrelated, dynamic aspects that affect the decision-making processes. However, models within advanced product development that describe decision-making are often based on simplistic process models and assumptions [4]. These models often prescribe that product development should be planned in detail and prepared before initiation (product planning and/or portfolio management). They also state that decisions in the early phases of projects should be treated with rigor in order to prevent unexpected consequences downstream. The same message is told in university educations, company guidelines, and in the quality assurance systems used in companies [5]. These models are used to guide activities within projects and are often regarded as an ideal for practice. The models are based on the notion that structured, rational decision-making processes lead to better results, including time to market [6-11]. However, the industry still reports that shortening development schedules is the most common challenge in product development today [12].

This notion of rational decision-making is still persistent and is the basis for most normative and prescriptive models within product development. These ideal models have high status as an ideal for practice. This status has been questioned by scholars, beginning with Simon, and others have followed [5, 13-15]. Engwall states: *"In spite of the rhetoric, there are probably few projects in practice that are the result of a rational decision making process"* [5]. In conclusion, the question is why companies are not experiencing shortened development schedules with the normative, rational models guiding their practice? As Engwall [5] states: *"There are two possible answers to this question. Firstly, practice can (still) be dominated by dysfunctional behavior. This means that the actions of the practitioners have to be corrected so that they match the ideal. Secondly, it could be the normative*

*theory that is unreasonable, i.e. the dominating role model might not correlate with the conditions that practical project managers have to adhere to. If so, it is the theoretical models - not the practical actions - that have to be revised".* The conducted research is based on the second part of that statement.

The nature of product development projects means that most activities in early project phases are based on uncertainty in goals, knowledge, information, and plans. Further, as these activities are conducted in a highly dynamic and interrelated environment, deviations from the ideal are inevitable. Planning will always be vital for project performance, but so will the practice of managing deviations. Actors experience that these diversions from the ideal interfere with project progress and targets and need attention, resources, and action to be managed.

Research on managing early phases in product development is extensive, yet knowledge about the concept of deviation and its relation to decision-making has received little attention. Few cases describe the current practice of managing deviations in projects, with the exception of Hällgren [16] and Söderholm [17], for example. They describe the practice of managing deviations in project teams. Hällgren [16] found eight practice patterns used to decouple the management of deviations from regular activities in order to be able to manage deviations in tightly coupled projects. Also, Badke-Schaub and Gehrlicher [18] studied decision sequences, in which disturbance and conflict management accounted for 18% of critical situations in projects. They [18] also found that most critical decision situations are approached based on ad-hoc planning (55%).

In all, more knowledge about the practice of managing deviations is needed. Therefore, a research question was stated in order to investigate the practice of managing deviations related to decision-making: *How are decisions regarding managing deviations made in practice?*

By describing the current practice of managing deviations related to decision-making, a double loop learning cycle [19] is made possible for the practitioners as well as scholars. Double loop learning uses learning from past actions to question assumptions underlying current understanding. When considering the learning, teams need to ask not only "why are we doing what we are doing?", but also "what else could we do?" (in other words, "what practices could we utilize in managing deviations in projects in different situations?").

## **1.1 Research Methodology and Methods**

This research has been carried out through a case study and a review of the related literature.

A Project-as-Practice approach [20, 21] has been adopted to answer the research question: *How are decisions regarding managing deviations made in practice?*

The standpoint of this research is that normative models in product development are based on simplistic decision-making models and an exaggerated belief of rationality in practice. This standpoint have been proclaimed for a long time but has only been approached by suggesting more in detail process and case studies of projects, e.g. [22, 23]. This has been criticized by several scholars who have put forward an approach in dealing with this from a micro-organizational perspective, e.g. [16, 24, 25]. The approach, called Project-as-practice, is adopted in order to capture the situated praxis of the actors in the project as well as the surrounding structural circumstances that shape, and are shaped by, praxis (i.e. practice). The project-as-practice approach is used to contextualize phenomena (in other words, to place focus on the social circumstances and settings that create certain practices). In this case, it is a matter of identifying team members' praxes of managing deviations in relation to decision-making during the early phases of a product development project. This approach is relevant for this research because it views managing deviations as a socially skillful, situated activity emerging from the actions and interactions of multiple level actors [26]. As Hällgren [27] states: "*Contrary to the process perspective, a practice perspective means that existing processes are not noted in favor for studies of how the processes arise*".

Further, the methodology of case study was chosen because it is an effective way of investigating relationships within companies. A case study is described as: "*...an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident*" [28].

Data collection was conducted through nine semi-structured interviews with eight employees in the case study company. To achieve a wide perspective on the decision-making process, interviews were made in different departments and with people on different organizational levels who had dissimilar backgrounds and experiences regarding the deviation under study. The analysis of the different

sources was made individually by the authors and then once again together by the authors. During the case study, the researchers have had full access to the documents connected to the project (e.g. project organization, time schedule, meeting minutes, decision log, administrative documentation, product documentation, and mail). Data has also been collected through active intervention (action research), as one of the researchers has been an active participant in the project. Diary keeping from this participant has also been part of the analysis material.

Finally, theoretical studies on product development and decision-making literature were made before the case study started, as well as afterwards. The theory was used for creating interview questions and analysis filters. The data was transferred to a qualitative data analysis software called NVivo8. The analysis filter was used in NVivo8 to categorize the data. See detailed description of analysis method in Section 3.

## 2 DECISION-MAKING AND DEVIATION

Despite an overwhelming amount of research results that point to man's inability to make fully rational choices, rationality is still the most prevailing and sought-after point-of-view in business. Rational actions are sought to such an extent that actors within corporate organizational systems need to disguise certain decision-making processes as rational processes in order to gain acceptance in thought and action [13]. The thought of man as fully rational prevailed until the 1950s. Since then, scholars have published remarkable results showing that man indeed suffers from a large amount of barriers to making rational choices [14, 15]. The inability of our minds to handle the complexity of important decisions, our bias towards recent information, risk aversion, political factors, and our emotions are some factors that affect our decision-making behavior. Despite all of these findings about our natural way of making decisions, we still aspire to make effective and efficient decisions in a rational manner. The notion of rationality in decision-making influences our efforts to minimize resource spending and maximize output in our activities [27]. Logically, our aspiration for high performance in our thoughts and actions is no exception when conducting product development projects. High performance in thought and action logically means fewer resources, right tasks, right input, right goals, and increased profit [27]. This notion, in turn, impacts our efforts to improve the way we conduct and support product development activities, which include design practice and methodologies, communication methods, and process models, for instance.

In our efforts to minimize resource spending and maximize output, obstacles arise. Product development organizations experience difficulties in managing higher complexity in projects due to shorter lead time, an increased number of stakeholders, distributed teams, parallel processes, and technical advancement. The flexibility of the product development organization's activities is decreased and unplanned events and changes impact on the activities to a larger extent due to a tightly coupled system of activities [29, 30]. This has led to project development projects being more sensitive to change and the consequences of decisions in such situations. Many of these unplanned critical situations are seen by members of the teams and steering committees as deviations in project processes.

### 2.1 Deviation in projects

Plans are a vital part of managing projects that codify the desirable, necessary, and likely expectations if activities are carried out without unexpected events. These codified expectations also guide our attention and determine if our expectations are valid. [17]

Unfortunately for people managing and working in projects, unforeseen events that disrupt progress occur regularly [31]. As Söderholm [17] states: "*A project is to some extent truly ambiguous and filled with unexpected events created as things do not unfold as planned or because conditions change over time*".

A product development project can be disrupted by unexpected situations. One example is delays in related projects developing technology to be used in the product. Some unexpected events are crises, merely surprises, or just snags, difficulties, and tensions [16]. However, these unexpected events are not considered part of normal operations by team members and management [32], and they are referred to here as deviations [16, 27]. As Hällgren [16] states: "*Deviations are simply unexpected events that need attention from the project team because they interfere with cost, time or scope goals*". Some ethnographically-focused studies of the practices of managing deviations show how teams manage deviations by decoupling the deviating situation from the ordinary operations and context. In

Hällgren [16], 29 practices and eight practice patterns were identified in managing project deviations. The patterns were the following:

1. *Identify and get to know the boundaries*
2. *Interpret the goal in an advantageous way*
3. *Mobilization of network*
4. *Displacement of responsibility*
5. *Concentration of organizing*
6. *Acceptance of responsibility*
7. *Situated use of resources*
8. *Creation and maintenance of space for actions*

Söderholm [17] distinguishes between three different categories of events and management practices: Re-opening, Revision, and Fine-tuning. Re-opening means that the project is opened up for new definitions of, for example, scope, time or budget. Revisions of initial plans, for instance, are common and inevitable for any project extended over a long period of time. Fine-tuning means that there is a daily fine tuning of project work and outside commitments that is due to channels for exchange of experiences and knowledge, not only within a project but also between projects to the overall organization [17].

## 2.2 The practice of decision-making when managing deviations

If organizations and projects are analyzed more in detail, a picture of more loosely coupled activities within organizations emerges, which means that these activities are not necessarily governed by plans or methods [27]. Loose couplings emerge as a necessity to allow deviations to be isolated and acted upon without spreading throughout the entire project organization, as well as allowing the organization to retain its identity [33].

Orton and Weick [29] describe that the ability of a system to absorb a deviation is determined by “Responsiveness” and “Distinctiveness”. Responsiveness describes the ability to absorb change, and Distinctiveness the ability to retain logical or physical distance. If there is neither responsiveness nor distinctiveness a system cannot be considered a system, and is therefore a non-coupled system. If there is responsiveness but not distinctiveness, the system is tightly coupled. If there is distinctiveness but not responsiveness, the system is decoupled. If both distinctiveness and responsiveness exists, the system is loosely coupled. [29]

If the most common decision models are reviewed (the Optimizing Model [34], the Satisficing Model [14], the Muddling Model [35], the Mixed Scanning Model [36], the Contingency Model [37], and the Garbage-Can Model [38]), one stands out as suitable for understanding decision-making when managing deviations in an unpredictable environment: the Garbage-Can model, as argued below.

When coping with a deviation, the activities are decoupled and that part of the project system becomes temporarily loosely coupled with normal operations. Loosely coupled parts of organizations are most likely to resemble the garbage-can decision model. This is because of the display of problematic preferences due to lots of ambiguity, no clear cause and effect relationships, or members passing through the decision process briefly. Problems are issues of frustration that need attention. In such situations, according to the Garbage-Can model, objectives emerge spontaneously and are not set in advance. Ideas of solutions and problems may exist independently, and chance connects them. A good decision occurs when a problematic situation matches a remedy in a good way. According to the model, decision makers search for existing solutions, problems, participants, and opportunities to connect. [38]

Brunsson [39] puts forward the theory that decisions in organizations can have four roles (consequences) in an organization (See Table 1).

Table 1. Four roles of decisions [39]

	Decision as choice	Decision as mobilization	Decision as responsibility allocation	Decision as legitimation
Handle uncertainty as to	Alternatives	Commitments	Decision makers	Organizational legitimacy

Connection to actions	Connected	Connected	Connected	Disconnected
Design	Rationality	Irrationality	Irrationality for responsibility acceptance	Rationality in environments of inconsistent norms

As Brunsson states [39]: “Decision-making can reduce uncertainty related to alternatives, actors, decision-makers, or legitimacy. Decision-makers may adapt the design of decision-making processes to these different roles and to what the decision-makers want to achieve within the role”.

The extent of which actors follow rational norms of standard decision theories varies according to decision makers’ roles and purposes. A high degree of rationality can be interpreted as attempts to manage choices, hinder action (by requesting more rational procedures), escape responsibility, or legitimize events in an environment where inconsistent norms are important (e.g., in politics). A high degree of irrationality does not always mean irrational choices. Rather, it can be interpreted as creating commitment to action, accepting responsibility, or legitimizing an event in relation to a group of consistent norms. [39]

Decision processes in practice may play more than one of the four roles described in Table 1, sometimes all four. Decision-makers may want to use decision processes for different purposes or decision-makers may be aware of observers’ different interpretations of the processes. Decision processes may involve a struggle between groups trying to establish it by playing a specific role. These decision processes may become very complicated to manage and seem extremely uncertain both for participants and external observers. Such decision processes are not possible to understand if analyzed from the perspective of only one of the four roles. [39]

### 3. CASE STUDY – DECIDING ON OPTIONS OF PRODUCT FEATURES

The case study company operates within the manufacturing industry. The number of employees is approximately 1,200, and 70% work in the manufacturing department. The case study company has a department responsible for securing all new development projects within the company. This department is also responsible for securing the progress of all new development projects, managing the deliveries and costs within the right time with expected quality, and driving and improving the work with development and project models. The project leader from this department is responsible for the decisions in the project and manages a cross-functional engineering team to be able to reach the project goals. The project leader in this case was considered to be highly skilled by co-worker and management in the company.

The interview questions asked to the interviewees involved the activities of the decision process, involved actors, influencing factors, and measures taken to remedy the situation, for example. Data was collected and transferred to NVivo8. The filter used to codify the data in order to identify praxes can be seen in Table 2. The praxes identified by using Filter 1 were then transferred to another filter, Filter 2.

Table 2. Filter 1 used for the codification of data in NVivo8.

Input:	Source event & circumstances	Internal project
		External project
Process:	Events & Praxes	Internal project
		External project
Output:	Output events & Praxes	Resulting internal praxes
		Resulting decisions

In a second step of the analysis, four types of decision consequences was codified and related to praxes. The filter used to codify the data in order to identify the relationship between praxes and decision consequences can be seen in Table 3.

Table 3. Filter 2 used for the codification of data in NVivo8.

Praxis	Sequence	Decision consequences			
		Choice	Mobilization	Responsibility	Legitimation
	n				
	n+1				

Thereafter, the Garbage-Can model of decision-making was used as a means of analysis in order to explain the practice of managing deviations in relation to decision-making. By using the distinctive features of the model, data was codified.

### 3.1 The circumstances when the deviation occurred

The first matter that was important to identify was the circumstances (as well as the history leading up to the circumstances) surrounding the occurrence of the deviation. During the last two years the company had made huge investments in production re-organization and production technology. Their production had gone through radical changes and cost billions. This made the company management cautious about investments in general. *“One reason for choosing alternative four was probably the cash-flow at the moment. The company does not have the money to invest at the moment”* (a manager). The company also had implemented an overall strategy that focuses on minimizing new technology risk in projects. It impacted on how much new technology content was seen as acceptable in project development projects by management in general. *“We checked the cost and necessary resources and took it to the steering committee, who said that it was too much money right now and also that it was too much risk with the ”new content”* (a team member).

Also, within the product development organization, there was a strong culture of hurrying through early phases of the project in order to get into detail design. *“A lot of people want to initiate and be done with the project before it has entered detail design”* (a team member). This was caused by manning problems in the overall project portfolio, where there was a shortage of experts within different areas. The understaffing of projects impacted on their ability to make informed decisions and had led to an overall feeling of a trial-and-error decision-making culture. *“We make decisions with great uncertainties but act as if we are sure. I think that the decisions we are uncertain about, and where we risk taking decisions on uncertain grounds, we get to regret in the form of quality deficiencies later on in the process and thereby lose market shares and all that follows with competitive advantage and profits”* (a manager).

The “Marketing” department has closer relationships with management than the project team, which could have impacted on the final result of the process. *“Marketing (and management) sits at the same site and in the same building, which makes their relations tighter than ours”* (a team member). The project team also had little view of activities in the “Marketing” department, which made their understanding of marketing’s assumptions and reasoning limited. *“It’s not certain that our (the team’s) perspective matches marketing’s perspective. It’s an uncertainty when we really do not know the goals used for their (marketing’s) evaluation”* (a team member).

The overall goal of the project was to decrease energy consumption in the machines and considered to be too unspecific in the project. There were no specific targets set for the decrease of energy consumption, and this was considered a problem when investigating cost-benefit tradeoffs in the project. *“An overall target to reduce energy consumption can be too unspecific ././ Goals need to be a bit more specific”* (a team member). This ambiguity in project goals had persisted in the project since the team members remained the same throughout the project’s early phases and no handovers meant no external pressure to clarify goals. *“It is more or less the same people that have worked in the project throughout the process and handovers are not very sharp. You shake hands with yourselves pretty much. The negative with that is that if something is fuzzy from the start it can persist along the way”* (a team member).

### 3.2 The decision-making process

A single deviation was investigated by first mapping activities considered by actors to be critical for the decision-making process (See Figure 1). The process was then described in detail in order to investigate the praxes used in order to manage the situation and to get the project moving forward again. (In the picture, “A” stands for Alternatives, and “Eval” for Evaluation).

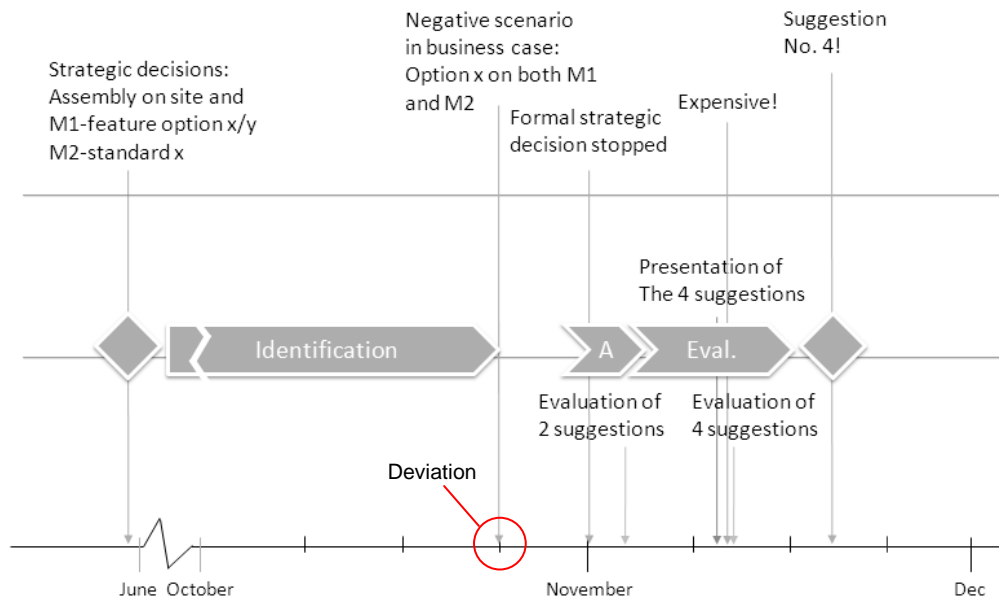


Figure 1. The identified important activities of the decision-making process.

On the 25<sup>th</sup> of May, a strategic decision was made by management to manufacture and assemble an in-house designed machine component (“X”) at the home site. The new component should be offered to customers as an option (between “X” and another, simpler component “Y”) in machine M1 and as standard in machine M2. This was a strong requirement from the four market representatives. During the following period, the marketing department conducted market surveys with market representatives regarding how much they could increase the price for machines containing component “X”. The answer from the different market representatives differed from 0 to 300 €. With that information, the business case of offering “X” as standard on M2 did not show positive numbers any more. Marketing informed management of the new situation and insisted on measures in order for the business case to show positive numbers again. The marketing department had indications that competitors were going to offer a cheaper variant of component “X” as standard in their comparable machines. As a result, the marketing department felt that they could not omit offering this feature to the customer, at least as an option to component “Y”. At the same time, market representatives indicated that there could not be any increases in price on machines even if component “X” were chosen by customers.

Management went over the business case with the marketing department and decided to change the previous decision involving the options of having component X and Y as options on both M1 and M2. When the news of the new decision reached the manufacturing representative in the development team, it went contrary to all her expectations of the options, which impacted investments in production technology, component costs, and uncertainty in projected sales volumes. She went to an expert on production costs and put forward her view of the situation. With the support of other people in the organization, she managed to get management to withdraw the new decision. The production representative in the project brought in two controllers to analyze and calculate different costs dependent on the volume scenarios related to capacity in production and the resulting need to invest in production technology. The team found that a cost estimate of production costs related to component “Y” was off by ~30% which gave component “X” an unfavorable cost ratio compared with component “Y”. This came as a surprise to management, which reacted strongly to the big increase in costs for component “Y”. Management then asked the industrialization group (and manufacturing representatives in the project) to do an analysis of component costs given two alternatives with three different volume scenarios for component “X” (100% X in both M1 and M2, 20% in M1 and 100% in M2, 21% in M1 and 59% in M2). These three scenarios were important input to management when they made the latest decision. The expert on production costs also had two alternatives that he had made rough calculations on earlier. These two alternatives had been investigated during the radical production re-organization.

The team made an analysis, with the new decision as an prerequisite, of the four alternatives (buying external components, buying in-house designed components and outsourcing manufacturing,

manufacture component at home site, or partly manufacture parts of the component at home site and outsource the rest) and reported the resulting figures to management. Management found two alternatives too costly and asked the project to continue evaluating the remaining two other alternatives (Manufacture component at home site, or partly manufacture parts of the component at home site and outsource the rest). The analysis continued, and the conclusions were that options of “X” and “Y” made calculating production capacity and investments uncertain. Large variations in unexpected volume ratios will lead to under or over capacity dependent on investments. If the decision of options of “X” on both M1 and M2 stands, costs in production will increase and impact component costs and component “X” will increase by ~8%. The recommendation to management was to not offer options on feature “X” due to cost increases and the risk of uncertainties in production capabilities, including outsourcing alternatives. Management still decided to once again offer options of “X” on both M1 and M2 and adopt the last alternative, partly manufacturing parts of the component at home site and outsourcing the rest. The component should still be assembled at the home site. The project manager of the project wrote in the formal decision document: *“Marketing has not estimated it possible to increase the price on the machines so [component “X”] can be included as standard. The project has presented the consequences with [component “X”] as option. Management has decided to offer [component “X”] as an option on [M1] and [M2] anyway”.*

#### 4 ANALYSIS AND RESULTS

The decision process was shown to include a series of eleven sub-decisions that had some of the four consequences stated by Brunsson [39]. By dividing the decision process into these four perspectives, a clear picture of purposes of praxes could be exposed (See Section 4.1). Further, by viewing the decision-making process according to the Garbage-Can model [38], the sub-decisions and consequences are explained (See Section 4.2).

##### 4.1 The decision episode – praxes, decisions, and decision consequences

By comparing the identified praxes (by using Filter 2) with the four different decision consequences stated by Brunsson [39], a pattern of praxes was identified. It shows how a single praxis, or combination of praxes, is used to reach sub-decisions that have specific consequences. By identifying praxes of both internal project members (for example, project managers, design engineers, production engineers) and external participants (for example, steering committee members, and production investment experts), the interactions show which sub-decision were shared decisions. External praxes are marked as dark grey and internal praxes light grey in Table 4.

Table 4. Praxes, decisions, and consequences (Filter 2).

Praxis	Sequence	Decision consequences			
		Choice	Mobilization	Responsibility	Legitimation
Seek external confirmation of deviation	1				1
Call for attention	2			2	
Indicate wrong assumption	3				3
Indicate deviation	4				4
Revoke decision	5			5	
Request objective information	6			6	
Involve external expertise	7		7		
Detach project time	8		8		
Develop alternatives	9	9			
Reuse old alternatives	10	10			
Produce objective information	11	11			
Confirm interim results	12				12
Limit alternatives	13	13			
Produce objective information	14	14			



Present final information	15				15
Decide against proposal	16	16			
Transfer responsibility	17			17	

In total, eleven sub-decisions were identified by finding connected praxes related to the same decision consequence. The sub-decisions were: (1), (2), (3-4), (5-6), (7-8), (9-11), (12), (13-14), (15), (16), and (17), where (9-11) and (13-14) were shared decisions between internal and external actors.

What the company considered to be a single choice decision was in fact three choice decisions, one mobilization decision, three responsibility decisions and four legitimation decisions – eleven in total, with four different types of consequences.

Sub-decision (1) was made by the production representative in the project, who decided to seek confirmation of the experienced deviation with a production investment expert. The purpose of the decision was to legitimize the project's concern about the management decision. The expert confirmed the deviation, and the project leader was informed of the situation. Sub-decision (2) was made by the project team to call the steering committee's attention to the experienced deviation. The purpose of the decision was to get the steering committee to take responsibility of the issue, which was the result of their actions. It took some time for the team and the steering committee to begin to understand the deviating situation. Therefore, the project team (3) decided to clarify the situation from their perspective by (4) indicating that the steering committee's former decision was based on incorrect assumptions about product costs. By doing so, the team tried to gain acceptance for their point of view regarding the deviating situation. The steering committee decided to revoke the decision (5), with the consequence that it gave the project responsibility to investigate the deviation in the project which concerned other interrelated projects as well. The steering committee also decided (6) to request objective information about the situation from the project team. This resulted in the team taking responsibility for clarifying the situation from the team's perspective. In order to decouple the deviation from normal operations, the team decided (7) to bring in two external experts on calculating production costs. The production representative in the project also decided (8) to cancel what was thought of as non-value adding meetings (e.g. weekly department meetings and some other project meetings) in order to be able to pay full attention to managing the deviation. The consequence of the decision was that the team mobilized resources to be able to manage the deviation.

The steering committee decided (9) on two alternatives, and handed them to the team to investigate and evaluate. One of the external experts had been a part of a team investigating production technology investments during the earlier re-organization and production technology investments. In that work, there were two alternatives related to the current deviating situation. The team decided (10) to include these in the investigation and evaluation process. The team also decided (11) it was time to initiate the work of producing the objective information the steering committee had requested. These praxes had the consequence that common choices were made about what alternatives to evaluate. This, in turn, initiated the overall choice process of alternatives to remedy the possible consequences of the deviation. A sub-decision (12) was made by the team to present and confirm interim results with the steering committee in order to legitimize the chosen line of investigation pursued by the team members. The steering committee decided (13) to limit the alternatives to two of the alternatives they felt corresponded to their understanding of the situation. The other two were obviously too costly and risky at this time. By doing so, the steering committee wanted to focus the team's attention on the two remaining alternatives. The team accepted the choice and chose (14) to focus on producing further objective information about the two remaining alternatives. These praxes resulted in a common choice regarding alternative remedies.

After some time, the team decided (15) to present the final information about the situation and recommended alternatives to act on. The team tried to gain acceptance for their conclusions and point of view, thereby legitimizing future actions related to the preferred alternative of the team. The steering committee decided (16) to adopt another point of view related to marketing arguments, long-term costs, and risks, and decided against the team's suggestions. The steering committee made a choice to implement the chosen alternative in order to mitigate the consequences of the deviation from their point of view. The team decided (17) as a response to mitigate the responsibility of the chosen alternative by formally writing down their arguments and the results of the investigation in the project decision document, a management document shared by the project leader and the steering committee

members, among others. As a result, the team formally relinquished itself from responsibility by referring to the rationality of the information produced by the team. The deviation was managed from the team's point of view.

#### **4.2 Managing deviations as a garbage-can decision**

First of all, the notion that the Garbage-Can model is suitable to explain loosely coupled activities seems to be valid since the deviation which was managed by decoupling was characterized by distinctive features similar to the model. A great deal of ambiguity is present in both the input to the situation and during the process of managing the deviation. The overall goals of the project are experienced as being too unspecific and affecting the team's ability to make tradeoffs between cost and benefits. When the deviation occurred, objectives emerged spontaneously in the form of specific product costs related to different volume scenarios and investment levels. The team searched for existing solutions by contacting external experts who had been involved in similar calculations of production costs. The experts found two alternatives besides the two handed down by the steering committee. One of these was the final alternative chosen in the end as a remedy for the consequences of the deviation. The idea of the solution and the problem existed independently and chance connected them. According to the model, decision makers search for existing solutions, problems, participants, and opportunities to connect [38], which was the case in managing this deviation. At the same time, by bringing in external experts, the feature of members passing through the decision process briefly seems to enable detaching the deviation from normal operations. This in turn creates a loosely coupled system regarding project time (mobilization). If the decision episode is reviewed, it can be said that a good decision occurred when a problematic situation matched an independent existing remedy in a "Satisficing" [14] way (in other words, the search of alternatives was terminated when a sufficient alternative was found).

The circumstances played an important role in the resulting management of the deviation. The huge investments made in production re-organization and technology made the steering committee members reluctant to invest in production technology, thus limiting the alternatives from an investment perspective. The criteria emerged spontaneously after the team had clarified the four alternatives' impact on production investments. At the same time, the overall strategy (that focused on minimizing new technology risk in projects) contributed to a low risk tolerance in the steering committee, limiting alternatives from a risk perspective. It seems that different overall strategies and rules are spontaneously selected as decision criteria when these criteria match an alternative under investigation. A criterion is not selected *before* a process of managing a deviation is initiated but *during*. This is related to possible alternatives identified along the way.

When conducting the interviews, there were clearly two distinctly different points of view regarding decision-making: some saw the prescriptive decision model as the rule to follow (mostly managers and external experts), and some saw decision-making as adapting to the current circumstances and making the best out of it in order to progress (mostly team members). Those who saw the prescriptive decision model as the rule to follow gave statements such as: *"We make decisions with great uncertainties, but act as if we are sure. I think that the decisions we are uncertain about, and where we risk taking decisions on uncertain grounds, we get to regret in the form of quality deficiencies later on in the process and thereby lose market shares and all that follows with competitive advantage and profits"*. Those who saw decision-making as adapting to the current circumstances gave statements such as: *"A good decision is when we get to reach a decision and it is in line with the goals we are trying to achieve. ././ Also, the delimitations of the decision are dependent on the current circumstances, such as current economic situation, strategies in the company regarding components, etc"*. They all seemed to experience an overall feeling of a trial-and-error decision-making culture but from their two distinctively different perspectives. Managers and experts at planning processes and investment calculations saw the culture as troubling, while project members saw it as everyday practice. This seems to indicate that team members see managing deviations as a natural occurrence in the process that needs to be managed on a regular basis, while management sees deviations as recurring occurrences that need to be eliminated from processes. They all see deviations as problems that are issues of frustration and that need attention. However, their approaches are dependent on their points of view regarding decision-making. These two different points of view impact on what kind of decision results are pursued by the internal and external actors. They also result in uncertainty in preferences regarding the expected consequences of alternatives.

## 5 CONCLUSIONS AND DISCUSSION

This research contributes enhanced knowledge of how project managers cope with deviations in order to reach decisions. We have described how praxes are used in order to reach sub-decisions with specific consequences. For example, the inclusion of external experts as well as detaching project time enables the creation of a loosely coupled system. This in turn enables the team to focus on the management of the deviation and to manage normal operations in parallel in the project. The overall decision-making process when managing the deviation show resemblance with the Garbage-Can model which is stated to be suitable for explaining decision-making in loosely coupled systems. For example, ambiguous goals and preferences are a part of both the input to the situation as well as the process itself. Two different points of view regarding decision-making (based on a prescriptive or adaptive decision model) impacts what kind of decision results that are pursued by the internal and external actors and result in uncertainty in preferences regarding expected consequences of alternatives. Further, a criterion used for evaluating alternatives is not selected before a process of managing a deviation is initiated but during the process, related to possible alternatives identified along the way. Also, a good decision occurs when a problematic situation matches an independent existing remedy in a “Satisficing” [14] way, i.e. the search of alternatives is terminated when a good enough alternative is found. The contribution of this research can be used by project managers to reflect upon their practices in managing deviations (double loop learning). Finally, this new knowledge can be further developed by investigating how loosely and strongly coupled activities affect the team members’ practices of reaching decisions in early phases.

Great curiosity and interest in understanding deviations in product development processes has been shown by the case company. A need to understand the current practice regarding managing deviation is thought to be important in order to reason about process governance improvements in advanced product development. The improvements are thought to be derived by considering uncertainty aspects not covered by management models used currently, without trying to eliminate uncertainty that cannot be eliminated. This could create realistic prerequisites for making decisions in planning activities and create robust ways of working in projects.

## REFERENCES

- [1] Christiansen, J.K., Formal Rules in Product Development: Sensemaking of Structured Approaches. *The Journal of Product Innovation Management*, 2009, 26(5), pp502–519.
- [2] Engwall, M., No project is an island: linking projects to history and context. *Research Policy*, 2003, 32(5), pp789–808.
- [3] Christiansen, J.K. and Varnes, C.J., The ignorance of information at gate meetings. In *13th International Product Development Management Conference*, 3. Milan, Italy, June 13-14. pp17
- [4] Jupp, J., Eckert, C. and Clarkson., J., Dimensions of Decision Situations in Complex Product Development. *International Conference on Engineering Design, ICED0924-27 August*, Stanford University, Stanford, CA, USA, 2009).
- [5] Engwall, M., The futile dream of the perfect goal. In Sahlin-Andersson, K. and Söderholm, A., eds. *Beyond project management: New perspectives on the temporary-permanent dilemma*, pp261-276 (Copenhagen Business School Press, Copenhagen, 2002).
- [6] Cooper, R.G., Perspective: The Stage-Gate® Idea-to-Launch Process - Update, What's New, and NexGen Systems. *The Journal of Product Innovation Management*, 2008, 25(3), pp213-213.
- [7] Gidel, T., Gautier, R., Duchamp, R., Decision-making framework methodology: an original approach to project risk management in new product design. *Journal of Engineering Design*, 2005, 16(1), pp1–23.
- [8] Pahl, G. and Beitz, W., *Engineering Design: A Systematic Approach*. (Springer-Verlag Ltd, London, 1977).
- [9] Ullman, D.G., *The Mechanical Design Process*. (McGraw-Hill Education - Europe, New York, 2002).
- [10] Ullman, D.G., *Making Robust Decisions*. (Trafford Publishing, USA, Victoria, 2006).
- [11] Ulrich, K.T. and Eppinger, S.D., *Product Design and Development*. (McGraw Hill Higher Education, New York, 1995).
- [12] Brown, J. and Boucher, M., NPD - The 2011 Growth Imperative: Optimizing Speed and Cost in

- New Product Development. (Aberdeen Group, 2010).
- [13] Brunsson, N., *Mechanisms of hope: maintaining the dream of the rational organization*. (Copenhagen Business School Press, Copenhagen, 2006).
- [14] March, J.G., *A Primer on Decision Making - How decisions happen*. (The Free Press, New York, 1994).
- [15] Simon, H., *Administrative Behaviour: A Study of Decision-making Processes in Administrative Organizations*. (The Free Press, USA, New York, 1997).
- [16] Hällgren, M., Mechanisms of deviations: observations of projects in practice. *International Journal of Managing Projects in Business*, 2009, 2(4), pp611-625.
- [17] Söderholm, A., Project management of unexpected events. *International Journal of Project Management*, 2008, 26(1), pp80–86.
- [18] Badke-Schaub, P. and Gehrlacher, A., Patterns of decisions in design: Leaps, loops, cycles, sequences and meta-processes. *International Conference on Engineering Design, ICED03* Stockholm, 2003).
- [19] Agyris, C. and Schön, D.A., *Organizational Learning – A Theory of Action Perspective*. (Addison-Wesley, Reading MA, USA, 1978).
- [20] Whittington, R., Completing the practice turn in strategy research. *Organization studies*, 2006, 27(5), pp613–634.
- [21] Whittington, R., Strategy practice and strategy process: family differences and the sociological eye. *Organization studies*, 2007, 28(10), pp1575–1586.
- [22] Packendorff, J., Inquiring into the temporary organization: New directions for project management research. *Scandinavian Journal of Management*, 1995, 11(4), pp319-333.
- [23] Söderlund, J., Building theories of project management: past research, questions for the future. *International Journal of Project Management*, 2004, 22(3), pp183–191.
- [24] Cicmil, S., Understanding project management practice through interpretative and critical research perspectives. *Project Management Journal*, 2006, 37(2), pp27-37.
- [25] Cicmil, S., Williams, T., Thomas, J. and Hodgson, D., Rethinking project management: researching the actuality of projects. *International Journal of Project Management*, 2006, 24(8), pp675-686.
- [26] Paroutis, S. and Pettigrew, A., Strategizing in the multi-business firm: Strategy teams at multiple levels and over time. *Human Relations*, 2007, 60(1), pp99–135.
- [27] Hällgren, M., Avvikelsens mekanismer: Observationer av projekt i praktiken. Thesis (Doctoral). Handelshögskolan Umeå universitet 2009
- [28] Yin, K.R., *Case Study Research: Design and Methods*. (Sage Publications, Inc, Thousand Oaks, CA, 1994).
- [29] Orton, J.D. and Weick, K.E., Loosely Coupled Systems: A Reconceptualization. *The Academy of Management Review*, 1990, 15(2), pp203-223.
- [30] Snook, S.A., *Friendly fire: The accidental shootdown of US black hawks over northern Iraq*. (Princeton University Press, Princeton, NJ, 2002).
- [31] Dvira, D. and Lechler, T., Plans are nothing, changing plans is everything: the impact of changes on project success. *Research Policy*, 2004, 33, pp1-15.
- [32] Weick, K.E., *The social psychology of organizing*. (Addison-Wesley Publishing Company, Reading, Massachusetts, 1979).
- [33] Weick, K.E., Educational organizations as loosely coupled systems. *Administrative Science Quarterly*, 1976, 21(1), pp1-19.
- [34] Howard, R.A. and Matheson, J.E., An Introduction to Decision Analysis. *Long Range Planning Service* (Stanford Research Institute, Palo Alto, 1968).
- [35] Lindblom, C.E., The science of" muddling through". *Public administration review*, 1959, 19(2), pp79-88.
- [36] Etzioni, A., Mixed-scanning: A" third" approach to decision-making. *Public administration review*, 1967, 27(5), pp385-392.
- [37] Beach, L. and Mitchell, T., A contingency model for the selection of decision strategies. *Academy of Management Review*, 1978, 3(3), pp439-449.
- [38] Cohen, M.D., March, J.G. and Olsen, J.P., A garbage can model of organizational choice. *Administrative Science Quarterly*, 1972, 17(1), pp1-25.
- [39] Brunsson, N., *The consequences of decision-making*. (Oxford University Press, Oxford, 2007).