
Managing uncertainty in innovation project portfolios: tasks of managers and steering committees

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Abstract: Innovation project portfolios as organizations' strategic investments face uncertainties both within the organization and in the business context. Management of such uncertainties is distributed in the organizations and requires cooperation, but it may be challenging to coordinate in and across the complex portfolios. This study increases knowledge of the social aspects of innovation project portfolio uncertainty management, when its responsibilities are divided across managerial levels and steering committees. Experiences in two highly innovative case firms reveals firm-specific emphases in the attention to uncertainties, potentially stemming from industry dynamics. Complex mechanisms are used for filtering uncertainty information from individual actors' sensing and seizing activities to steering committees' decision-making processes, across the levels of projects, programs, portfolios, and strategic management.

Keywords: innovation portfolio; project portfolio management; uncertainty; steering board; managers' tasks; dynamics

1 Introduction

When companies invest in multiple innovation projects in parallel to implement their innovation strategy and renew their business, they need to ensure that their project portfolios take into account the context in which the portfolios are managed (Martinsuo, 2013; Martinsuo & Geraldi, 2020). Any portfolio's context is always more or less uncertain, and project portfolio management (PPM) needs to acknowledge dynamics and uncertainties (Petit & Hobbs, 2010) stemming from the surrounding organization and the broader business environment, besides those emerging from single innovation projects (Korhonen et al., 2014; Martinsuo et al., 2014). Turbulence in the business environment has been proposed among the core factors differentiating the effectiveness of various PPM practices (Kock & Gemünden, 2016; Voss & Kock, 2013), and also readiness for taking risks is influential at the projects' front end (Kock et al., 2016) and for portfolio

success (Teller & Kock, 2013). This paper focuses on uncertainties in innovation project portfolios and draws attention to managers' individual and group-level uncertainty responses in PPM.

Top and middle managers take part in leading and steering innovation portfolios, with the mission to align the innovation projects with strategy, prioritize and coordinate the portfolio, and maximize the value of the innovations. Individual managers' involvement in PPM has been considered generally from the perspective of middle managers and their practices, roles and responsibilities (Behrens et al., 2014; Blomquist & Müller, 2006), and senior managers in connection with project termination (Unger et al., 2012). Managers use different types of mechanisms for managing innovation portfolios (Kester et al., 2009; McNally et al., 2009) and project portfolio uncertainty (Petit, 2012; Martinsuo et al., 2014). They may notice uncertainties very differently and use different controls to respond to specific types of uncertainties (Korhonen et al., 2014). Such previous studies have focused on managers generally, or a certain manager level (project managers, portfolio managers, program managers) specifically.

Decision making in innovation PPM very often occurs in steering committees (sometimes also referred to as steering boards or management groups) that involve managers from different positions. Steering committees negotiate and decide about project portfolio issues and consequently guide and communicate the decision implementation in the organization (Christiansen & Varnes, 2008; Mosavi, 2014). Not all negotiations and decisions take place in the actual steering committee meetings in a formal way but, rather, are improvised by managers outside of them in situated action (Jerbrant & Karrbom Gustavsson, 2013; Christiansen & Varnes, 2008).

This study begins with the need to understand the distribution of work between individual managers and portfolio steering committees concerning uncertainty management in innovation project portfolios. The goal is increased knowledge of the social aspects of project portfolio uncertainty management, particularly in terms of distribution of responsibility across managerial levels and the portfolio steering committees. We focus on one primary research question: *How do firms divide the tasks of uncertainty management across managerial levels and the steering committees in innovation project portfolio management?* Our attention is directed at highly innovative project portfolios where the firms are considered as top innovators in their industry.

2 Literature review

Innovation project portfolios typically include uncertainty (Kock et al., 2016; Martinsuo et al., 2014; Teller et al., 2014; Voss & Kock, 2013), due to the market and technology risks concerning the new products and services developed, the lack of knowledge in the early phase of development, and any unforeseen strategic events both within and outside the organization. Uncertainties are an increasing concern for project portfolio managers (Martinsuo et al., 2014), as managers need to make decisions on the portfolio and keep the projects aligned with strategy, which requires high contextual awareness and appropriate management of the sources of uncertainty (Teller, 2013; Martinsuo et al., 2014). When the portfolio context is dynamic, both internal and external contexts are

prone to changes. Risks and uncertainties emerge as the evolution of markets and technologies is quite difficult to forecast (Martinsuo et al., 2014).

According to Petit and Hobbs (2010), uncertainty in project portfolios deals with any unexpected events perceived as relevant to the project portfolio, not fully known, and having impacts on multiple projects in the portfolio. Where the probabilities and outcomes of various *risks* can be assessed, *uncertainties* tend to be unanticipated and encountered with little previous information. Therefore, facing uncertainty typically requires, first, understanding the environment and identifying the possible sources and drivers of uncertainty, before responding to them or managing them. This study acknowledges that uncertainties may appear both within the organization as the internal context of a project portfolio and outside of the organization in the business environment. Portfolio uncertainties may encompass opportunities and threats as well as neutral or ambiguous situations, of which managers have incomplete information and which may have implications on the portfolio (Martinsuo et al., 2014).

Sources of uncertainty in project portfolios

Organizations want to avoid unpleasant surprises and missed opportunities by recognizing the most impactful uncertainties proactively. Contextual awareness requires the organization to identify information on three main sources of portfolio uncertainty: external environment, organizational complexity, and single projects (Korhonen et al., 2014). Table 1 illustrates these diverse sources of portfolio uncertainty.

Table 1 Sources of project portfolio uncertainty. (building on Korhonen et al., 2014)

<i>Single projects</i>	<i>Organizational complexity</i>	<i>External environment</i>
Variability associated with estimates of project parameters (time, cost, quality)	Parent organization's systems, structures and activities (Korhonen et al., 2014)	Technological opportunities and threats (Kock & Gemünden, 2016)
The basis of estimates of project parameters, design and logistics, and objectives and priorities	Norms and regulations (Petit, 2012)	Changing customer needs (Kock & Gemünden, 2016)
Relationships between project actors	Portfolio dynamics (Teller et al., 2014)	Competitive conditions (Kock & Gemünden, 2016)
(Ward & Chapman, 2003)	Changing strategic goals (Kock & Gemünden, 2016)	Changing agreements with third-party suppliers (Petit & Hobbs, 2010)
	Changing resource situations (Kock & Gemünden, 2016)	
	Potential interdependencies among portfolio components (PMI, 2008, p. 89-90)	
	Financial opportunities and threats (Petit, 2012)	

Uncertainties stemming from the projects within the portfolio may be reflected on the portfolio level in many ways. Uncertainty, changes, and risk management have been

widely covered on the project level (Steffens et al., 2007; Geraldi et al., 2010), such changes may deal with strategy, resourcing, and performance expectations relevant to the portfolio, and some studies have linked project-level events to the project portfolio level (Olsson, 2008; Petit & Hobbs, 2010; Petit, 2012; Teller, 2013; Teller & Kock, 2013; Korhonen et al., 2014; Teller et al., 2014). Especially the front-end of projects (idea generation, planning, design, and resource allocation) is prone to a high degree of uncertainties due to lack of clarity in estimates, related judgments, objectives and priorities (Ward & Chapman, 2003), particularly in risky innovation projects (Kock et al., 2016).

Uncertainties from organizational complexity include changes in some of the organization's systems, structures, and activities (Korhonen et al., 2014), and organization-specific norms and regulations (Petit, 2012) somehow linked with the portfolio. Portfolio dynamics as one of the uncertainties refers to the degree of changes in the portfolio structure over time (Teller et al., 2014). In addition, changing strategic goals and resource availability may cause some uncertainties impacting one or more portfolios (Kock & Gemünden, 2016), as may the potential interdependencies between projects in the portfolio (PMI, 2008, p. 89-90).

Uncertainties from the external environment deal with technological and market turbulence and include pressures from competition and changes in supplier collaboration and agreements (Petit & Hobbs, 2010; Teller, 2013; Kock & Gemünden, 2016). Such turbulence and the related degree of uncertainty may depend on the type of the specific industry (Teller, 2013). Some financial opportunities and threats presented by Petit (2012) could be classified as external or organizational complexity, depending on the situation.

Recently, portfolio risk and uncertainty management have started to gain increasing attention in PPM (Olsson, 2008; Petit, 2012; Petit & Hobbs, 2010; Teller & Kock, 2013; Kock & Gemünden, 2014). Project or enterprise level risk management alone is not sufficient for comprehensive risk management (Olsson, 2008; Teller, 2013; Teller & Kock, 2013; Teller et al., 2014), but there is also a need to consider uncertainty for the portfolios. Managing risks shared among projects within the portfolio and recognizing the potential uncertainties emerging from project interdependencies accumulate on the portfolio level (Teller, 2013; Martinsuo et al., 2014) and will promote better project portfolio performance (Teller et al., 2014).

Managers' involvement in portfolio uncertainty management

PPM research has covered the involvement of certain groups of managers in PPM in various ways, sometimes focusing specifically on portfolio managers or certain managerial levels such as top or middle managers. Unger et al. (2012) studied senior managers' involvement in terminating projects and ensuring the strategic fit of the project portfolio, whereas Blomquist & Müller (2006) mapped the roles and practices of middle managers in PPM. Jonas et al. (2013) included data from project portfolio coordinators and top managers and noticed that their assessments of portfolio success differed from each other, with top managers as better sources of information on success, and portfolio management quality (coordinator's assessment) is positively associated with portfolio success (top managers' assessment). While such studies are important in their focal

perspective and in drawing attention to managers' information access and use, they do not focus on uncertainty as such, or include it merely through a certain background variable.

Another track of research covers managers' collaboration in steering committees or meetings, when deciding upon the project portfolio (Beringer et al., 2012, 2013). Mosavi (2014) inspected the roles of portfolio steering committees and emphasized that decision making is not their only role, but he did not cover uncertainty specifically. Christiansen & Varnes (2008) delved into portfolio meetings and their non-rational aspects where managers observe others, use information from the context and learn from previous experience, to come up with the most appropriate actions. Again, their study did not investigate uncertainties specifically in the portfolio meetings. Furthermore, Jerbrant & Karrbom Gustavsson (2013) explored the improvisational work of portfolio management and gave examples of how managers created the action spaces they needed for handling uncertainty and making fast decisions outside of the formal arenas and forums. While these studies do not focus on uncertainty as such, they clearly draw attention to the social arenas where managers collaborate in PPM and the inherent informality and non-rationality in situation-specific actions.

Only a few studies connect certain managers' activities with managing uncertainty in PPM. Petit (2012, also Petit & Hobbs, 2010) focus on PPM and uncertainty specifically and the results include some examples of certain managers' involvement in handling uncertainties, but these studies encourage further research in different contexts and they do not cover steering committee's involvement. Korhonen et al. (2014) have purposely mapped different managers' viewpoints to uncertainty in project portfolios and their control mechanisms when managing uncertainty. They reveal very different experiences by portfolio managers, program managers and project managers, but again their study does not cover uncertainty management in portfolio steering committees, and they recommend further research into the involvement of different managers in managing uncertainty. Our study is motivated by the reality of managers working both individually and in steering committees in PPM, and the need to understand how portfolio uncertainties are tackled in such managerial work.

3 Research method

A qualitative multiple-case study was used, to enable comparison and contextual sensitivity (Yin, 2009, p. 54). We purposely sought innovative firms that have one or more innovation portfolios, operate in a dynamic business environment, and actively engage in various research and development projects. With these criteria, we approached two companies that represent different industries and were willing to participate in the research. The companies are treated anonymously and labeled here Company A and Company B. Table 1 summarizes some background information on the companies.

Company A operates internationally in the software industry and provides innovative solutions for other businesses. Their main offering is a configurable software platform intended for data processing and optimization. Company A has quickly grown into a significant actor within their industry and manages two innovation project portfolios. Project length varies between a few weeks to even years, depending on the complexity of

the project. *Company B* operates globally in the heavy machinery industry and provides innovative hardware and industrial services for other businesses as well as software solutions. Similarly to *Company A*, *Company B* manages two innovation project portfolios. Due to the industry specific characteristics, the project length of developing cutting-edge heavy machinery could take multiple years to complete.

Table 2 Case company background information and interview data.

	<i>Company A</i>	<i>Company B</i>
Industry	Software solutions	Heavy machinery
Revenue (2019)	> 60 M€	> 600 M€
Number of employees	> 900	> 1700
Innovation portfolios	R&D portfolio (long-term development), about 10 projects	Hardware development portfolio (technology and product development), about 20 projects and additional continuous improvement activities, both long-term and short-term development
	Product portfolio (short-term development), over 20 product development areas with roadmaps	Software solution portfolio (software development), about 10 projects, both long-term and short-term development
Nr of interviewees	5	3
Interviewees' job profiles	Senior data analysts, product director, R&D director, head of product management	R&D director, technology manager, research manager

Semi-structured interviews was chosen as the data collection method. The interview outline included the following main themes: interviewee's position and background; innovations and strategy in the firm; portfolios and managing the portfolios in the firm; business environment; stakeholders and responsibilities in project portfolio management; uncertainties and managing them; recent example of reconfiguring the project portfolio; development needs. All interviewees (Table 1) were positioned at the managerial level and engaged in innovation activities. The interviews lasted on average 63 minutes (range 52..81 min), they were recorded and fully transcribed. Some secondary data such as the internet-sites of the case companies were utilized to support the collected interview data.

For the purposes of analysis, portfolio uncertainties were categorized by utilizing the thematic framework identified in the literature review (uncertainties from the *external environment*, *organizational complexity*, *single projects*) and complemented with some inductively discovered codes within the categories. Managers' and steering committees' involvement in portfolio uncertainty management was analyzed by first dividing the stakeholders into two main categories: *individuals* and *committees*. After that, more detailed sub-categories were added inductively, covering both project-level and portfolio and business level actors and committees. These stakeholders' key responsibilities were compiled from different interviews and coded, particularly covering tasks of *sensing*, *seizing*, and *reconfiguring* practices of uncertainty management (following Petit, 2012; Petit & Hobbs, 2010).

4 Results

Context: Innovation environment in the case companies

Innovation is seen as an integral part of the Company A business strategy, and a separate innovation strategy has not been defined. Especially the successful recruitment of smart, independent, and cooperative employees was experienced as a foundation for the innovation culture. The CEO was seen to play a significant role in promoting innovativeness. One interviewee highlighted the importance of the company's success and well-established customer relations in creating a meaningful innovation environment: "Our success probably plays a role as well. The fact that we have a good relationship with our customers, and we want to keep it that way, encourages us to find good solutions." [13] Accordingly, customer value is among the key factors in defining innovation at Company A. Some interviewees highlighted the importance of novelty in defining innovation as an essential driver of competitiveness in a dynamic environment.

Company B is also highly innovation active, and the company files multiple patent submissions each year. Innovations are tightly linked to the company's technology strategy, and the company has not defined a separate innovation strategy. Most interviewees define innovation in a similar way, each highlighting the importance to bring value to the customers. In addition, innovations were considered as an important source of competitive advantage. Company B's innovativeness also benefitted recruitment. According to an interviewee, the innovative product offering attracts jobseekers through positive visibility and public recognition. The company strengthens its innovation culture by encouraging employees to innovate on their own and participate in innovation competitions and external cooperation.

Uncertainties in the innovation project portfolios

Both companies acknowledge the risky nature of long-term research and development, as innovation portfolios are exposed to various uncertainties. Uncertainties mentioned during the interviews and their relative significance at each case company are compiled in Table 3. The significance of the main uncertainty categories was evaluated on a relative scale of low, medium, and high.

Although both companies reported similar portfolio uncertainties, table 3 reveals some differences. For example, Company A seems to experience uncertainties arising from all three main uncertainty categories relatively evenly, whereas Company B reported a higher number of the uncertainties arising from the external environment especially compared to uncertainties arising from organizational complexity.

Single project uncertainties deal with the variability associated with project parameters and basis of estimates of project parameters, design and logistics, and objectives and priorities. Especially the significance of the variability associated with project parameters, i.e., time, cost, and quality, was evident in both case companies. For example, time delays on a single project level may have an impact on the estimated schedule of the whole innovation portfolio. Such variability may also be linked to the basis of these estimates as project length, cost, and added value is almost always based on subjective judgement of these attributes and may therefore cause uncertainties

influencing the whole portfolio. Although the significance of single project uncertainty was perceived differently between the case companies, an interviewee at Company B also acknowledged the linkage between the two uncertainty categories: “*Well perhaps uncertainties would be that if we estimate the workload incorrectly or the resourcing, so that we end up having some key people in too many projects at the same time and the schedules start to fall apart.*”[18]

Table 3 Portfolio uncertainties in the case companies.

<i>Uncertainty</i>	<i>Case A</i>	<i>Case B</i>
Single projects	Medium	Medium
Variability associated with project parameters	++	+++
The basis of estimates of project parameters, design and logistics, and objectives and priorities	++	+
Organizational complexity	Medium	Low
Changing resource situations	++	+
Portfolio dynamics	+	
Human competences*	+	
Potential interdependencies among portfolio components	+	+
External environment	Medium	High
Changing customer needs	++	+++
Technological opportunities and threats	++	+++
Competitive conditions	++	+++
Collaboration with third parties*		+++
Legal factors*	+	+
Coding: Empty space = no observations; + = mentioned by some interviewees; ++ = mentioned by most interviewees; +++ = mentioned by all interviewees.		
*inductive coding; not apparent in earlier research		

Organizational complexity contains uncertainties related to changing resource situations, portfolio dynamics, human competences, and interdependencies between portfolio components. Such uncertainties were perceived quite differently between the two case companies. Uncertainties of human competences such as shortage of senior expertise were only reported by Company A, which could be partly explained by the relatively young age and quick growth rate of the company. Company B was established over 30 years prior to Company A, and hence the organizational maturity level differs between them. Additionally, portfolio dynamics was only discussed in Company A, where portfolio reconfiguring is done almost monthly in roadmap steering group meetings. At Company B, the roadmap is reviewed on an annual basis. The project cycles in Company B are typically longer compared to more fast-paced software industry of Company A, as one of the interviewees at Company B explains: “- - *our industry is relatively slow cycled*”

and a little, - - conservative, as the development cycles and product life cycles are vastly different [compared to some other industries]. – if we think about starting to develop something completely new from the scratch, then it might easily take three to five years until it is in our customers production use.”[17]. This industry-specific difference in project pace could also explain why portfolio dynamics were only mentioned as a portfolio uncertainty at Company A.

External environment was considered as the most significant uncertainty category by both case companies. For example, the need for close collaboration with the customers was described by one interviewee at Company B as follows: *“Indeed we need to collaborate closely with customers and listen to the customers’ needs, since not all wisdom lays here at our facilities. That has been noted multiple times. That is why we need to keep an open mind while listening to the needs of the customer.”[16]* Also technical opportunities and threats and competitive conditions were mentioned by almost all interviewees. The significance of the external environment was especially apparent in Company B, where almost all sub-categories were mentioned by all interviewees. This could be partly explained by the active collaboration with third parties in research and development. In addition, Company B reported a higher number of external stakeholders compared to Company A, possibly because the value chain of heavy machinery is often more extensive compared to software solutions.

Managers’ involvement in managing project portfolio uncertainty

Company A and Company B resemble each other in the key actors, committees, and their typical responsibilities in managing project portfolio uncertainty. Both companies reported a high count of actors involved, including project, program and portfolio managers and their team members as well as middle and top managers. However, the clarity of tasks and responsibilities in terms of portfolio uncertainty management differed: interviewees of Company B reported higher task clarity compared to Company A.

In both companies the individual actors typically focus on sensing and seizing portfolio uncertainties. Project and program managers are responsible for identifying, evaluating, and communicating uncertainties arising from single projects and programs, whereas portfolio and sub-portfolio managers assume responsibility for uncertainty management on portfolio level. Middle and top managers, in turn, often focus on sensing and seizing uncertainties arising from the external environment. These managers also have a crucial role of aligning the portfolios with company-level strategic objectives, and certain top managers make key decisions on budgeting, scheduling, and allocating resources.

The above actors participate actively in relevant steering committees on project, program, and portfolio levels. Some actors belong to other committees such as the product council, and Company B additionally utilizes temporary groups designated for customer and competitor mapping to guide strategic planning. The actors, committees, and their main responsibilities are listed in table 4. Among the main objectives of steering committees is to monitor, control, and share project, program, or portfolio status information. Where the individual actors mainly focus on sensing and seizing uncertainties, portfolio reconfiguration is determined by steering committees. For example, the project and program steering groups may decide to terminate or delay a project due to certain

uncertainties or reallocate resources to projects upon need. Portfolio steering groups may make similar decisions, where projects in the portfolio are re-prioritized, added, delayed, or terminated. In Company A, such portfolio steering meetings typically take place once a month, whereas in Company B portfolio steering meetings usually gather on an annual basis.

Table 4 Actors and committees involved in portfolio uncertainty management.

<i>Actor or committee</i>		<i>Responsibilities</i>	<i>Company A</i>	<i>Company B</i>
Project	Project managers and team members	Project uncertainty management (sensing and seizing)	X	X
	Project steering group	Project uncertainty management (seizing and reconfiguring), and monitoring, controlling, and sharing project status	X	X
Program	Program managers and team members	Program uncertainty management (sensing and seizing)	X	
	Program steering group	Program uncertainty management (seizing and reconfiguring), and monitoring, controlling, and sharing project and/or program status	X	
Portfolio	Portfolio managers and team members (incl. sub-portfolio managers)	Portfolio uncertainty management (sensing and seizing)	X	X
		Involved in strategic decision-making and planning of portfolio content, acts as the final decision maker in portfolio steering	X	X
		Estimates duration, resource needs and potential value of portfolio components	X	
		Defines portfolio budget		X
	Portfolio steering group	Portfolio uncertainty management (seizing and reconfiguring), and monitoring, controlling and sharing portfolio status	X	X
Management	Middle and top managers	Portfolio uncertainty management (sensing and seizing)	X	X
		Aligns the portfolios with company level strategic objectives, acts as the final decision maker in product council	X	X
	Product council	Involved in strategic decisions related to portfolio content (seizing and reconfiguring)	X	X
		Holds the highest decision-making power related to research and development	X	X
	Temporary groups	Customer and competitor mapping to guide strategic decisions		X

Product council holds the highest decision-making power in terms research and development in both case companies. It is involved in strategic decisions related to portfolio contents and contributes to portfolio reconfiguration by evaluating, approving, and prioritizing projects in the portfolio according to strategic importance. The product council might also decide to completely refocus the portfolios due to certain uncertainties, meaning that the whole strategic direction of the portfolio might change. For example, the chaos caused by the Covid-19 pandemic forced both case companies to take drastic measures, including rapid re-prioritization, reallocation of resources, and terminating or delaying certain innovation projects.

5 Discussion

Our analysis revealed various portfolio uncertainties in two innovation project portfolios, both lending support to and complementing previous research (Martinsuo et al., 2014; Korhonen et al., 2014; Petit, 2012; Petit & Hobbs, 2010). The mapping of uncertainties spotted novel uncertainty perspectives, particularly by drawing attention to human competences within the organization, third parties outside of the direct supply chain, and legal factors in the broader institutional field. While both companies were originally categorized as highly innovative, the observed pattern of uncertainties from the external environment differentiated them in an unexpected way. Interviewees in the more mature firm in a slower-moving industry (case B) perceived external uncertainties more dominantly than those in the younger firm in a fast-moving industry (case A). As case A did more frequent, even monthly adjustments to the project portfolio, it is possible that their high-pace rhythm for portfolio monitoring and control was used as a mitigating act, in response to or even in anticipation of emerging uncertainties.

The main question guiding this study inquired: *How do firms divide the tasks of uncertainty management across managerial levels and the steering committees in innovation project portfolio management?* The findings described the broad involvement of different managerial levels and steering committees into managing portfolio uncertainties, despite the focus on fairly small firms with only two portfolios. In contrast to Beringer et al. (2012) who reported low levels of managers' engagement into PPM activities, our study revealed managers' fairly high engagement in at least uncertainty sensing and seizing. There are indications that project-level uncertainties require stepwise filtering of uncertainty information towards the upper levels of the organization, due to the existence of various level committees and distributed project ownership. In particular, the case studies revealed a distinction between the individual level sensing and analysis activities to committee-level assessment, control, decision-making, and reconfiguration activities, and showed a clear connection between them. The involvement of different manager levels in PPM has been covered earlier (Beringer et al., 2012, 2013; Blomquist & Müller, 2006; Jonas et al., 2013; Unger et al., 2012), but the interplay between different manager levels and the complexity caused by versatile steering committees identified in this study offers a novel viewpoint and appears as a central in the uncertainty responses. The escalation and way of organizing uncertainty management in project portfolios may be an important factor either in enabling or hindering timely responses to uncertainties.

The cases pointed out the active use of steering committees in PPM in both case firms, specifically in relation to uncertainties. Where the general decision making duties of such committees are well understood particularly in selecting and steering portfolios (Mosavi, 2014), this study highlights their interplay across organizational levels, their role in responding to uncertainties filtered from lower levels, and their constant possibility to reconfigure the project portfolio even through rather minor adjustments of resources and timing. This finding offers a complementary perspective to such studies that distinguish between the formal and informal routines of steering committees (Christiansen & Varnes, 2008) and routine vs. improvised decision making (Jerbrant & Karrbom Gustavsson, 2013), by showing such committees' continuous responsibility both for planned and emergent decisions concerning the project portfolio.

6 Conclusions

The study has three key contributions. First, it developed an uncertainty-driven perspective to innovation project portfolio decision processes that should not be treated merely as devices for project selection and termination, but more generally in governing innovations (Kester et al., 2011). Second, it reported additional evidence to the previous discussion about uncertainty management in innovation project portfolios (Petit, 2012, Petit & Hobbs, 2010), specifically revealing new uncertainty aspects and industry-specific rhythms in uncertainty management. Third, it showed how tasks concerning uncertainty management are handled between individual managers and steering committees and, thereby, complemented studies that focus on either group separately (Korhonen et al., 2014; Mosavi, 2014). In particular, the findings built linkages between the formal tasks of different manager levels and steering committees, showed how uncertainty information is filtered from individual actors to steering committees, and portrayed the complexity of uncertainty-related decision making even in the context of organizations with few project portfolios.

The two-case study includes validity limitations caused by the choice of cases, access to data, and developing the analytical framework. Further research is suggested in project portfolio uncertainty management and related steering committees' routines in large firms that have multiple project portfolios. When complexity in and across project portfolios increases, it is important to understand how this is reflected in the steering structures and use of routines for uncertainty management.

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