

Managing the Unexpected in a Multi-project Environment

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Abstract

The aim of this paper is to present the results from a case study aimed at answering the following research question: *How are decisions on managing deviations in a highly interrelated project made in practice?* The results are based on analysis of a single case study of a complex system development project, interrelated with eight other projects. It reveals the development team's efforts to make sense of, and decisions on, deviating situations. The analysis reveals the characteristics of the sensemaking processes related to the consequences of the decision processes. This research contributes enhanced knowledge of how project managers cope with deviation in order to reach informed decisions involving four different types of sensemaking and four types of decision consequences. The results of this research can be used by project managers or other decision makers within product development to reflect upon how to manage unexpected deviations, proactively as well as reactively.

Keywords: *Product development, deviation, decision-making, practice, sensegiving, and sensemaking.*

1. Introduction

Many manufacturing companies with advanced products implement structured development processes (Christiansen, 2009) with the aim to improve performance. A key issue is to increase the predictability of project execution, and project governance models are commonly used for that purpose (gate models or similar models, for example). These are used both to ensure the quality of the execution, but also to manage the increased complexity caused by the parallel execution of several projects (Bras & Mistree, 1991). However, using these prescriptive project models may also have some potential negative effects. The synchronization between dependent projects with pre-defined gates needs very accurate planning and execution. This rarely occurs in practice, resulting in additional waiting, coordination and waste.

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 (Christiansen & Varnes, 2006). Models within advanced product development that describe decision-making are often based on simplified models and assumptions (Jupp et al., 2009). These models often prescribe that product development should be planned in detail in advance. It is assumed that project objectives are fully defined and that all needed information is available. The models also state that decisions in the early phases of projects should be treated explicitly, with rigor, in order to prevent unexpected consequences downstream. The same message is told in university education, company

guidelines, and in the quality assurance systems used in companies (Engwall, 2002). These rational models are used to guide activities within projects and are often regarded as an ideal for practice. This notion of rational decision-making has been questioned by scholars, beginning with Simon, and others have followed (for example, Brunsson, 2006; Engwall, 2002; March, 1994; Simon, 1997). Regarding rational decision-making in projects, Engwall (2002, p. 262) states: "*In spite of the rhetoric, there are probably few projects in practice that are the result of a rational decision making process*".

The nature of early phases in product development projects involves a high degree of uncertainty in activities, knowledge, and information, including plans. Politics and social aspects will also influence the decision-making processes. Further, as these activities are conducted in an interrelated and highly dynamic environment, deviations from the ideal are inevitable. Planning and re-planning will always be vital for project performance, but so will the practice of managing deviations.

Research on managing early phases in product development is extensive. Still, knowledge about the concept of deviation and its relationship to decision-making is limited. Few cases describe the current practice of managing deviations in projects, with the exception of, for example, Hällgren (2009b). Hällgren (ibid) describe the practice of managing deviations in construction project teams and 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.

In conclusion, more knowledge concerning the practice of managing deviations is needed in order to better understand the current decision practices. The understanding could be used to improve both proactive as well as reactive decision-making when managing deviations. Therefore, a research question was formulated: *How are decisions on managing deviations in a highly interrelated project made in practice?*

By describing the current practice of managing deviations related to decision-making, a double loop learning cycle (Agyris & Schön, 1978) is made possible for both practitioners and 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 praxes could we utilize in managing deviations in projects in different situations?*").

2. Research approach

The standpoint of this research is that rational based models frequently used in product development are based on simplified decision-making models and an exaggerated belief in rationality in practice. This standpoint has been proclaimed for a long time. However, it has only been approached by suggesting more detailed process level studies of projects (Packendorff, 1995; Söderlund, 2004). This has been criticized by several scholars who have put forward an approach for dealing with this from a micro-organizational perspective (for example, Cicmil, 2006; Cicmil et al., 2006; Hällgren, 2009b). The approach of project-as-practice (Whittington, 2006; Whittington, 2007) 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 (in other words, practice) (Hällgren, 2009a). In this case, it is a matter of identifying team members' praxes used when managing deviations in relation to decision-making during the early phases of an interrelated 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 (Paroutis & Pettigrew, 2007). As Hällgren (2009a, p. 25) states: “*Contrary to the process perspective, a practice perspective means that existing processes are not noted in favor of studies of how the processes arise*”.

The case study approach was chosen, as 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*” (Yin, 1994, p. 13).

A one year participant observation study was carried out in an interrelated product development project in the manufacturing industry during 2009-2010. The “*participant observer*” field technique is well-recognized in sociology, anthropology, and communication studies, and has been adopted by other research disciplines as well. The technique is based on the notion that a community's internal relationships, dynamics, values, and organization are understood best by observing actions, rather than their (normative) statements of what those relationships “*are*” (Douglas, 1976).

The case study company is an international company, and its products can be described as complex systems (in other words, large mechatronic systems). The selected case study project was carried out by a core team of ten people and several hundred people in their surrounding social network. The project was planned to have a five-year-long lead time. The observation took place the first year of the project, until the project entered the detailed design phase. Data was collected through direct observations of on-going project team work (approximately 600 hours), notes, and document reviews (approximately 5,300 e-mails and approximately 5,000 project documents). The researcher had full access to all essential documentation and critical activities, such as steering group meetings and other decision meetings. The role of the researcher was as a passive observer, and the researcher did not influence the way the team executed the project.

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 filters for analyzing data as well for theoretical comparison. The data was transferred to a qualitative data analysis tool, the software NVivo8. The analysis filters were used in NVivo8 to categorize the data and make cross references. Also, a social network analysis was made through two central project managers’ emails, sent and received, during the first year to illustrate the social environment affecting the team members’ decision-making processes. The case study section contains a detailed description of the method used for analysis.

3. Theory

Studies of managing deviation, from a micro-perspective, mean understanding emergent activities and consequences resulting from the situated praxis of interacting actors. Praxes are used to produce decision consequences that enable the project to move past the deviating situation. The process can be described as being composed of decisions having several roles and consequences besides choice and actors continuously working to understand the deviating situation (sensemaking) in order to decide upon suitable responses. Therefore, theory regarding sensemaking in an interactive social environment and the role of decision-making is relevant to use as a basis for the analysis of decisions concerning managing deviations in interrelated projects.

3.1 Sensemaking and sensegiving

Sensemaking has been approached in various manners, from micro-cognitive functions to social and organizational behavior. Micro-cognitive approaches often focus on studies of how people integrate information and knowledge to form interpretations. Social and organizational approaches expand the concept of sensemaking by integrating how cues are singled out and trigger sensemaking processes in order to construct reality and its consequences. Sensemaking focuses on how actors construct meaning in this constructed reality.

A sensemaking approach views human behavior as an unfolding process, in contrast to the normalized assumption that decisions are the triggers for a certain course of action. Chia (1994, p. 794) describes decision-making as imposing order on streams of events and as a “*product of a post-hoc rationalization process.*” Decision making is seen as “*our projection of purposive and intentional behavior onto those we observe and analyze*” (Chia, 1994, p. 795). Sensemaking de-emphasizes people as rational actors and argues that much of what we do is articulated and understood only in retrospect (Weick, 1995).

Sensegiving, on the other hand, focuses on how actors intentionally try to influence how other actors interpret situations. Weick et al. (2005, p. 416) have defined sensegiving as “*a sensemaking variant undertaken to create meanings for a target audience.*” Sensegiving has mainly been used as a concept within strategic management studies. It describes the influence and persuasion related to strategic change initiatives (Corley & Gioia, 2004; Rouleau, 2005). Maitlis (2005) found four characteristically different sensemaking processes in a study of leaders and stakeholders managing issues together by sensegiving processes (see Table 1). The study was conducted on three symphony orchestra organizations in Britain, a type of organization that can be compared to small and medium-size enterprises (Maitlis, 2005).

Table 1. Four types of organizational sensemaking (Maitlis, 2005)

Leader Sensegiving <i>High Sensegiving</i> <i>Low Sensegiving</i>	<i>Guided organizational Sensemaking</i>	<i>Restricted organizational Sensemaking</i>
	Process characteristics <ul style="list-style-type: none"> • High animation • High control Outcomes <ul style="list-style-type: none"> • Unitary, rich account • Emergent series of consistent actions 	Process characteristics <ul style="list-style-type: none"> • Low animation • High control Outcomes <ul style="list-style-type: none"> • Unitary, narrow account • One-time action or planned set of consistent actions
	<i>Fragmented organizational Sensemaking</i>	<i>Minimal organizational Sensemaking</i>
	Process characteristics <ul style="list-style-type: none"> • High animation • Low control Outcomes <ul style="list-style-type: none"> • Multiple, narrow accounts • Emergent series of inconsistent actions 	Process characteristics <ul style="list-style-type: none"> • Low animation • Low control Outcomes <ul style="list-style-type: none"> • Nominal account • One-time compromise action
	<i>High Sensegiving</i>	<i>Low Sensegiving</i>
	Stakeholder Sensegiving	

Within this conducted research, a sensegiving-sensemaking perspective is considered appropriate to use for analysis of collected data. That is because a project team developing a complex product system is constantly engaged in multiple sensegiving-sensemaking processes in order to create common understanding and action within as well as between parties in the development organization. Project managers generally aim at managing the project from a holistic perspective and the functional representatives more often from an expert, detail perspective. Commitment and support from management members is also often a vital part of maneuvering the project through a deviating situation. Maitlis' (2005) four types of sensemaking were used in this conducted research to categorize and characterize sensemaking processes used when making decisions on managing deviations in the project. The four types of organizational sensemaking explain the interaction between leaders and stakeholders as a common process of sensemaking and sensegiving. A summary of Maitlis' (2005) results is described below to explain these four types in detail.

Guided organizational sensemaking processes were guided through the systematic and confidential approach the leaders in the orchestras used to interact, gather, coordinate, and shape stakeholder contributions. Thirty percent of the four types of sensemaking were of a guided nature. Leaders were engaged in a vast amount of sensegiving activities in private meetings with different stakeholders that were often planned in advance and provided *high control* (commanded by a small number of people) of the processes. The processes were also

often *highly animated* (high level of interaction), as a result of stakeholders insisting on being a part of discussions and solutions and thereby engaged in sensegiving. Due to the high level of stakeholder involvement, the knowledge of the issue under discussion was widespread and discussed over a long period of time. The outcome of guided sensemaking processes led to unitary and rich accounts (understandings). Unitary accounts were produced by leaders systematically gathering constructions from stakeholders on the issue and creating a single, new shared account. The richness of the accounts was produced by leaders gathering accounts from many different stakeholders and by building on accounts, cumulatively creating a dense construction.

Fragmented organizational sensemaking resulted when the processes were *animated* but not *controlled*. Twenty-six percent of the four types of sensemaking were of a fragmented nature. Stakeholders arguing for different constructions and solutions, in combination with leaders not integrating stakeholder accounts into coherent shared accounts, led to high stakeholder sensegiving but low leader sensegiving. Since the different stakeholder accounts were not integrated and built upon, the outcome was not settled between parties. These sensemaking processes remained active over a long period of time since new accounts kept arising, producing multiple individualistic accounts. (Maitlis, 2005)

Restricted organizational sensemaking occurred when processes were *highly controlled* but not very animated. Twenty-six percent of the four types of sensemaking were of a restricted nature. Leaders spread general accounts of issues that stakeholders often accepted with few suggestions of alternative accounts. However, they did identify stakeholders important to the understanding of the issue and sought those stakeholders' input in scheduled private meetings. These processes produced a unitary account that was narrower than the outcome from the guided and fragmented sensemaking processes. (Maitlis, 2005)

Finally, *Minimal organizational sensemaking* resulted from processes that were neither *controlled* nor *animated*. Fifteen percent of the four types of sensemaking were of a minimal nature. The process is characterized by leaders and stakeholders engaging in low levels of sensegiving. In these processes, parties tend to await the other's accounts on issues, which often served as a response to external triggers. Few discussions between leaders and stakeholders with no attempts to consolidate any shared construction added to the process characteristics of low control and animation. (Maitlis, 2005)

3.2 *The role and consequences of decisions*

Observing decision strategies needs to be done with a wider perspective than just observing the actual decision, but also to involve the considered consequences resulting from certain decisions in order to determine the patterns of decision praxes. A literature review of decision models provides a unanimous answer as far as what consequence a decision has; it is a choice between two or more alternatives. In fact, the definition of *decision* is "to cut." It is what you will and will not do (in other words, what to include and what to cut out in order to design satisfactory results) (Baron, 2000; Yates, 2003). A decision is a commitment to a course of action and the irreversible commitment of resources (Howard, 1988; Marsh, 1997; Mintzberg & Raisinghani, 1976). Brunsson (Brunsson, 2007), however, puts forward an additional theory, asserting that decisions in organizations can have four different roles, or consequences (See Table 2).

Table 2. Four roles (consequences) of decisions (Brunsson, 2007)

	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 (2007, p. 27): *“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 to which actors follow rational norms of standard decision theories varies according to the decision makers’ role and purpose. A high degree of rationality can be interpreted as an attempt to manage choices, hinder action (by requesting more rational procedures), escape responsibility, or legitimize events in an environment where inconsistent norms are important (in politics, for instance). 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. (Brunsson, 2007) states, *“In practice, decision processes may play more than one of the roles described here, sometimes all four. Different or the same decision-makers may want to use decision processes for different purposes or, whatever their own preferences, decision-makers may be aware of observers interpreting the processes in several ways. Budgeting or other decision processes may even involve a battle between groups trying to establish it as playing one role or another. Such decision processes may become very complicated and seem extremely fuzzy both for participants and external observers, and they are not possible to understand if analyzed from the perspective of one role only”* (Brunsson, 2007, p. 28).

To better understand the purposes of decisions made by the project team when managing deviations, the four different decision consequences are used in this conducted research in order to codify data in this regard. By viewing consequences of decisions as not only choice, a more nuanced view on the practice of managing deviations can be achieved.

4. Case study – Making sense of unexpected deviations in early project phases

The case study company is an international company that operates within the manufacturing industry. The company has development and manufacturing on multiple sites around the world, and sells their products on the global market. The number of employees in the specific company organization in this case study is approximately 1,200, and 30% of them work in the product development departments. 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 regarding development and project models. A project is initiated by a formal request from the product planning function, and a head project manager is appointed to manage the project. The steering committee and the head project manager meet on a monthly basis in order to follow-up the progress in relation to the defined targets and discuss actions if needed. The steering committee also makes decisions when investments related to the project exceed a certain amount of money. The head project manager is responsible for the decisions in the project, and manages a cross-functional development team whose aim is to reach the project goals. In the case study, the head project manager also received support from discipline project leaders who represented different functions (for example, engineering, manufacturing, after market, validation and verification, and purchasing). The head project manager in this case had ten years of experience developing this particular type of system and was considered to be highly skilled by co-workers and management in the company. The project was carried out by a core team of ten people and several hundred people in their surrounding network. The project was planned to have a lead time of five years, of which the early phases was planned to take 15 and a half months.

A picture of the communication of project managers could be identified and illustrated by conducting a social network analysis of the two key project managers' emails (sent and received) during the first year of the project (see Figure 1). The two managers were the head project manager and the project leader representing engineering. A software called NodeXL was used for the analysis of the emails, and a Harel-Koren Fast Multiscale algorithm and layout was used to identify natural groupings. The closer an actor is to one of the two managers, the more interaction occurs between them. The large circle marks the head project manager and the smaller circle the project leader of engineering, the two most central and observed people in the study. The analysis illustrates the different stakeholders involved during the first year and the connections made between the two managers and stakeholders in the organization. The stakeholders ranged from internal experts to the CEO of the company to management members of a cooperative external company. The interactions passed through functional, project, and organizational boundaries. In total, 664 people were involved to a greater or lesser degree, from only being informed to taking an active part in the project. Figure 1 represents a large extent of the project team's social environment affecting the sensegiving-sensemaking processes and interactions during decision-making on management of deviations in the project. It shows the amount of actors involved and the level of complexity which the project managers needed to relate to when managing deviations in the project.

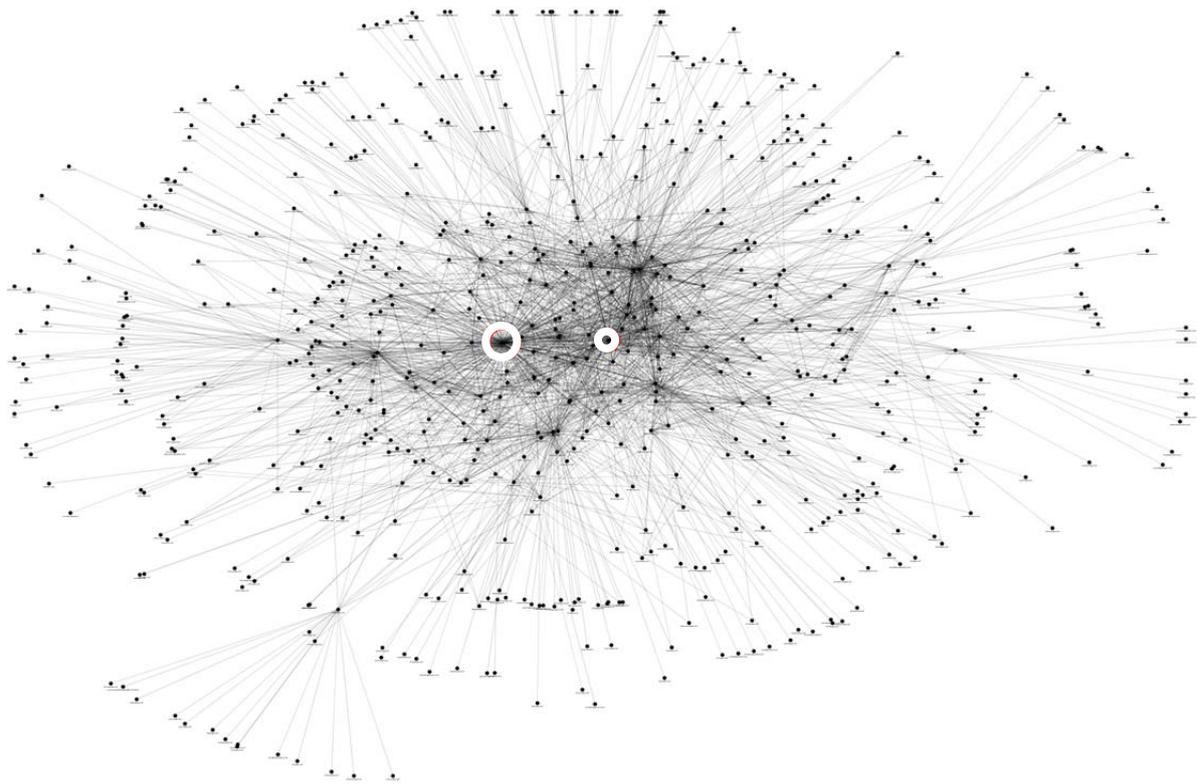


Figure 1. A social network analysis of the two key project managers' email communication during the first year of the project.

4.1 Interpretation of case study data

The observations of the team's day-to-day work in the project involved observing the activities of communication, decision processes, related 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 practice patterns can be seen in Table 3. Four types of decision consequences were related to praxes and codified. The filter was also used to codify the data in order to identify the relationship between the praxes and Maitlis' four types of sensemaking. The decision episodes' process and output characteristics were identified and coded accordingly.

Table 3. The filter used for the codification of data in NVivo8.

Decision episode		Decision consequences				Sensemaking type
Praxis	Sequence	Choice	Mobilization	Responsibility	Legitimation	
	n					A, B, C, or D
	n+1					

4.2 Observed deviations

The unit of analysis was deviations experienced by the development team and the associated practice of making decisions. Thirty-seven deviations were observed during the early phases of the project (13 months of observations). Each of the 37 deviations was intensely observed to identify the praxes used when making decisions. By using Hällgren's (2009a) identified praxes, observation notes were codified accordingly. In addition, all information shown

during meetings or drawn on whiteboards was printed and attached to associated observation notes and codified.

Further, it was greatly important to identify the circumstances related to the occurrence of the deviation, as well as the history leading up to those circumstances. The circumstances changed throughout the process and were important to understand in order to analyze the applied praxes appropriately. At the same time, some circumstances were consistent throughout the process. Examples included the overall economic situation for the company, market shares, production volumes, and the project governance organization. The economic recession was just starting to recover at the time of the study, and the development departments were understaffed due to recent budget cuts. This was a constant reality for the project manager, who was hard pressed to find enough experts to include in the project team. Before the economic recession, the company had made massive investments in the re-organization and development of the production system. Their production had undergone costly and radical changes. This made the company management cautious about investments in general, in addition to the consequences of the recession. Market shares and projected sales volumes were still relatively low compared to the situation before the recession and affected tolerated project costs in projects in general. This made project time a critical factor in the project, where engineering time was extensive and costly. The product development departments had also gone through a re-organization. Thus, the decision boards and decision procedures were to some extent new to the head project manager in the observed project. This made it difficult sometimes for the project managers to identify those responsible for decisions on a governance level in the organization.

Plans in the early phases of the project were described in the company’s formal project governance documentation. The project was divided into three project phases: feasibility of project, pre-study of concepts, and concept development. The phases were broken down into project activities, tasks, and deliverables, and were managed in a web-based interface by the head project manager. The activities were not unambiguous to team members, including the project manager, since the activities were given to the team upon project initiation. In addition, discussions regarding the practical meaning and definition of stated activities were common in team meetings. Determining whether actions taken by the team were a part of managing a deviation or a part of regular operations was not always easy. It was important to establish if a situation was unexpected to the team. The technique for clarifying this was simple: ask the project members in a non-disclosure manner. When comparing observed actions to formal plans and discussed expectations within the team, the 37 deviations could be analyzed. They are summarized in Table 4. The table is a budget list of the observed deviations, without any chronological order.

Table 4. Observed deviations.

<i>ID</i>	<i>Deviation</i>	<i>ID</i>	<i>Deviation</i>	<i>ID</i>	<i>Deviation</i>
1	Responsibility of test	14	Software off-line	27	Delivery date delay
2	Synch of project plans	15	Requirement signing	28	Installation re-planning #2
3	Lead time on alt. component	16	Manufacturing capacity	29	Quality information
4	PMs stuck in Peking	17	Requirement process	30	Sales requirements
5	Stretch target	18	Preliminary request	31	Platform input

6	Component information	19	Component supplier	32	Component size
7	Responsibility of simulations	20	Installation re-planning #1	33	System effect
8	Change of project scope	21	Re-organization #1	34	Development cost calculation
9	Strategy of choice of system	22	Re-organization #2	35	Data quality
10	Missing representative	23	Re-organization #3	36	Information request
11	Late requirements #1	24	Risk management	37	Reuse of components
12	Late requirements #2	25	Late resources		
13	Requirement review	26	Project delay		

4.3 Analysis and results – praxes, decision consequences, and sensemaking types

Each deviation was analyzed by identifying the praxis used and the resulting decision consequences. Also, the processes of managing each deviation were analyzed by comparing the process and output characteristics with Maitlis' descriptions of the four types of sensemaking (see Table 5).

Table 5. Decision episodes, deviations, praxes, sensemaking types, and decision consequences. (Examples of coding.)

<i>Decision episode</i>			<i>Decision consequences</i>				<i>Sensemaking type</i>
<i>ID</i>	<i>Deviation</i>	<i>Praxis</i>	<i>Choice</i>	<i>Mobilization</i>	<i>Responsibility</i>	<i>Legitimization</i>	
1	Responsibility of test	Reminder		X			Restricted
		Check status			X		
		Implement			X		
2	Synch of project plans	Reminder			X		Fragmented
		Enable alternatives	X				
		Discuss				X	
3	Lead time on alt. component	Force alternative				X	Guided
		Marginalization		X			
		Resource allocation		X			
		Implement	X				
		Enable alternatives	X				
	Discuss				X		
	Marginalization	X					

When analyzing the episodes, it was shown that different types of sensemaking processes constituted 16%, 51%, 22%, and 11% of the identified episodes. When analyzing the distribution of the sensemaking types related to decision consequences, the sensemaking processes was shown to correlate to decision consequences whose ratio was interesting. Most deviations were managed by restricted sensemaking processes, controlling the processes by creating responsibility and making choices. At the same time, many deviations were managed

by fragmented sensemaking processes, where control was low and discussions were open for most stakeholders (see Table 6). In order to explain the analysis and results in detail, a detailed description and discussion will follow.

Table 6. Types of sensemaking processes and related decision consequences, based on (Maitlis, 2005).

Leader Sensegiving	High Sensegiving	<p>Guided organizational Sensemaking (6/16%)</p> <p><i>Decision consequences:</i></p> <p>Choice: <u>21</u> Mobilization: 6 Responsibility: 11 Legitimization: 7</p> <p>Tot. 45 (24%)</p>	<p>Restricted organizational Sensemaking (19/51%)</p> <p><i>Decision consequences:</i></p> <p>Choice: <u>19</u> Mobilization: 10 Responsibility: <u>21 (i:15, e:6)</u> Legitimization: 7</p> <p>Tot. 57 (31%)</p>
	Low Sensegiving	<p>Fragmented organizational Sensemaking (8/22%)</p> <p><i>Decision consequences:</i></p> <p>Choice: 18 Mobilization: 8 Responsibility: <u>28 (i:13, e:15)</u> Legitimization: 18</p> <p>Tot. 72 (40%)</p>	<p>Minimal organizational Sensemaking (4/11%)</p> <p><i>Decision consequences:</i></p> <p>Choice: 2 Mobilization: 3 Responsibility: <u>5</u> Legitimization: 0</p> <p>Tot. 10 (5%)</p>
		High	Low Sensegiving
		Stakeholder Sensegiving	

Guided organizational sensemaking (16% of the episodes) would often be controlled by formal planning meetings where project managers and team members met different stakeholders in planned meetings to resolve a deviation. One example was meetings held between project managers and experts of different development project teams. Between formal meetings, the involved actors communicated by email and local small face-to-face meetings in order to prepare information and reach local common understanding. The project manager and project leader would promote a distinct perspective from the specific project's perspective. However, at the same time, they would invite a large number of stakeholders to share their accounts of the situation. This shaped common beliefs and knowledge, including the important aspects of the issue and different views (strategic targets for commonality within the product portfolio and detailed choices of technology design, for instance). The decision consequences produced by this kind of sensemaking processes were mostly focused on choices. Often in these processes, the project managers had a specific complex issue they needed external experts or management support to resolve, and controlled the process themselves. Responsibility was also a common decision consequence. This underlines the

importance for the project managers of clarifying and defining whom to contact, gather information from, and remind of the already established responsibility in some cases. The processes were about issues that transcended the development team, and the different stakeholders tried to shape opinions. That was why the project managers in some cases needed to legitimize their ideas and actions to be able to move forward with the support of the stakeholders. In some cases, the processes led to unexpected situations that demanded more manning, and the project managers needed to mobilize the team with experts, managers, or other actors in order to manage the deviation. This kind of sensemaking process produced 24% of all the decision consequences observed when managing deviations in the project.

Restricted organizational sensemaking processes (51% of the episodes) could be observed in deviating situations the project manager and leaders found important to control, and could be managed internally by the team, except in a few cases where a few managers or external experts needed to be involved. Different types of meetings were used to mobilize the actors, develop and gain acceptance of solutions, create legitimization, and distribute responsibility (team meetings, small planned meetings, or face-to-face meetings). The sensemaking processes could be ongoing during a single face-to-face meeting, over several weeks, or even months where emails were a common communication form. Interestingly, these sensemaking processes produced decision consequences of responsibility and choice. Responsibility was an important consequence, since the project managers tried to “*position*” the thought alternatives and choices related to external issues and stakeholder opinions. This demanded that the project managers explored and defined their responsibility in relation to external consequences. It was shown that 15 out of 21 (i:15) consequences concerned the team’s responsibility, and six out of 21 (e:6) consequences concerned identifying and sometimes reminding external actors of their responsibility. These issues of responsibility were often treated in an informal manner by the project managers (phone calls, emails, or one-on-one spontaneous meetings). Since alternatives and, ultimately, choices were sought to resolve the deviating situations, the consequences of choice were common as well. Mobilization also ended up being a fairly common decision consequence. It is explained by the project manager’s need to contact remote actors in the company to investigate certain aspects of the issue and in that way gather information. The processes were about issues that in some cases needed management support, and the project managers needed to inform and legitimize their ideas and actions. This was also common in order to prepare management actors for planned actions before steering committee meetings and cross-reference meetings, gatherings designed to ensure support before taking action in the project. This kind of sensemaking process produced 31% of all the decision consequences observed when managing deviations in the project.

Fragmented organizational sensemaking characteristics (22% of the episodes) can be compared to a decision-making model called the Garbage Can model (Cohen et al., 1972), with the outcome being multiple, individualist accounts. This form of sensemaking could be observed over time when an issue became widespread in the organization (often by email and other day-to-day contacts). External stakeholders contacted the project managers regarding the issue and described their accounts. The misalignment of priorities (use of time and other resources), tactics (planned possible ways of acting), and understandings of current prerequisites in the project were often too extensive to be processed into a single account. This made the resulting accounts fragmented, which acted as a source of reoccurring discussion and discontent regarding the results of the deviation management processes. The team did what they could afford (time and resource-wise), and sacrificed stakeholder commitment and satisfaction in order to manage the deviations. These discontents sometimes led to stakeholders taking action, informing management of their discontent or wanting them

to intervene. Sometimes stakeholders took actions that did not support the actions of the team, which were intended to remedy the deviating situation. A highly relevant finding regarding this kind of sensemaking process was the strong output of responsibility decision consequences. Twenty-eight out of 72 decision consequences involved responsibility. Further, it was shown that 13 out of 28 (i:13) responsibility consequences were internal, and 15 out of 28 (e:15) were external. This even ratio indicates the highly animated and uncontrolled nature of these sensemaking processes. Many external actors demanded to give their accounts of the deviating situation. This was of great importance for them, but not always equally important to the team. This often led to discussions surrounding the responsibility of the issue and its consequences, both internally within the team and externally. In these highly dynamic and uncontrolled processes, politics often emerged as a dominating factor, and the project managers needed to skillfully legitimize the team's point of views, ideas, and actions. Many choices were made. However, those choices unfortunately were often not based on a consistent single account (common view and resulting planned actions). This kind of sensemaking process produced 40% of all the decision consequences observed when managing deviations in the project. This account for a substantial amount of effort, which led the project managers to, in some cases, mobilize experts or management actors in order to cope with the management of the deviations.

Minimal organizational sensemaking (11% of the episodes) could be observed when a deviation was considered easily remedied and the team felt confident in their common account of a deviating situation. Also, since the deviation was considered easily remedied, no commitment or support was needed from management members to progress. These sensemaking processes were often short-lived and informally managed. Responsibility was the most common decision consequence, and was often enough to resolve the issue. An issue was remedied by either accepting responsibility or reminding some external actor of his or her responsibility for the issue. Few choices were made, and mobilization was not needed (except in a few cases where new information needed to be generated by external actors). This kind of sensemaking process produced five percent of all the decision consequences observed when managing deviations in the project.

6. Conclusions and discussion

This research contributes enhanced knowledge of how project managers cope with deviations through the use of certain decision-making strategies that are, in turn, the result of different types of sensemaking processes. We have described how praxes are used in order to result in different decision consequences, so as to navigate in a tightly coupled environment when managing deviations. What can be noted is that fragmented sensemaking processes involve an extensive amount of the total applied praxes of the actors (22% of the episodes produce 40% of the decision consequences). This indicates the effort it takes for the project managers to manage processes that are "*politics prone*," and choices still need to be made. Legitimization plays a big part in these processes and indicates the social skill needed to manage deviations that involve many diverse actors' accounts in the organization. Restricted sensemaking processes include, apart from choice, an extensive amount of responsibility consequences. This indicates the amount of work that goes into positioning deviating issues throughout the organization. Internal issues need to be understood in relation to external issues and consequences in order to define internal responsibilities.

The results of this research can be used by project managers or other decision makers within product development to reflect upon how to manage unexpected deviations,

proactively as well as reactively, within their specific contexts. A largely open project organization will lead to an increase in fragmented sensemaking processes, since it leads the way for external actors to submit accounts the project team needs to consider. If the project managers' relative power in the organization is large, the processes may be converted into more guided sensemaking processes and increased focus on the production of choices. On the other hand, if the project organization is largely closed, an increase in restricted or minimal sensemaking processes may occur. This leads to an increase in internal responsibility to be defined in order to produce choices.

Finally, depending on the situation, context, parties, and possible control, different praxes need to be used to produce decision consequences to maneuver the project through deviating situations. The project managers in this study used great social, political, and organizational mindfulness to be able to cope with deviations in the interrelated project environment. This research contributes enhanced knowledge of how project managers cope with deviation in order to reach informed decisions that produce four types of consequences through four different types of sensemaking processes.

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