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Perceived Managerial Functions in the Front-End of Innovation

Purpose: Exploring managerial functions and related activities of inexperienced project managers in the front-end of the innovation process (FEI).

Design/methodology/approach: Fifteen student project managers were interviewed while they were engaged in the front-end phase of their respective 8-month projects. 757 interview transcript segments on their perceptions of managerial functions were categorized based on thematic similarity of content.

Findings: Four major managerial functions emerged: providing structural support, coordinating and acting as a link, empowering the team, and encouraging and providing social support. Out of these, traditional task-oriented managerial functions were emphasized.

Research limitations/implications: Although limited by the small amount of participants in a university setting, the results suggest that task-oriented managerial functions are dominant even in the FEI for inexperienced project managers. More research is needed to understand the antecedents and consequences of such task-dominance, and whether it persists as more experience is accrued. On the other hand, domain knowledge seemed to play a smaller role than indicated by previous research.

Practical implications: Project managers should pay attention to creating structure in the uncertain front-end phase. Swift familiarization with the capabilities and practices of each team member cannot be overemphasized, as otherwise the heterogeneity of the team might become a limitation rather than asset. On the other hand, domain experience of the manager may not be necessary in the FEI.

Originality/value: The study addresses the gap in previous research on managerial functions specifically in the FEI. Task-oriented managerial functions emerged as way of novice project managers attempting to deal with the fluctuating contingencies in order to foster innovation.

Keywords: front-end of innovation, project management, managerial functions, managerial activities, experience

1 Introduction

Innovations are increasingly important in the modern economy for new and established organizations alike. While the innovation process, characterized by uncertainty (Lenfle & Loch, 2010; Collyer & Warren, 2009) and changing needs (Kim & Wilemon, 2002; Koen et al., 2001; Seibert, Slavejkov & Wagner, 2001; Collyer & Warren, 2009), is well known, project management literature still tends to be very execution-oriented,

focusing on planning activities that are based on a rational view of organizational processes and assume that projects are highly analyzable (Lundin & Söderholm, 1995; Loch et al., 2006). Morris (2013, p.19) aptly criticizes the overt emphasis on execution delivery within budget and deadlines, calling for project management that adds value “rather than providing cruise control”. To this end, the inclusion of the front-end of innovation emerges as a key current issue in project management (Morris, 2010, 2013; Williams, Samset & Sunnevåg, 2009). The front-end can have far-reaching consequences, leading to typical sources of difficulties in projects: poor project definition, changes in strategy, lack of top management support, unsupportive environments, and so on (Morris & Hough, 1987).

Managing the front-end of innovation requires continually dealing with complexity, uncertainty, and unexpected events (Oddane, 2015), placing the project manager under considerable psychological and social pressure (Williams & Samset, 2010). Edkins and colleagues (2013) point out that project managers used to managing projects in latter phases can be ill-equipped for this initial phase. Indeed, tackling front-end phases in innovation projects can be a daunting task, especially when lacking previous experience. The current study briefly reviews previous literature on project management in the front-end of innovation, after which the perceptions of fifteen inexperienced project managers attempting to deal with the front-end are investigated through in-depth interviews. The results illuminate how new project managers portray and make sense of their role in the front-end of innovation. As such, we aim to add to the ongoing discussion on the appropriateness of established managerial functions in the initial phases of the innovation process.

2 The front-end of innovation and its distinctive management needs

Managing an innovative project requires the project manager to balance between a variety of different managerial roles and functions, coping with multiple, fluctuating, and often conflicting contingencies (Lewis et al., 2002). Furthermore, the requirements for management change as the innovation process evolves, as the different phases of the innovation and project cycle entail notably different tasks (Kim & Wilemon, 2002; Koen et al., 2001; Morris, 1988). The front-end of innovation bears particular importance – it is “not only where mistakes get engineered-in but where there is also the

most opportunity to optimise value” (Morris, 2010, p.141). The front-end phase of the innovation process can roughly be described as the period from idea generation to its approval for development or termination (Murphy & Kumar, 1997), and is marked by “fuzziness” and unpredictability (Zhang & Doll, 2001; Zien & Buckler, 1997), intense time and cost constraints, and difficulties in coordinating team members due to them having different professional backgrounds (Pons, 2008). While some studies on project management in the front-end have focused exclusively on pre-project activities (Edkins, et al., 2013), the current study adheres to the broader view on the front-end as the initial phases of defining and initiating innovative projects (Kim & Wilemon, 2002).

Unfortunately, innovative projects, such as new product development (NPD) projects, have often been viewed as projects to be handled as any other, ignoring the unique features of such projects (Pons, 2008). While recognizing different stages in project lifecycles, for example the prominent PMBOK Guide® largely still assumes that most project management functions can be applied in all stages (Edkins, et al., 2013; Morris, 2013), as does the majority of academic studies (Rekonen & Björklund, in press). However, many conventional project management approaches require relatively complete definitions of outcomes and scope, which may be difficult to apply for NPD projects, especially in the front-end phase. As Lindkvist, Söderlund and Teil (1998) propose, when it comes to creating a new product, the process cannot be planned in every detail. In innovative projects, interactive problem solving of a trial-and-error type may be called for (Lindkvist, Söderlund & Teil, 1998), plans need to be flexible and allow for changes of direction and exploration for new ideas (Kenny, 2003), challenging the standard stage-gate, control-oriented project management approach (Lenfle & Loch, 2010). R&D projects often suffer from significant uncertainty and are ill-suited to the traditional linear approach. As a result, front-end project management practice is yet poorly understood (Edkins, et al., 2013).

The responsibility for managing the complex process, as well as the people in the team striving towards creating an innovation, is typically in the hands of the project manager (Elkins & Keller, 2003). Execution-centric conceptualizations of project management as delivering projects on time, on budget, and on scope, fail to address the strategic level of management required in the front-end (Morris & Geraldi, 2011). Indeed, the management of creative ideas has attracted more interest in the past decade (e.g. De

Jong & Den Hartog, 2007; Kosaroglu & Hunt, 2009), with product development offering a particularly fruitful context for studying innovation and knowledge-intensive work (Björklund, 2010). Earlier studies have noted that project managers of NPD projects are required to perform several diverse roles in order to successfully manage innovative projects (e.g. Roberts & Fuschel 1989; Barkzak & Wilemon 1989; Kim et al., 1999). While lists of managerial roles or functions have been criticized, with calls being made for more integrated models of management (Mintzberg, 1998, 2004), lists do afford an efficient starting point for comparison between the requirements of different innovation phases. The managerial roles required in innovative projects include both managerial functions performed solely within the project team, such as project leading (Roberts & Fuschel, 1989), team builder, (Kim et al., 1999), planner (Barkzak & Wilemon, 1989) and technical expert (Kim et al., 1999), as well as roles including external functions performed outside the project team, such as champion and gatekeeper (Kim et al., 1999). In general, Mintzberg (1998) identifies three key internal roles (controlling and communicating through information, leading people, and doing) and three external roles (communicating, linking people, and dealing) for managers. Simon (2006) found project managers in creative projects to act as sense-makers, web-weavers, game-masters, and flow-balancers, whilst Edkins and colleagues (2013) identify six key tasks for project managers in the front-end specifically: leadership and decision making, selecting individuals and forming teams, technical and technology assessment, project scoping and estimating, risk and value assessment, and establishing and instilling an appropriate oversight and governance system.

The above lists of needed managerial functions can be intimidating for practitioners, especially for new project managers. Knowledge on how project managers themselves perceive their functions in the front-end is scarce, as is information on the activities they aim to carry out them with. Considering the unique nature of the front-end phase of innovations and limited amount of project management research conducted in its context, the present study proceeds to investigate project managers' perceptions of their managerial functions and related activities in the front-end phase of product development efforts, interviewing 15 inexperienced project managers whilst their projects were in the precarious phase. We focus on the perceived managerial functions and related activities intentions informing of the goals and sensemaking process of the

project manager, rather than on the realized actions or effects of the project manager. The results offer insights on how novice managers attempt to foster innovations and deal with the contingencies of the uncertain front-end of innovation.

3 Methods

In order to create a deeper understanding of the subjective perceptions of novice project managers of their functions and activities in the front-end phase of innovative project, this study adopted a qualitative, exploratory research approach, conducted in an inductive manner. Adopting an exploratory research approach enabled creating a comprehensive and holistic understanding of the managers' perceptions as well as recognizing the perceived key issues in managing the front-end of innovative projects, forming a base for future work on the topic. Data were collected from a graduate level product development course at [name of University anonymized], during the semester of 2010-2011 by one researcher. Altogether 15 in-depth semi-structured interviews were conducted. All of the project managers of the projects were interviewed for the study after their respective projects had been running for approximately two months, i.e. when the projects were in the midst of the front-end phase, having spent a fourth of the length of the course. By this time, the project teams had been redefining the project brief, conducting market studies, ideating various alternatives for an initial concept, and choosing concepts for further development.

The interviews were all conducted by the same interviewer, who was unrelated to the course teaching and grading staff and activities. The interviewees were explained that the interviews were anonymous and would not affect their grades in any way. The interviewees were prompted to reflect on their managerial activities, their principal roles, and challenges in the projects. The resulting 15 interviews lasted between 28 and 72 minutes, averaging at 40 minutes. The interviews were audio recorded and transcribed for analysis.

In the course, each team is given a unique industry-provided design brief (see Table 1) and a €10 000 budget by the project sponsor for the development work for the duration of the eight-month course. Thus the students work for a real customer throughout the project. The course requires the teams to produce a functional prototype as a result. The

course ends with a Gala day, which is open to the public and where the teams present their end product and have the functional prototype available in their fair booth. The design briefs are quite open-ended, communicating only a main intent or topic, and do not contain any instructions on how to reach the project goals. Neither sponsors nor the course teaching personnel provide detailed tasks, apart from the requirements of producing the working prototype, creating material such as project documentation and posters, and regularly presenting progress. The managers do receive separate training beforehand, but are free to run their projects as they best see fit. Thus the projects conducted for the course are highly similar to professional projects. Furthermore, the project briefs represent a wide array of industries and organizations, enhancing the generalizability of the results.

Students are selected to the course based on student applications, and project managers need to separately apply for the position – hence all of the interviewees were willing to take the duty of managing the project. The project managers were in their mid-twenties, and had educational backgrounds either in business, industrial design, product development or work psychology. Most of the project managers had several years of working experience in their field, although accrued in various summer and part time jobs. In project management, all of the project managers could be considered novices or advanced beginners in the terminology of Dreyfus and Dreyfus (2005), facing a given problem and a given situation for the first time or with very little real-life experience. Cicmil (2006) has noted that novice and advanced beginner levels of knowledge in project management are mainly based on textbooks, prescriptive methods, and procedures that do not take into account context-dependent factors. Advancing to higher levels of project management knowledge can only be attained through personal experience in the domain (Cicmil, 2006). Thus the course can be perceived as a first step of the students growing towards higher levels of project management competence.

As the course was organized by a technical university, the majority of the student in the project teams were from various fields of engineering, but all teams had also a few business and industrial design students. Nine out of fifteen teams also had a few off-site team members from a partner university abroad. The project teams varied between eight and 13 persons in size (see Table 1).

Table 1 Project information

Project	Industry	Project brief	Team composition
1	Furniture	New business concept for small company. Business and service emphasis	Nine team members divided roughly equally between those of technical and non-technical backgrounds.
2	Communications	Consumer product for a large organization. Technological emphasis.	All-male eight person team with three off-site team members from a partner university.
3	Medical technology	New part of a technical, physical product for a large company. Technological emphasis.	Eight team members comprising mostly of males with technical backgrounds.
4	Mobile	Consumer service-focused product for a large company. Business and service emphasis.	Diverse eleven-member team with four off-site members from a partner university.
5	Healthcare	Service-focused product for a small company. Business and service emphasis.	Mostly female team with eight team members, including three off-site members from a partner university.
6	Construction	New high technology product for a large company. Technological emphasis.	Mostly male and technical team with nine team members.
7	Power and automation	Business-to-business product demonstration for a large company. Technological emphasis.	Seven team members comprising of males mostly with technical backgrounds.
8	Mobile	New business-to-business product for a large company. Technological emphasis.	Thirteen team members comprising mostly of males with technical background. Four off-site members
9	Transportation	New part for an integrated business-to-business product solution for a large company. Service emphasis.	Interdisciplinary team comprising of approximately equal amount of men and female team members. Three off-site members from partner university.
10	Transportation	New solution for a business-to-business product for a large company. Technological emphasis.	Nine member team comprising of only male students with technical background and one exchange student.
11	Industrial machinery	Demonstration of an integrated infrastructure solution for a large company. Service emphasis.	Eight-member team consisting of three female designers and five male-engineers. Also three off-site members from a partner university.
12	Trans-	New concept for a part of a business-to-business integrated	Ten team members with roughly equal amount of designers and engineers,

	portation	product for a large company. Technological emphasis.	mostly males. Three off-site team members.
13	Industrial machinery	New product concept for a large company. Technological emphasis.	Seven-member team consisting of approximately equal amount of females and males. Most of the members have a technical background but also two designers belong to the team.
14	Electronics	New integrated concept for a product solution of a large company. Design emphasis.	Interdisciplinary team consisting mostly of engineers but also business and design students. Twelve team members with four off-site members.
15	Trans- portation	Customer product for a small organization. Design emphasis.	Eleven-member team comprising mostly of males. Three off-site members from a partner university.

The transcripts of the 15 interviews were studied thoroughly in order to find common themes, identifying all segments related to the project managers' perceptions and descriptions of their managerial functions and related activities. We were particularly interested in the "lived experience" of the inexperienced project managers – what functions aims or concerns they portrayed as relevant to managing the front-end of innovation. The initial coding resulted in 757 segments. These initial codes were then grouped together based on thematic similarity of their content, resulting in 19 managerial activity categories. For example, the segment "*I made sure for them, that if you don't want to do, or if you think it's too difficult, just tell and we're going to find a way. You're going to talk to someone, who knows someone, who could do.*" was coded to the category of creating an open and trustful atmosphere. The resulting 19 managerial activity categories were subsequently grouped together, again based on thematic similarity, into five more general-level managerial functions of the project managers: providing structure, coordination and acting as a link, empowering the team, encouraging and providing emotional support, and contributing to the development work (see Table 2). The interview transcripts were then re-coded again with the final coding scheme to ensure the reliability of the segmentation, ensuring that all segments related to managerial functions and activities were included in the developed 19 categories. Although discrete, non-problematic categories cannot not truly exist, functional groups of empirical findings serve well as a basis for future analysis, helping to make sense of the results (Dana, 1995). The occurrences of the codes were counted in

order to make the data analysis process more transparent and to illustrate the prevalence of the different managerial functions in the perceptions of novice project managers.

4 Results

A total of 757 managerial activities were identified in the interview transcripts of 15 project managers. These formed five major functions for the project manager to perform: providing structural support, coordinating and acting as a link, empowering the team, encouraging and providing emotional support, and contributing to the development work (see Table 2).

4.1 *Providing structural support*

The most frequently mentioned function of the managers was that of providing structural support, totaling in 254 reported segments. Roughly half of these segments belonged to the managerial activity category of clarifying and setting goals, and the rest were divided into four smaller categories.

Clarifying roles and setting goals were the most frequently reported activities of the project managers, containing activities such as defining team member roles, forming and delegating tasks, and deadlines. The managers also reported that finding roles for every team member was challenging, especially for the less active team members. Further, in some of the cases defining separate roles for all members when there were many representatives from the same discipline was reported as difficult. The second category, *time management*, involved scheduling the project and meetings of the team, and clarifying how much each member had time to use for the project. Here, all project managers reported creating schedules that would allow all team members to participate in team meetings or events to be problematic, as all team members had other duties outside the project. *Documenting and monitoring work*, in turn, included segments reflecting documenting decisions and a few mentions of following up on delegated tasks, for example by checking the situation in weekly team meetings or inquiring on progress by phone or email. Project managers also attempted to *establish ways of working*, primarily creating a weekly structure to work and promoting practices that supported ideation. The managers would for example “sell” ideas to the team, attempt to protect ideas from premature criticism, and communicate the desired project standards

to the team. Finally, the class included some segments reflecting the project manager making the final decisions in situations where no clear decisions could be made with the team, or minor decisions such as deciding on meeting times, thus promoting clarity and efficiency (the category of *making minor and final decisions*).

4.2 *Coordinating and acting as a link*

Coordinating and acting as a link was the second most frequent function reported by the project managers, totaling in 180 segments, divided amongst the two larger categories of coordinating the whole and accommodating to diversity, and two smaller categories of acting as an interface between the team and other parties, and solving interpersonal issues and acting as a mediator within the team.

All of the managers emphasized the importance of *coordinating the whole*, including activities such as defining the whole, keeping the project (direction) under control, seeing the big picture, and coordinating the work of different parties. Activities such as sharing information between subgroups and making sure everyone was heading in the same direction were perceived as important. Project managers noted it to be challenging to *accommodate to the diversity* related to both educational and cultural backgrounds, as well as managing off-site project members. For example, creating a common vision and understanding was more challenging due to the educational and cultural diversity of the team, and ideation challenges resulted from the different perspectives and approaches of designers and engineers.

Acting as an interface between the team and other stakeholders, in turn, consisted of mainly of segments describing acting as a link between the team and the project sponsor, reporting on progress, answering inquiries and obtaining information. These activities were somewhat emphasized by the project managers, and collectively defining the scope of the project was a major task in the front-end phase of the projects. Finally, the project managers also had to *solve interpersonal issues with team members and act as mediators* in within-team disagreements. Many project managers reported personality clashes between themselves and some team member. In the case of clear conflicts, one-on-one discussions with team members were usually utilized to calm the situation.

4.3 *Empowering the team*

Empowering the team included 151 segments on the project managers encouraging team member participation and giving decision making power to the team, divided into the dominating category of activating team members, and two smaller categories - providing autonomy and dispersing decision making.

The first category, *activating team members*, was the second most numerous activity reported by the managers in any class, with only clarifying roles and setting goals totaling in more mentions. The project managers attempted to activate team members by actively asking for opinions, explicitly encouraging participation in tasks, dividing the team into smaller subgroups and contacting quieter team members individually to prompt for their view. Activating team members was also seen as challenging in terms of getting all team members to voice their opinion as team meetings were held in English, the mother tongue of none of the members, and in getting engineers to participate actively in tasks outside their field of know-how.

All of the project managers reported *providing autonomy* to team members, reporting activities such as letting team members pursue solutions to possible challenges independently. Autonomy was mainly provided through offering more general level task definitions rather than specific instructions, and all the managers provided decision authority to the sub-groups of the project on their own tasks. In general, most decisions were reported being made jointly with the entire team, forming the category of *dispersing decision making*.

4.4 *Encouraging and providing social support*

Encouraging and providing social support was approximately equal in frequency to empowering the team, totaling in 150 reported segments divided into two larger categories (encouraging exploration and creating an open and trustful atmosphere) and four smaller categories reflecting creating a supportive working environment.

The largest category, *encouraging exploration*, contained activities such as explicitly requesting the team members to produce several solution alternatives to problems, encouraging team members to take on multiple perspectives, and avoiding providing any ready solutions. This was seen to be challenging as the managers were still searching for the best way to interact with their rather newly-formed teams. The other

large category, *creating an open and trustful atmosphere*, was highlighted by all of the project managers. Managers emphasized the importance of getting to know their team and making the team meetings more relaxed. They encouraged team members to give feedback, acted in an open and relaxed manner themselves, and aimed not to dominate the meetings. The managers felt that creating or maintaining a supportive atmosphere was complicated by some team members being reluctant to spend time and participate actively in team meetings or informal gatherings.

The other four categories were relatively small. Some project managers highlighted the importance of *being present and available* for team members by allocating time for one-on-one meetings, keeping contact by phone and being present while subgroups were working on their own tasks. *Showing concern and appreciation*, in turn, involved managers showing interest in the well-being of individuals and appreciating the expertise of each team member. Some managers also attempted to *minimize the fear of failure* by emphasizing the importance of learning rather than succeeding right away. Finally, some managers reported *providing positive feedback and recognition* on work well done. No manager reported giving any negative feedback in the front-end phase, and no challenges were reported related to any of these four categories.

4.5 Contributing to the development work

Some managers made individual *contributions to the development work* itself. While all project managers for example took part in ideation sessions and created ideas along with team members, a couple of managers described designing and implementing product components, websites or such on their own or together with a team member. While one manager described planning to take part in the execution of the work to enhance the team spirit, another felt that the team expected such involvement in sharing the workload. On the other hand, one manager described difficulties managing the process without technical understanding of the product.

Table 2 Managerial functions and related activities in the front-end phase of innovation

Managerial function	Managerial activity	Quotes from interviews	Interview quote example
Providing structural support	Clarifying roles and setting goals	119	<i>“I’ve told them that it is my job to think that everything is under control. You need to just take care of your part and you don’t need to worry whether the others get their part done or not. Concentrate only on your own task.”</i>
	Time management	58	
	Documenting and monitoring work	32	
	Establishing ways of working	28	
	Making minor and final decisions	17	
	Total	254	
Coordinating and acting as a link	Coordinating the whole	80	<i>“I am prioritizing tasks and checking what needs to be done and by when and also to recognize the ones we don’t have time to.”</i>
	Accommodating to diversity	63	
	Acting as an interface between the team and other stakeholders	20	
	Solving interpersonal issues and acting as a mediator	17	
	Total	180	
Empowering the team	Activating team members	97	<i>“I have let them make decisions independently regarding the features of the product and such since I have trusted them that they are the best ones to make decisions regarding their part of the work and let them work freely.”</i>
	Providing autonomy	28	
	Dispersing decision making	26	
	Total	151	
Encouraging and providing social support	Encouraging exploration	64	<i>“First, the team members were pretty restricted in their thinking and did not really explore different possibilities. But then I said that ‘hey, we can look for inspiration from totally other industries as well. After that they had also been looking into totally other kind of businesses.”</i>
	Creating an open and trustful atmosphere	53	
	Being present and available	11	
	Showing concern and appreciation	9	
	Minimizing fear of failure	7	

	Providing positive feedback and recognition	6	
	Total	150	
Contributing to the development work	Total	22	<i>“It has been mainly me and the industrial designer from our team that have been developing the websites, we kind of did them all by ourselves.”</i>

5 Discussion

Despite an increased interest in managing innovative projects, studies rarely differentiate between the inherently different phases in the innovation process, raising the question of how much of previous project management literature applies to the unique front-end phase of innovation. Based on interviews of fifteen project managers conducted while their projects were in the midst of the front-end phase of innovation, the present study explored the inexperienced project managers' perceptions of their key functions and related activities in this tumultuous setting. Although the rather small amount of participants all located in a university context does somewhat limit the generalizability of the study, the results provide important insight on the circumstances of novice project managers in the front-end of innovation and how they aim to cope with fluctuating contingencies in order to foster innovation.

5.1 Reducing uncertainty through clear roles, goals, and coordination of tasks

Despite previous literature highlighting the need for leadership over management in the front-end (Morris & Geraldi, 2011), traditional management activities dominated the concerns of the project managers in the current study. The most emphasized managerial activities were clarifying roles, setting goals and coordinating the whole, making the managerial functions of *providing structural support* and *coordinating and acting as a link* the core aims of all fifteen project managers in the front-end phase of NPD projects. Indeed, given the uncertain nature of creative work, leadership actions reducing uncertainty are essential (Lenfle & Loch, 2010; Mumford et al., 2002). For example, developing a vision or setting a direction to cope with uncertain goals has been noted to be one of the most important functions of leaders (Keller, 1992; Kotter, 2001). All of the managers also described employing a rather democratic, dispersed decision-making style. Monitoring was conducted mainly in weekly meetings, and high levels of

autonomy were provided especially to subteams. This is in line with creativity literature, emphasizing the benefits of autonomy on employee motivation and effectiveness (e.g. Amabile et al., 1996; Amabile, 1998; see also Hohn, 2000; Shalley & Gilson, 2004).

Although all project managers recognized the importance of creating an open and trustful atmosphere and explicitly encouraged exploration, these activities were less emphasized than clarifying roles, setting goals, and coordination. This is interesting, as earlier studies have highlighted the need for developing team membership and fostering an environment of mutual trust supporting innovative pursuits of the team working in projects that demand creative efforts (Amabile and Khairi 2008; Barczak and Wilemon, 2001; Edmonson, 1999). Earlier studies have also suggested that leaders should explicitly request creative and innovative solutions (Waldman & Bass, 1991; Mumford et al., 2002; Amabile & Khairi, 2008), as well as stimulate team members to consider and conceptualize problems in new ways (Waldman & Bass, 1991; Hohn, 2000) and offer complex and demanding tasks (Shalley & Gilson, 2004) to further encourage exploration. Clearly, in our study, the project managers were more concerned about being able to define clear roles to each team member, set goals for the project, and keep the project under control in general, rather than establishing a climate supporting creativity. This might be a strategy by which the project managers aimed to keep the projects in check even in the front-end phase where uncertainty and ambiguity are strongly present. On the other hand, the study of Lathan and Locke (1979) recognized knowledge workers to be motivated from realistic, concrete goals that are challenging but not impossible to reach. Amabile (1998) has noted that key to creativity is providing people autonomy concerning the process but not the ends, supporting the fact that more traditional managerial functions providing structure and clarity are needed also in the creative phases of the project. Hence, defining clear roles and direction to the project might have an elevated significance in the front-end phase which otherwise is characterized with high-levels of uncertainty and ambiguity. In explorative settings, where the outcome is not known at the outset, the team has a central role in defining the possible solution and in proactively searching alternative routes to reach it, which requires taking initiative and identifying, proposing and pushing forward possible solutions. Making it easier for team members to proactively pursue their creative efforts is crucial in the front-end, creating a framework within which individuals can direct their efforts in a fruitful way.

5.2 Challenges in utilizing heterogeneous teams

Most of the project managers noted having faced considerable challenges in taking full benefit from the heterogeneity of the team: finding ways to work with the diverse team members and including team members from off-site locations and minority backgrounds (compared to the majority team composition). This problem seemed to be exacerbated by the fact that the vast majority of, if not all, team members were working together and with the project manager for the first time. This challenge might be somewhat mitigated in a company setting where often at least part of the team would have previous experience working together, however, innovative projects do tend to utilize at least partly novel team compositions. Hence, project managers need to simultaneously find the best ways of working with each team member, showing concern for their unique problems and approaches to work, and providing developmental opportunities according to individuals' needs and desires (Bass, 1988; Keller, 1992), as well as to create shared working practices that accommodate to and enhance the effectiveness of collaboration between individuals from a wide variety of backgrounds. In order for the project manager to be able to utilize the heightened ability of the diverse team to solve complex tasks through the broad array of expertise, skills and knowledge, he or she needs to be aware of all of these capabilities of the team already in the front-end phase. The better the project manager is aware of the skills, knowledge, and capabilities of the team at the front-end phase, the better the project manager is able to define roles and delegate tasks.

The project managers also struggled with figuring out how many hours each member could put on the project on a weekly-basis, i.e. how much resources there are available, as all project members (including the manager) were involved in other projects and functions as well. Although these results occurred in a university setting, previous research has found lack of time to be a major challenge, and perceived to be largely beyond employees' control, also in professional product development projects (Björklund, 2010). We suggest that in addition to clarifying and making sense of larger unities, such as the competences of the team, the project manager needs to also pay attention to more micro-level essentials, like the availability of the team members.

5.3 The role of the project managers' domain experience

Previous research on managerial functions and roles has emphasized the importance of domain experience of the project manager in development projects (Barczak & Wilemon, 1989; Clark & Wheelwright, 1992; Edkins, et al., 2013; Howell & Higgins, 1990; Kim, et al., 1999). For example Kim and colleagues (1999) emphasize that especially in the case of radical development projects, it is important that leaders suggest new ideas and alternative technological solutions themselves and by this way provide technical stimulation. Professional team members may also better accept authority based on expertise than hierarchy alone (Kim, et al., 1999). On the negative side, technical expertise in the domain might entice the project manager to go too deep into the role of a technical expert, at the expense of more fundamental leadership behaviors (Valle & Avella, 2003). Hands-on participation in the project, however, was fairly minor in the present study, excluding participation in the ideation sessions. In terms of participating to ideation, even managers without any domain expertise took part in the ideation sessions, and reported encouraging ideation by giving examples and suggestions. These results suggest that when aiming for novelty, the inclusion of heterogeneous and non-domain perspectives can be beneficial for avoiding design fixation, and thus the degree of domain knowledge of the project managers might not be as relevant as perhaps in latter, more evaluative phases of innovation. Furthermore, as the premature evaluation and criticism of ideas need to be prevented by leaders (Farris, 1972), one could argue that a lack of domain experience can even be beneficial for the leader in the front-end phase, allowing him or her to avoid judging ideas.

5.4 Suggestions for future research

The managerial functions recognized in this study clearly represented either task-oriented approaches (the functions of providing structural support, coordinating and acting as a link, and contributing to the development work) or people-oriented approaches (the functions of empowering the team and encouraging and providing social support). The results are in line with previous research that highlights the need for successful managers to apply a two-fold strategy in their approach, including both leading the people and leading the work (e.g. Mumford, et al., 2002), and with the classical behavioral approach of the two-factor theory of leadership, dividing manager activities into either task- or relationship-oriented (or people-oriented) actions

(Fleishman, 1953). Task-oriented leadership actions target the problem at hand rather than the satisfaction of the group members, including activities such as defining tasks and coordinating group members' actions, whereas relationship-oriented actions address the feelings and attitudes of team members, attempting to for example boost morale and reduce interpersonal conflict (Derue, et al., 2011; Forsyth, 1990). Task-oriented functions were clearly dominant in the current study, highlighting three intriguing avenues for future research.

First, previous research suggest project managers to utilize a more task-oriented than people-oriented approach (e.g. Mäkilouko, 2004), and the current research suggest that this is true even in the front-end of innovation, with the task-oriented functions of providing structure and coordinating dominating the described managerial functions both in frequency and emphasis. As literature tends to highlight the importance of social support and climate factors, this begs the question of whether project managers would benefit from a more people-oriented approach in the front-end of innovation. It may also be possible that task-oriented management functions form the necessary core on which people-oriented functions must be built. On the other hand, one could claim that people-oriented managerial functions are not needed as much in the early phases as e.g. interpersonal conflicts have had little time to develop yet. Longitudinal studies could help to shed light on the longer-term consequences of adopting task-oriented styles.

Second, research should investigate why do task-oriented functions emerge as dominant. Are inexperienced project managers more comfortable in the traditional managerial role, already burdened by the uncertainties of the front end of innovation? Are more experienced managers less task-oriented in the front-end? Cicmil (2006) showed that one of the key skills in successful project management is the ability to engage individuals in communication and conversation aiming to diminish the anxiety resulting from the unpredictable and complex nature of projects. The frequently reported time management challenges in the current study might have their roots in for example unaddressed climate problems. Selmer (2002) has suggested that project managers, in response to stressful project problems, may choose mental avoidance as their strategy to cope with the situation. As noted by Walker et al. (2008), novice and advanced beginner project managers may well be qualified with the theoretical

knowledge, but lack the experiential knowledge to reflect upon. Experienced project managers in for example the study of Cicmil (2006) highlighted importance quality interaction and relationships when project plans inevitably fail to live up to the scrutiny of reality, suggesting that once project managers are able to move past the simplifying, rule-based competence levels, they might have the band-width to concentrate more on people-oriented concerns. First-hand experience and reflective participation have been suggested as key methods for advancing to higher competence levels in project management (e.g. Cicmil, 2006), and it would be interesting to track how this learning process would reflect on the managers' perceptions of their functions and actions while they occur. Again, more detailed longitudinal studies examining the evolution of managerial functions throughout the innovation process, as viewed through the task versus people-oriented dimension, could produce further insights on what is required for successfully managing such complex and dynamic projects.

Finally, the current study offers little support for previous literature on the importance of the task-oriented, domain knowledge of project managers in innovative projects. Project managers reported taking part in ideation regardless of domain experience. It might be that a lack of domain-knowledge could even be beneficial in this phase. On the other hand, professional team members might require more domain experience from the project manager in order to accept the authority of the project manager, or domain-knowledge could be more relevant in latter phases of innovative projects. Future research should investigate in more detail the effects of having various degrees of domain-related knowledge in the front-end phase of innovation.

5.5 Conclusions

The current study investigated project managers' perceptions of managerial functions and related activities in the front-end of innovation based on interviews of fifteen novice project managers of NPD projects in a graduate level university course. Four major managerial functions in managing the front-end phase were recognized: providing structural support through establishing a framework for working (roles, milestones, etc.), coordinating individual efforts and acting as a link between the project team and sponsor, empowering the team by enhancing participation and providing autonomy, and encouraging the team by providing a rationale for exploration and a psychologically

safe climate for such efforts. Also a fifth function emerged for a few of the project managers, namely contributing to the development work itself, designing details and executing parts of the product or service itself. All managers took part in the ideation and concept creation efforts.

The inexperienced project managers emphasized relatively task-dominant activities to reduce uncertainty in the front-end, highlighting coordination, clear team member roles, and project goals. Time management and integrating the efforts of the heterogeneous team members were the most pressing concerns reported by the project managers. While the present study offers interesting insights into how new managers attempt to deal with the contingencies of the front-end, longitudinal studies are clearly needed to connect perceptions with subsequent effects on the team and project. Furthermore, given the small amount of individuals in a single setting, the generalizability of the results is naturally somewhat limited, and similar studies should be repeated in a larger scale and in professional settings. However, the current results do raise clear questions for future research to explore, as all of the novice and advanced beginner project managers emphasized task-oriented functions and actions above and beyond people-oriented concerns. Is this task-emphasis adopted by the inexperienced managers an effective way to reduce uncertainty in the long run, or would project managers benefit from more people-oriented approaches? On the other hand, the degree of domain experience had no clear impact on the project managers' perceptions and actions in the current study for inexperienced project managers. Could the absence of technical, domain experience be helpful for delaying judgment and focusing on management (rather than design activities), or are these benefits overshadowed by the costs of a reduced ability to estimate technological difficulties and potential, or of professional team members' lesser acceptance of the project managers authority? These questions offer promising venues for future research to better understand successful project management in the front-end of innovation.

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