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Identifying and Managing Creative Tasks in Collaborative IS Research Projects

Abstract: Collaborative research projects require a high amount of creativity to create innovative results. Project management has to ensure that it recognizes and encourages creativity. This can be done successfully only if the nature of creative tasks is well understood. Current literature on creativity provides a well-accepted model to characterize creativity. Based on a literature review and case study we transfer the findings into the context of collaborative IS research projects and we evaluate their applicability. We derive specific criteria and characteristics for the identification of creative tasks, find a set of different task types, and provide implications directly usable by project managers.

Keywords: collaborative research project, Information Systems project, creativity, qualitative data analysis, creativity-aware project management, creative task, management implications, embedded case study, European Union-funded research project

Introduction

Companies react to challenges in today's business and information technology environment by building their research capacities and engaging directly in the development of innovative solutions, services, and business models (Gassmann & Von Zedtwitz, 1999, Meyer-Krahmer & Schmoch, 1998, Nobelius, 2004). Resulting collaborative research projects are commonly planned, financed, and conducted by a consortium of academic, public, and industry partners (Gibbons, Limoges, Nowotny, Schwartzman, & Scot, 1994, Inganäs, Hacklin, & Marxt, 2009). Inter-organizational and inter-disciplinary research collaboration plays an increasing role in organizations' project portfolios, motivated by factors like access to complementary knowledge (Todeva & Knoke, 2005, Vonortas, 1997), new investments in high-opportunity, high-risk activities (Hagedoorn, Link, & Vonortas, 2000), and pressure for innovation in times of crisis (Borgatti & Foster, 2003). In addition, the strong support by national and international funding organizations of the paradigm of mode-2 knowledge production

(Gibbons, et al., 1994) and of triple-helix models for multi-stakeholder research (Etzkowitz, 2003) contributes to project-based research's becoming a major form of organizing innovation activity. This development results in increasing attention in project management (PM) research. The specific characteristics and challenges of this type of project complicate the application of many existing approaches such that the ability to innovate in PM has become a major factor of success (Lenfle, 2008). In order for a project-specific management approach to be developed, the needs and requirements of the project type must be well-understood (Shenhar, Aaron J., 2001), so most existing contributions aim at making the everyday settings and processes of such collaborative research projects explicit and plausible. Examples include the underlying collaboration process in French innovation clusters (Calamel, Defelix, Picq, & Retour, 2012); the tasks, roles, and responsibilities in inter-disciplinary research management (König, Diehl, Tscherning, & Helming, 2012); and the inquiry process in a UK government-funded research network (Winter, Smith, Cooke-Davies, & Cicmil, 2006).

We add to this stream of research by investigating the phenomenon of creative tasks in a specific type of collaborative research projects, namely projects executed under the Cooperation Programme by the European Commission in the area of Information Systems (IS). Such projects can be defined as "focused research projects with clearly defined scientific and technological objectives and specific expected results" (Europeancommission, 2007b, p.20). They are strongly design-oriented and problem-focused in the sense that they develop new technologies and applications and evaluate their use in novel application areas. To produce the required innovative research results, considerable creativity is required, as it essentially supports problem-solving (Amabile, Conti, Coon, Lazenby, & Herron, 1996, Runco, 2004). Creativity is commonly associated with a person's ability to perform innovative thinking and results in the generation of original and valuable ideas, services, and

solutions (Amabile, et al., 1996, Woodmann, Sawyer, & Griffin, 1993). Factors that support individual creativity are the freedom offered to a creative person to cope with the information boom, newly arising opportunities, and changes in technology (Runco, 2004).

Therefore, research projects have to be managed without defeating creativity and researchers' motivations by facilitating spontaneity and supporting the desire for change and rule-breaking (flexibility). At the same time, however, research has also shown that these projects benefit from firmness in project execution (Tatikonda & Rosenthal, 2000), suggesting that formality and flexibility are distinct constructs in the approach to PM and should be simultaneously applied for optimal project performance (Brattström, Löfsten, & Richtnér, 2012, Naveh, 2007). Ideally, project managers should understand which tasks are creative or less creative and the characteristics of such tasks and adapt their PM style accordingly. In this regard, this paper aims at investigating the occurrence and characteristics of creative tasks in the daily operations of collaborative research projects in IS. Our focus on creative tasks is based on the understanding that they are an important component of any PM method. Therefore, this paper explores the research question, *how can creative tasks in collaborative IS research projects be identified?*

The study of creativity has a long history (e.g. Amabile, 1983, Barron & Harrington, 1981, Drazin, Glynn, & Kazanjian, 1999, Rhodes, 1961, Woodmann, et al., 1993). It has been subject to a variety of disciplines (Runco, 2004, Styhre & Sundgreen, 2005) and has been shifted from an early emphasis on the individual and his or her thinking process to interactions on the group or organizational level (Drazin, et al., 1999). Creativity is an important research topic, and many aspects of the topic have been well investigated and understood. However, less has been done in the context of collaborative IS research projects; in particular, creativity on an operational level as it relates to the daily tasks of projects (also referred to as the micro-level of creativity) has received little attention. To address this

shortcoming, we conduct a literature review and complement this by an embedded case study. The literature review collects and synthesizes existing knowledge on creativity in general. In pursuit of clarifying the nature of creative tasks in the environment of collaborative IS research projects, we chose an explorative method, which provides substantial descriptions of a particular phenomenon (Creswell, 1998). Our research approach—a literature review followed by a case study—allows us to compare the findings of the two research steps and to analyze the extent to which the findings from the literature on creativity also apply in collaborative IS research projects. Our analysis is based on the four perspectives commonly used to describe creativity: the creative process, the creative product, the creative person, and the creative situation (Woodmann, et al., 1993, p.294).

Further details on the research method are provided after a theoretical introduction to the research background. The core of the paper then presents the results of the analysis and provides criteria and characteristics for the identification of creative tasks in collaborative IS research projects and a set of specific task types. This understanding can improve the development of a creativity-aware PM approach. Then we conclude the article with a discussion of the implications for practitioners and further reflections on the management of creativity in projects in order to turn an abstract phenomenon into a tangible notion for project managers.

Research Background

Collaborative IS Research Projects

This section introduces collaborative IS research projects and their characteristics, focusing on the nature of design-oriented IS research and the set-up of collaboration in these projects.

One of the most important characteristics of collaborative research projects is the nature of research work itself, which is naturally more uncertain and less tangible than the work in more traditional types of projects. The level of uncertainty is high, especially with respect to the existing knowledge base (in the sense that it usually changes during the project as a result of parallel research), the working method (Shenhar, A. J., 2001, Turner & Cochrane, 1993), and the overall project outcome because of missing customer requirements (Lenfle, 2008). According to Clarke (2002, p. 59), *"*R&D is not only characterized by uncertainty in terms of project duration, or budget, but also by the nature of the results". The work is guided by a research question that is often not clear at the project's start, but its definition is part of the research process (Booth, Colomb, & Williams, 2008). Research rigor is achieved by following a systematic process and applying well-established methods and the goal of any research activity is to extend the existing state of the art by creating new knowledge for a certain field of study (Creswell, 2009). Only if results prove novel in terms of solving a previously unsolved problem are they recognized as a scientific contribution.

Within our study we do not consider research and development as tasks of a homogenous process or functional unit, but we clearly acknowledge their organizational and managerial differences. A traditional classification of research and development (R&D) separates basic research, applied research, and development (Cox, 1990, Oecd, 1994). Various authors build upon the difference and provide a clear distinction between research projects and development projects (see e.g. Chiesa, 1996, Chiesa & Frattini, 2007, Cox, 1990, Kapsali, 2011, Lenfle, 2008, Wouters, Roorda, & Gal, 2011). Research explores the technology and the market, while development, particularly new product development, matures the technologies and introduces them into the market (Cox, 1990, Kapsali, 2011). Research has to deal with higher levels of novelty and uncertainty in terms of the expected result and working methods, while the problems in development arise from market uncertainty and the

technological complexity of large-scale implementations (Kapsali, 2011, Turner & Cochrane, 1993, Wouters, et al., 2011). In terms of project culture, Chiesa et al. (1996, 2007) point out that the culture in research projects is characterized by a high amount of freedom and by mistakes being accepted, whereas development projects have clear-cut priorities and more formal communications. The project type we investigate here primarily conducts applied research due to the involvement of end-users and their specific needs, but some projects also produce general and basic research results.

IS research projects funded by the European Commission have a particular focus on aligning business needs and research objectives and designing rigorous solutions based on the design science principle in IS (March & Smith, 1995, Peffers, Tuunanen, Rothenberger, & Chatterjee, 2008). Unlike behavioral science, which seeks to develop and justify theories and hypothesis, design science is fundamentally a problem-solving paradigm "to create innovations that define the ideas, practices, technical capabilities, and products through which the analysis, design and implantation, and use of information systems can be effectively and efficiently accomplished" (Hevner, March, Park, & Ram, 2004, p.75). This problem-solving character leads to a high percentage of evaluation and testing activities in research projects in order to demonstrate the utility, quality, and efficiency of a research result (Hevner, et al., 2004) and to test various alternatives before finding an answer (Lenfle, 2008).

As to the set-up of collaboration in these projects, strategic alliances among autonomous actors occur in many forms and for many reasons, among them research collaborations (Todeva & Knoke, 2005). Many companies are directly involved in research activities and partner with other industry players, academia, and public bodies, a development that has been called the "6th generation of research and development management" (Nobelius, 2004). A wide range of formats can be distinguished to organize joint research endeavors, ranging from single academia-industry collaborations to strategic alliances and joint ventures (Hagedoorn,

et al., 2000, Inganäs, et al., 2009), and covering inter- and intra-collaboration on various levels, such as the individual, departmental, sector, and national levels (Katz & Martin, 1997). This paper focuses on a consortium of equal and autonomous partners that collectively define, finance, and work on a research topic of mutual interest, thus "allowing the project to be of both scientific and industrial interest" (Inganäs, et al., 2009, p.214). Working processes and intellectual property rights are governed by contracts that are collectively defined and that grant equal decision rights to all parties. These consortia involve multiple partners from a variety of backgrounds, so they address the need for interdisciplinary integration between research fields (Huutoniemi, Klein, Bruun, & Hukkinen, 2010). Gibbons et al. (1994) describe this type of interdisciplinary, heterogeneous, and "heterarchical and transient" knowledge production (Gibbons, et al., 1994, p.3) as mode-2 since it is carried out in an application context provided by the industry partners. Particularly when they involve many partners, such research consortia are often constructed as a response to calls from public funding agencies (Protogerou, Caloghirou, & Siokas, 2010, Van Der Meer & Trommelen, 1996). Examples are European Union (EU) Framework Programmes, which foster multidisciplinary research and cooperative activities in Europe and beyond[1], Cooperative Research Centres (CRCs) in Australia[2], and projects funded by the German Ministry for Education and Research (BMBF) in Germany[3]. We are particularly interested in projects funded by the European Union since these funding opportunities, with IS a major focus, are growing significantly, so related projects are gaining significance in the project portfolios of companies and academic institutions. The current EU 7th Framework Programme has a budget of 50.5 billion euro, of which 9.1 billion euro are reserved for research in the area of IS (Europeancommission, 2006).

[1] http://cordis.europa.eu/fp7/

[2] https://www.crc.gov.au/Information/default.aspx

[3] http://www.bmbf.de/foerderungen/13546.php

In summary, the collaborative IS research projects addressed in this paper are "level-4-projects," which are characterized by ill-defined goals and working methods (Turner & Cochrane, 1993) or, using the hard and soft dimensions framework (Atkinson et al., 2006; Crawford and Pollak, 2004), are characterized as mostly soft projects, where goals and objectives are ambiguously defined, goal tangibility is low at the project start, and many alternative solutions are explored and discarded. To produce innovative design ideas, such projects operate under considerable pressure in terms of innovativeness and require a large amount of creativity within the research process. With respect to the collaborative set-up, this project type differs significantly from principal-contractor relationships since it brings together a set of autonomous organizations that operate under the umbrella of a larger funding program and (inter-)national policies. The relationship between the partners is reflexively reconstructed through discussion, negotiation, learning, and consensus building, leaving room for uncertainties and change processes (Calamel, et al., 2012, Etzkowitz, 2003, Winter, et al., 2006). Within this environment creativity must be encouraged and channeled toward a common research goal, a challenging task for any project manager. A prerequisite for this creativity-aware management style is a clear understanding of how creative tasks occur in this particular project environment, an understanding that is investigated in this paper.

Creativity and Creative Tasks

The start of research on creativity is commonly associated with a speech of J. P. Guildford in 1950 to the American Psychological Association (Amabile, 1983, Runco, 2004, Sternberg, 1999). He proclaimed creativity as an important research field and argued convincingly that it is an essential "natural resource" (Guildford, 1950). The field experienced an advance in interest in the late 1950s as a response to the *Sputnik* shock, when related research turned to discovering and describing the nature of creative people (e.g. Barron, 1955, Mackinnon, 1965, Osborn, 1957). Since then, creativity has been investigated in many research fields (e.g.,

psychology, education, clinical research, neuroscience, and sociology), and the focus has shifted to multi-level models of creativity that consider individual, group, and organizational levels simultaneously (Amabile, et al., 1996, Drazin, et al., 1999, Woodmann, et al., 1993) and include various perspectives (Runco, 2004).

Within this paper, we follow the definition of Amabile et al. (1996) in defining creativity as the production of novel and useful ideas, processes, and solutions, so and thus adopt the "new and useful" view (Mumford, 2003). We elaborate on this notion in the context of collaborative research projects in IS since "how researchers interpret the new and useful definition of creativity will determine how they assess the construct" (Batey, 2012, p.57). Novelty in technological advances can be distinguished as either radical newness, where even the problem space is ill-defined, or a new combination of existing elements or solutions (Couger & Higgins, 1993). The requirement of value or usefulness was added to the definition later, based on the understanding that, "in business, originality isn't enough" (Amabile, 1998, p.78). We adopt this business perspective and assume that, for an idea, service, or solution to be creative, it must be driven by a purpose and must add use or value to the company or academic partner involved in the project. The wider area of societal implications of publically funded research projects, which constitute another stream of research (e.g. Bruce, Lyall, Tait, & Williams, 2004, Protogerou, et al., 2010), are not considered in this context.

Four widely accepted perspectives of creativity, referred to as the "4-Ps" model of creativity (Couger & Higgins, 1993, Runco, 2004, Styhre & Sundgreen, 2005, Woodmann, et al., 1993), describe what should be analyzed in the context of a creative study (Batey, 2012):

- The creative process refers to the steps usually taken to be creative and provides models for creative thinking.

- The creative product focuses on the characteristics of the idea, service, or solution that are required to classify it as creative. Here the nature and measurement of the idea, service, or solution are of interest.
- The creative person refers to analyses of the character, abilities, and motivations of creative people.
- The creative situation or press refers to the environment and its influence on creative people and processes.

These four perspectives, first introduced in Rhodes (1961) to structure a literature review on creativity, have since been used in the literature to conceptualize the aspects of creativity. A strength of the 4Ps-model is that it can be applied to the overall organization as well as to subsets, such as in our case a project (Couger & Higgins, 1993).

The development of creative ideas happens on various levels in organizations, so it can be studied on these levels. Individual creativity is concerned with understanding the creative behavior of a certain kind of character and the products of such behavior (Barron & Harrington, 1981, Sternberg, 1999). At a higher level, group creativity is explained as a combination of lower-level efforts (Amabile, et al., 1996, Drazin, et al., 1999). Finally, organizational creativity is the "creation of a valuable, useful new product, service, idea, procedure, or process by individuals working together in a complex social system" (Woodmann, et al., 1993, p.293). This paper remains within the boundaries of a single project, but the examination of certain perspectives might be classified as being on team (project) level since, for example, the overall project goal can be achieved only by aggregating individual efforts and results.

With respects to the central phenomenon of creative tasks, we focus on the creative thinking process that occurs repeatedly in a collaborative IS research project. Here, the concept of a creative task plays a major role. We understand a creative task to be a subunit of the work-

plan or work-breakdown structure in which the creative thinking process is performed and which is worked on by multiple individuals (e.g., the project manager, well as team members). We investigate the character traits of these individuals in concert with the environment that is perceived to be creativity-enhancing. As part of our analysis of the creative product, we determine precisely what kind of creative ideas are developed in these tasks.

Creativity and Project Management

This section reviews current research on creativity in the research area of PM and positions our research in this context. A first relevant stream of research addresses the need for micro-studies in the field of creativity management (Mumford, Scott, & Strange, 2002). Simon (2006) performs an in-depth study of the non-administrative tasks of managers of creative teams and finds that a creative project manager acts as a sense-maker, a web-weaver, a game-master, and a flow-balancer and is mostly concerned with "providing the team and individuals with meaning, knowledge sharing spaces and a balance of challenges and support" (Simon, 2006, p.124). Lingo et al. (2010) investigate the role and processes of brokers that integrate ideas within a creative environment or project. They discover that ambiguity plays a major role in how the creative process is performed and describe how the creative ideas of others are connected. These contributions focus on work practices and show how managers perform their daily management tasks with respect to leading creative people and integrating the individual results.

Another stream of research addresses the problem of aligning the flexibility and firmness of the PM approach within the project boundaries (Lewis, Welsh, Dehler, & Green, 2002, Naveh, 2007, Tatikonda & Rosenthal, 2000). This alignment is necessary in order to manage complementary contingency factors and tensions in the project (Lee & Kelley, 2008) and is of

particular importance for the management of collaborative research projects. This kind of project is characterized by tensions between different interests that is driven by academic and industry partners and their perception of creative freedom versus the need for professional PM methods (Barnes, Pashby, & Gibbons, 2002). Therefore, creativity-aware PM has to ensure that it manages creativity and necessary control simultaneously. Both firmness and flexibility are essential to PM and a balance is achievable by "having flexibility within a structure" (Tatikonda & Rosenthal, 2000, p. 418). In concrete terms, project managers should maintain control and formulate rules at the project level and allow for flexibility at the working level. The application of this flexibility vs. firmness approach in PM could be extended by applying it on several levels within the project and to tasks on the working level, depending on the required level of creativity. Collaborative research projects always contain a mixture of creative and routine/administrative tasks, so they are not entirely creative. Administrative tasks can be managed within firm structures and processes, while the creative work is stimulated through trust and allowable variations in processes. Our contribution extends this stream of research by offering an in-depth analysis of the nature and occurrence of creative tasks and shows how to adapt the management approach accordingly.

Trust is an important prerequisite when researchers, developers, and managers from different organizational, geographic, and professional backgrounds work together on creative ideas and share confidential research results. The development of trust has been subject to various studies, such as those that focus on inter-organizational relationships (Schilke & Cook, 2013), on technical development (Bidault & Castello, 2009, Brattström, et al., 2012, Dodgson, 1993), and collaborative research environments (Davenport, Davies, & Grimes, 1998). The results of these studies show that the level of trust develops and changes in the dynamic setting of collaborative research. Accordingly, management practices must adapt to and support the

concept of multi-dimensional trust. The results of our creativity study can be used to develop appropriate PM mechanisms along the project life-cycle.

Research Method

Research Design

Our main goal is to support the identification of creative tasks that must be managed when running a collaborative IS research project. In view of this goal, this research can be characterized as exploratory, as investigating on an operational level, and as advancing a qualitative research design by collecting empirical data and comparing it to the current literature on creativity (Creswell, 1998, Schutt, 2008). This third characteristic derives from the fact that, while a large amount of previous research concerns the nature and management of creativity in general, it is unclear to what degree this extant research can inform the special case of creative tasks in collaborative IS research projects. We start with a literature review on the topic of creativity and then apply case study research as the selected strategy of inquiry (Yin, 2003). Case study is an empirical investigation of a current phenomenon or a specific situation in its real-world context (Eisenhardt, 1989, Leonard-Barton, 1990), so it addresses the first two characteristics of our research, exploratory research on an operational level.

We selected SAP Research (the research department of SAP AG) as the case site for our data collection. We conduct a single case study with an embedded design (Yin, 2003) by involving more than one unit of analysis (collaborative research project) within a distinct context (SAP Research). SAP Research acts as a technology trend scout, significantly contributing to SAP's product portfolio and helping the company maintain its technological edge (Sapresearch, 2010). This organization is involved in a variety of technology research projects and has a significant experience in the area of collaborative IS research projects. We chose SAP Research as the case site, as it is the research organization of one of the world-leading

providers of IS and they conduct typical projects with respect to our project focus. Therefore, it meets the rationale for a single case study, as the wide portfolio of projects conducted by the same organization enables comparison while at the same time providing a sample of diverse projects.

Project Selection and Data Collection

We selected a set of suitable units of analysis for our study from a portfolio of more than sixty projects at SAP Research. As a first criterion, we focused on projects from the same funding body, that is, collaborative projects under the 6th and 7th Framework Progamme of the European Commission (EC) (Europeancommission, 2006, 2007a). This choice reduced the available projects to around 30. In a second step, a set of projects was selected based on two their budgets and current status. This step provided us with a matrix of 3×3 projects, from which we selected one project from each category. Finally, the availability of the project manager for a detailed interview limited the number of projects to seven. Further details about the selected projects are provided in table 1. Empirical data in each case was obtained from in depth-interviews conducted face-to-face and by phone with the project managers and from project documentation.

Interviews were conducted to gather detailed data on the occurrence of creative tasks and how the project managers describe them. The project managers at SAP Research are often involved in all phases of the projects and contribute directly to the project work (e.g., through coding and testing), particularly in the case of smaller projects. Three interviewees also worked previously at the company as researchers or PhD students. Therefore, all interviewees had an understanding of the creative tasks performed in their projects and were able to judge their novelty and usefulness. The interviews lasted an average of one hour. Since the project managers worked in several locations, some interviews were conducted by telephone. The

interviews were semi-structured with a set of core questions around the definition of creativity; the characteristics of the creative people, work, and ideas in the projects; factors that enhanced or hindered creativity; and the distribution of creative work during various project phases. The most core questions are shown at the bottom of table 1. The interviews were all transcribed to be used in the data analysis step.

In addition to the interviews, documents were collected to further develop the understanding of creativity and to provide additional information about the interview questions. We included statements of work and the periodic and/or final reports of each project, documents that are required under the funding scheme of the European Commission and are standardized across all projects conducted in the IS area. The number of documents analyzed for each project is shown in table 1.

Table 1: Overview of data collection sources

Data Analysis

Before analyzing the empirical data, we performed a systematic literature review (Bandara, Miskon, & Fielt, 2011, Webster & Watson, 2002) on the concept of creativity. As various authors indicate (e.g. Couger & Higgins, 1993, Woodmann, et al., 1993), creativity can be investigated along four perspectives (process, product, person, and press), so we clustered the relevant body of knowledge along these perspectives. It was the goal of the subsequent data analysis to portray each perspective specifically for collaborative IS research projects in order to confirm, add to, or reject the findings of the current literature.

Next, we conducted a directed content analysis (Hsieh & Shannon, 2005, Miles & Huberman, 1994) using the literature to derive initial coding categories (the four perspectives) and sub-categories (the existing descriptions/aspects for each perspective). For example, for the category/perspective of the creative product, we identified novelty, value, and artifacts as

initial sub-categories. Then we read through the documents and interview transcripts and coded the data accordingly. While the interviews provided the primary data source, the documents were used to provide additional information about certain aspects of the creative projects' results and management tasks. Text that could not be coded using the pre-determined codes was coded separately using other subcategories and then was assigned to one of the four perspectives. In our example about the creative product, we identified further results that were not described in the literature, such as concrete outcomes of the technical project manager's work.

Finally, we analyzed the findings and indicated whether a certain aspect or description from the literature was confirmed, whether more specific details were given, or whether it was invalid or unimportant. Two researchers were involved in the iterative coding process. Two projects were selected, coded, and analyzed at a time; then the questions were improved based on the results before the next set of interviews started. This approach allowed us to draw conclusions and refine the results from one interview to the next (Miles & Huberman, 1994).

Research Results

This section presents the results of our analysis based on the four perspectives of creativity. A discussion and interpretation with respect to implications for PM is provided in the subsequent section.

The Creative Process in Collaborative Research Projects

The creative process describes how creators think, feel, work, and enhance their creative abilities (Runco, 2004). The first set of interview questions aimed to analyze this process in detail. Here, we focused on four goals in terms of the creative process: to identify concrete steps in the creative-thinking process, to obtain a list of or types of tasks that are considered

creative, to understand how creative tasks are embedded in the overall project life-cycle, and to determine how much time is spent on such tasks in order to judge their importance.

Identifying concrete steps in the creative-thinking process

Various thinking models have been developed in the literature to describe the creative-thinking process (e.g. Isaksen & Trefflinger, 1985, Osborn, 1957, Wallas, 1926). While each model has its own focus and was developed to address certain shortcomings in other models, they have general themes in common. The creative-thinking process consists of several steps of varying imaginative and analytical granularity and is usually carried out in iterations. The interviewees confirmed this general process, describing creative thinking as a mixture of inspiring, chaotic idea generation and focused knowledge generation and documentation: "*Each process has creative peaks which turns into implementation and documentation"* (I1); "*Parts of the process need to be focused and goal-oriented, others are chaotic"* (I5). According to the literature, each creative-thinking process starts with a preparation phase aimed at the definition of the issue and the collection of relevant knowledge to solve it (Isaksen & Trefflinger, 1985). Some interviewees (I1, I4, I5) described this part of the process as particularly important for IS research projects (e.g., as opposed to creativity in the arts), claiming that only if the existing body of knowledge in terms of current solutions and technologies is well understood can researchers work on creative improvements and innovations. This initial phase is followed by a more disorganized stage which is depends heavily on the creative person, problem, and environment (Sawyer, 2006). One interviewee described this stage as a "s*pontaneous, complex, and time-intensive process that contains many unstructured thinking periods"* (I4). Most interviewees described this phase as the time when new ideas are developed and most of the chaotic and creative thinking happens. This cannot be planned and most interviewees had difficulty describing how they work during this phase. The creative-thinking process finishes with a practical phase aimed at evaluation and

implementation of actions (Funke, 2000). For collaborative research projects, the creative process must also be driven to implementation, documentation, and communication of developed ideas. As one interviewee explained, *"Successful innovation cannot be achieved purely by imagining new things; they need to be turned into reality and verified solutions"* (I7). Implementing solutions is particularly difficult when many partners are involved in providing a common technology or architecture component (I3). All interviewees described the thinking process as highly time-consuming.

Obtaining a list of or types of creative tasks

The interviewees were asked to describe the project managers' general undertakings or tasks that they considered creative in their particular projects, and we compared the results to existing work on the tasks of creative managers (Lingo & O'mahony, 2010, Simon, 2006). We also complemented the interview responses with the document analysis by searching the main work plan and periodic reports for tasks that required creative thinking. We identified two types of creative tasks, one that involves research work and the other technical PM work. This differentiation of two types of creative tasks was discussed during the interviews as leading to differing types of output and requiring differing personalities from the person performing the tasks:

- Research tasks: Creative research tasks aim to solve dedicated research questions and are long-running. They occur at intermittent points in the project life-cycle and are determined in terms of the expected research goal, start date, and an indication of timeframe. Concrete examples of these tasks in IS research projects include an analysis of business and technical requirements (projects 1, 3, 5, 6, 7), the definition of innovative-use case scenarios (projects 2, 4, 5, 6, 7), the development of a concept/methodology for a certain technical component (projects 1, 2, 6, 8), IS

architecture development (all projects), and an analysis of innovative business models (projects 2, 4, 6). In most projects, these tasks involved two or more project partners who must solve the research questions collaboratively. However, project managers reported that, in many cases, the work is further decomposed into single research tasks on which only one person works (I1, I2, I4). The integration of results is then part of the creative technical management tasks, which are described next.

- Technical PM tasks: Creative management tasks aim at providing technical leadership, vision management, and sense-making. Especially in light of the complex and autonomous set-up of collaborative research projects, these tasks were described as extremely challenging and as requiring out-of-the-box thinking and political talent. From a time-management perspective, technical management tasks occur continually throughout the project and are difficult to plan and estimate. We identified as typical task types in our projects the collaborative definition of a research vision and objectives, their constant revision, the building of shared meaning and its communication, the translation of vision into action, sense-making, and the combination of single results into an overall research solution.

Concerning the technical management tasks, we confirm the findings in Simon (2006), particularly with respect to its sense-making aspect, but Simon (2006) identifies additional creative activities, such as those related to networking and setting up and providing an innovative and motivating "playground." An explanation for this difference could be the technical, rather than management, background of our study participants, and it is also possible that our respondents did not consider some tasks creative so did not mention them.

Lingo et al. (2010) analyze the integration of ideas into creative products, labeled "brokerage" in the literature. Our interview results show some parallels to Lingo et al.'s work, which was performed in the music industry, in terms of the importance of integrating ideas into products

and its role in the technical management of collaborative research projects. However, the phases of the brokerage process and the interplay of *tertius iungens* (bringing certain people together) and *tertius gaudens* (keeping parties apart) outlined in Lingo et al.'s contribution could not be confirmed with the data from our interviews. Nevertheless, their results provide insights into the management practices of integration work and an important set of guidelines in this respect.

Understanding how creative tasks are embedded in the overall project life-cycle

Projects can be divided into various phases, from the initiation to the formal closing (Kerzner, 2006, Project Management Institute, 2008). Common phases for IS research projects derived from the project documentation include proposal, negotiation, execution, and closing. We showed this conceptualization to the interviewees to seek their opinions on whether each phase contains the above-defined creative tasks and whether these phases can be considered creative. The interview responses showed that the level of required creativity varies among the phases:

- Proposal phase: Public-funded projects conducted in the case organization start with the creation of a research proposal, which is submitted to the funding body for external funding. The goal of the proposal phase is to determine the research questions and project idea and to present a preliminary work plan to stakeholders. All interviewees considered this phase the most creative and believed that it contains creative research tasks as well as technical management tasks (100% of the interviewees considered this phase as creative).
- Negotiation phase: Further project details, such as the legal framework, budget details, and duration, are settled in this second phase. The interviewees linked this phase to

mostly administrative, managerial, and legal tasks and did not believe it required creative thinking. (None of the interviewees considered this phase creative.)

- Execution phase: The analysis of project documentation revealed that the execution of a project is divided into intermediate phases like requirements, design, implementation, and testing. Depending on the project set-up, these phases occur either in unified sequence or in iterations. The interviewees described the need for creativity as high in the beginning and then steadily decreasing, with ups and downs depending on the general work plan. (five interviewees considered the requirements phase creative, six considered the design phase creative, three thought the implementation phase was creative, while zero and two though the testing and proof-of-concept phases, respectively, were creative). These findings show that creativity is expected in the conceptual phases of the execution and less in implementation phases. However, the proof-of-concept activities, such as building a demonstrator or pilot out of the results, were considered creative since innovative-use cases and story lines of the technology presented play a major role here (I1, I4, I7).
- Closing phase: All interviewees contended that this phase does not produce creative results and is purely administrative.

The variation in the amount of creativity required for these phases relates to the findings of Seidel (2009) and Seidel et al. (2010) on the nature of creativity in business processes, which state that creative tasks appear in "pockets of creativity" (sub-processes in which a high level of creativity is required) and are distributed along the overall project life-cycle, alternating with administrative/structured tasks.

Determining how much time is spent on creative tasks in order to judge their importance

Finally, the interviewees were asked to estimate the time spent on creative work in their projects in order to clarify the relative importance of the creative tasks. This question was

asked at the end of the discussion, when the interviewees had already developed a good understanding of what they considered creative work. Table 2, which depicts the responses of all seven interviews in relation to the size of their corresponding projects, shows that the analyzed sample of projects provided no evidence for a relationship between the level of creativity and the project size (e.g., that smaller projects can produce more creative work since they benefit from less administrative overhead).

Table 2: Amount of creative work in research projects (in % of time spent on creative tasks)

The Creative Product in Collaborative Research Projects

In the research background section, we defined creativity as the production of novel and useful ideas, services, or solutions. The current section focuses on the aspects of novelty and usefulness, and how these are perceived by project managers, and obtains more precise descriptions and examples of the ideas, services, and solutions that are developed in collaborative research projects.

All interviewees mentioned novelty in defining creativity as the ability to develop new research results or to combine existing technologies in a novel way, thus supporting the idea of newness as an essential part of creativity. The product of creativity is also often serendipitous and non-obvious (mentioned in interviews) and, in the case of IS research projects, includes a high degree of technological complexity (mentioned in two interviews).

As for usefulness, one interviewee associated appropriateness and usefulness with the generation of business value, such as through dissemination and exploitation activities and the definition of subsequent business cases for the developed solutions (I3), while four interviewees associated usefulness with the proof of ideas' validity and results through demonstrator or pilot implementations. Both viewpoints on usefulness were also confirmed in the document analysis since all projects contained demonstrator or piloting work packages

and conducted exploitation activities in which business models for subsequent use of results were developed and evaluated.

The analysis of the product of creativity revealed a list of ideas, services, and solutions, as well as their features. The general outcomes of IS research projects are software solutions for IS-related problems. According to the literature, such outcomes can be either IS artifacts (constructs, models, methods, or instantiations) (Hevner, et al., 2004, March & Smith, 1995) or theories (Kuechler & Vaishnavi, 2008). All of our interviewees confirmed the creation of artifacts, but none mentioned theory development, and theory development was not an outcome of any of the analyzed project documentations.

Concrete products of these two types of creative tasks were distinguished and described as follows:

(1) Research results are tangible solutions to research problems that vary from project to project. All interviewees mentioned novel technologies as the overall project outcome and gave examples of smaller research outcomes as IS tools and methods (all projects), innovative use and business cases (Projects 2, 4, 5, 6, 7), process modeling language (Project 1), as-is and to-be processes (Interviewee 1), architecture/platform (Interviewee 5), and use cases (Interviewee 6). One interviewee observed that a research outcome could also be negative in the sense that something does not work as intended.

(2) Technical management results are similar in all projects in the sense that they relate to the overall vision, its management, and achievement. However, single tasks of the project managers may not produce concrete and measurable results. To gain tangible outcomes, we searched the project vision/scope documents, project proposals, work plans, and integrated project result documentations for overall project results that

could be assigned to the identified tasks as the overarching outcome. These include in all the projects a vision/scope document, a project proposal, a work-plan and the integrated project result. In addition, one interviewee defined a suitable output format of a task as a non-trivial, sometimes even creative, outcome of the technical project manager (I7). Typical output formats include written reports, scientific papers, code, and presentations.

The Creative Person in Collaborative Research Projects

Guildford (1950, p. 444) observed that, *"in its narrow sense, creativity refers to the abilities that are most characteristic of creative people."* We asked the interviewees to specify the creative individuals in the project and to describe their character traits, then compared their responses to Barron and Harrington (1981), who claim that creative individuals have a set of stable core characteristics , and to Amabile (1983) and Runco (2004), who declare intrinsic motivation as a key driver of creative thinking (Amabile, 1983, Runco, 2004). The interviews confirmed an independent working style, a sense of oneself as creative, and an interest in the topic area as characteristics of the creative people on their projects, and four interviewees discussed self-motivation as well. Interviewee 5 stressed that creativity does not so much arise from certain character traits as from a person's awareness of the expectation to be creative in his/her job and that the required freedom is supported through the work environment and management attention. Other characteristics defined in the literature, with particular reference to researchers, include an orientation toward academic recognition, rather than project work (Clarke, 2002); high individual spirit and low team orientation (Brown, 1999); and orientation towards things, not people (Clarke, 2002). These characteristics were not mentioned or discussed in the interviews.

In addition to describing the character traits of creative people in the project, the experts were also asked for the roles of these people. We distinguished two roles that a creative person can take up in parallel to the findings about the creative process and the creative product: technical project manager and researcher. In a standard project situation, the technical PM position is staffed with a senior researcher who is also directly involved in the research work. The question about the "most creative people" in the projects identified PhD students in all interviews because they spend most of their time on research activities, as opposed to administrative tasks, because their job description requires creative thinking, and because completing their theses provides additional motivation to be innovative.

The Creative Press in Collaborative Research Projects

The concept of "press" describes the influence of external factors on the creative process and on creative people (Runco, 2004). Various studies have explained the relationship of human beings and their environments. Witt & Beokrem (1989) identify the environmental influences on creativity as freedom, autonomy, good role models and resources, encouragement specifically for originality, freedom from criticism, and "norms in which innovation is prized and failures not fatal" (as cited in (Runco, 2004 p. 662). All of our interviewees mentioned freedom and flexibility as the most important factors in enhancing creativity. (*"To be creative a large amount of flexibility is required"* (I7).) Flexibility was broken down into free choice of working time, working place, and working method. ("*To be creative, I need to be able to choose where and how I want to work*" (I2).) Interviewees 2 and 5 reported that they would frequently leave the office when they were stuck on a problem and that a change of environment would generate new ideas. Thus, the environment of a creative organization has to adapt to the creative process and the creative person.

A second important factor is the time component. While the interviewees confirmed that, in some cases, pressure leads to faster completion of certain phases of the creative process (such as documentation), they also believed sufficient time to think and explore was crucial for the generation of new ideas (I2, I3, I4), especially in the preparation and illumination phases. This view confirms the findings of Amabile et al. (1996), where time pressure is divided into excessive workload pressure and challenge (Amabile, et al., 1996). Challenge has a positive influence on creativity, as it gives a perception of project importance, which correlates positively with intrinsic motivation. Excessive workload, on the other hand, hinders creativity. In this context one of the interviewees also identified the focus of the creative characters (such as students) as very important: *"In managing a creative person, I need to make sure he/she has only one thing to focus on"* (I1). The interviewees did not mention creativity-hampering factors, such as lack of attention and lack of respect for originality by management.

Summary of Findings

Our analysis of creative tasks, based on the four perspectives on creativity that are commonly referred to as the 4Ps model, offers a suitable framework with which to answer our research question: *How can creative tasks in collaborative research projects be identified?* Based on our research results, we can establish a detailed view the occurrence of creative tasks in collaborative IS research projects. These findings, summarized in table 3, contrast current literature on creativity and our case study.

Table 3: Occurrence of creative tasks in collaborative IS research projects

Discussion and Implications for Project Management

Creativity is a central source of innovation, and no research project can be successfully conducted without it. Our interviews revealed that creative tasks comprise 20-60 percent of

the project work in collaborative IS research projects. From a PM perspective, this estimate, while approximate, suggests a high amount of creative work, which is both difficult to plan for and associated with a high possibility of failure. A better understanding of the nature of creative tasks of project managers and team members can improve the management of the risk that might stem from such uncertainty (Berggren, Järkvik, & Sönderlund, 2008). Next, we discuss our findings with respect to five implications and needs related to PM that we derive from this work.

1. Project management must differentiate between research and technical management tasks.

Our data revealed a fundamental difference between research and technical management tasks. More details were gained on a micro-level and are documented in table 3. Although technical management tasks have been previously identified in creativity research (e.g. Lingo & O'mahony, 2010, Simon, 2006), the knowledge has not been transferred into PM theory and practice. Within this section we consequently discuss implications and currently available approaches for their management.

- Research tasks: Researchers, (PhD) students, and subject matter experts use creativity to generate research results and perform long-running creative research tasks that constitute the main work in the analyzed projects. PM literature suggests that concrete steps can be derived from the main steps of the applied research method (Alexander, 2002), which should allow for more low-level planning. This type of task also benefits from guidelines and tools specifically developed to support the management of research work (e.g. Alexander, 2002, Conforto & Amaral, 2010, Gokhale & Bhatia, 1997).
- Technical management task: The technical project manager uses creativity to create, manage and fulfill the project vision. In this respect, three task types were identified in

the data analysis: the (re)definition of the vision, the breakdown of the vision into workable items (including responsibilities and output formats), and the combination of results to support the vision. Since technical management tasks are difficult to break down and since it is difficult to assign start and end dates, they must be dealt with differently than other tasks. One possibility is to include them as long-running work items in each work plan, with the dedicated resources of the technical project manager. In addition, scope management could benefit from checkpoints where these tasks are measured in terms of the fulfillment of the overall work plan to compensate for the lack of low-level results. Since further details could not be extracted from the interview results, it is assumed that it is difficult to apply lower-level decomposition to these tasks.

2. The creative thinking process mixes inspiring, chaotic idea generation and focused work.

A detailed investigation of the creative-thinking process has shown that, in parallel to the overall distribution of creative tasks in the project, this process is comprised of structured and chaotic phases, so it calls for alternating management approaches even within creative tasks:

- Knowledge generation: This initial step aims at building the knowledge that is required to develop innovative results through, for example, literature reviews and staff training. Tasks, their duration, and outcomes are defined and progress is monitored. Various approaches to conducting a literature review describe the related tasks (Bandara, et al., 2011, Cooper, 1988, Vom Brocke, et al., 2009, Webster & Watson, 2002), while the durations of tasks and resource constraints can usually be obtained from the researchers' previous experience. This step can be time-consuming, so it should be planned for accordingly.
- Idea/solution generation: The creative product is developed in this step, which is described as chaotic, although the level of chaos involved depends on the creative

person. Management should apply emergent or agile approaches since they focus on monitoring, as opposed to control (Conforto & Amaral, 2010).

- Implementation/documentation: This step, which concludes the creative-thinking process, includes documentation and implementation activities. The data analysis showed that, for this step, too much creativity-enhancing management is counter-productive. If too many creative ideas are still emerging and developing, they can hinder the timely delivery of ideas that have already been developed. Consequently, these tasks should also be managed with planned styles to thrive on completion (Lewis, et al., 2002).

Thus, two sub-tasks are identified as relatively structured (knowledge generation and the documentation and implementation of results) and one (idea generation) is described as chaotic and as depending on the individual person and required creative ideas or solutions.

3. Creative tasks appear in "pockets of creativity" throughout the project.

Creative and administrative/structured tasks alternate in a collaborative research project, which is referred to as the theory of "pockets of creativity" (Seidel, et al., 2010). This structure requires the application of varying PM techniques during the project's life cycle. Lewis et al. (2002) suggest a mixture of contrasting PM styles (planned vs. emergent) depending on certain project contingencies and advise project managers to "use iterations between styles in response to changes in project uncertainty" (Lewis, et al., 2002, p.562). Administrative tasks are easy to describe, plan, and monitor with traditional plan-driven PM approaches, but the management of creative tasks is more challenging. Generally, creative tasks benefit from ensuring the presence of environmental factors (creative press) that support creativity. While current literature on creativity provides a longer list of such factors (e.g. Amabile, et al., 1996, Barron & Harrington, 1981, Martindale, 1989, Runco, 2004), our interviewees saw only a subset as relevant for collaborative research projects: flexibility of

working time, working place, and working method; focus on dedicated topics; and sufficient time to think and explore. So these factors should receive special attention. The character traits and motivations of people who work on creative tasks have also been evaluated, revealing that an independent working style and self-motivation are common characteristics of those who work on this type of project, which emphasizes the need for freedom and flexibility. However, freedom and flexibility should be granted only within certain boundaries and balanced against firmer PM processes to maintain control.

4. The firmness vs. flexibility approach can be extended to the task level.

In order to balance flexibility and control, it is advisable to set the overall goal, vision, and responsibilities for the project and to communicate this high-level plan. At the same time, management should allow for freedom in implementation and avoid formulating excessive guidelines on how to undertake the various sub-level development and research tasks (Sundström & Zika-Viktorsson, 2009). Therefore, the concept of trust, which mediates in decreasing uncertainty and encouraging creativity, plays a major role (Brattström, et al., 2012). If we apply these findings to our research results, we can formulate several guidelines: Firmness should be applied to tasks that are routine and/or structured, like administrative tasks, knowledge generation, and documentation of results, but flexibility is required for the phases of chaotic idea generation and for technical management tasks which cannot be broken down into work items. For routine tasks, the formulation of strict management practices and processes generates trust, while for idea generation and technical management tasks, trust should be granted to the individual team members in order to foster creativity.

5. Creative tasks are more complex in the context of collaboration.

In collaborative research projects, one partner acts as the coordinator of the consortium, leading the technical work and performing other tasks, such as the management of funds and

communication with the funding organization (Erno-Kjolhede, 2001). Table 1 outlines the projects for which SAP AG acts as the coordinator and indicates the role of the project manager we interviewed. Since all of the interviewees identified technical management tasks and research tasks, we conclude that they occur within the boundaries of a single company performing a certain aspect of work and that they occur when managing the work of the overall consortium. Naturally, the management of these tasks is more challenging when they involve multiple partners with respect to the limited authority of the project manager in collaborative research projects (Adler, Elmquist, & Norrgren, 2009). Here, the project vision plays a major role since it is a central instrument in harmonizing differing views and expectations (Barnes, Pashby, & Gibbons, 2006, Ruuska & Teigland, 2009) and a cognitive reference in supporting problem-solving processes in the project (Adler, et al., 2009). Therefore, not only are the related technical management tasks highly creative, they also require the project manager to perform his or her work in an environment of competing demands and a strong diversity of partners and individuals in the project. As a result, special attention should be given to the selection of the project manager. The person should offer strong knowledge-broker and communication skills (Ruuska & Teigland, 2009), a diplomatic attitude, and a degree of technical awareness (Barnes, et al., 2006) and should follow a delegating and participating leadership style in order to create a sense of commitment and mutual obligation (Erno-Kjolhede, 2000). This set of skills should be complemented by good oral expression, sound logical reasoning, originality, fluency of ideas in order to perform strategic planning, a high level of information ordering, oral fact-finding abilities, problem sensitivity, and strong written comprehension to successfully manage R&D teams (Friedman, Fleishman, & Fletcher, 1992).

6. Certain creative tasks types re-occur in the projects.

Our findings suggest a list of creative tasks in collaborative research projects and management implications as a practical result for project managers. These are summarized in table 4.

Table 4: Identified creative tasks and management implications

7. Level of creativity contradicts the staffing level.

Finally, our findings show that the most creativity is required in the initial project phase, although this phase usually has the lowest staffing level (Project Management Institute, 2008). Another creativity peaks occurs at the beginning of the execution phase, where the project is usually not fully staffed. Consequently, the level of creativity required contradicts the usual staffing level, which has strong implications for resource management: The technical management position should be staffed by a visionary project manager early in the proposal phase, and creative people should be brought in early in the execution phases. Another possibility is the use of flexible staffing techniques, where the people on the project are exchanged based on the required expertise.

Conclusion

From an academic point of view, our work contributes meaningfully to the body of knowledge in PM by identifying and formalizing the occurrence of creative tasks in collaborative IS projects. This paper is the first to investigate this topic and to derive implications for the management of such tasks. Based on a literature review - to account for pre-existing knowledge - and a subsequent case study – to add an empirical investigation to the currently available literature - , we establish the criteria and characteristics of creative

tasks based on the 4-Ps model. In addition we distinguish creative tasks stemming from technical PM and research work. In so doing, we identified various types of creative tasks: research tasks in which original thinking is performed to solve a research question; the knowledge generation process, idea generation, and idea implementation; and technical management tasks that aim at the vision generation, sense-making, and creative leadership required from the technical project manager.

We establish that understanding the characteristics of creativity in collaborative IS research projects and adapting the PM approach accordingly is important to every public and private research organization and industrial research department. In order to manage research projects successfully, PM must find a balance between the flexibility and freedom required for creativity and strict techniques to manage the related risks. Our results allowed us to formulate an initial set of PM guidelines to support managers in the challenging task of managing and controlling this project type.

Our study has some limitations. First, it uses an exploratory approach, so its findings require further empirical validation and theorization. Second, our results are based on the insights of a sample of seven project managers and related project documentation. We claim that this number of interviews allowed us to establish an initial understanding of creativity in comparison to the main characteristics identified in the current literature. In particular we were able to derive task types that re-occur in all investigated projects. However the results are not exhaustively and a larger number of samples might lead to further findings particular to certain projects and the experience of involved project manages. Third, the case study focused only on collaborative IS research projects that produce technological results, so devising a generalized PM approach for all research projects would require further research across other types of research projects. Fourth, the set-up of a single-site case study allowed interviewees' responses and project documentation to be compared, but this approach limits

the study to one company's view of IS research projects, which is, in this case, driven by the prospect of profit. Some aspects of creativity that we found might differ if the same study were performed in an academic environment, such as with research projects carried out by universities. Fifth, interviews were conducted only with project managers and no other project participants, which could result in a narrow perspective of the aspects of creativity. However, since all project managers in the case study were also directly involved in the project work, we believe we gathered a broad view on the topic of creativity. Finally, the coding process was interpretive in nature, and although it was conducted by two researchers, the results depend on their observations. In short, we cannot claim that this research conceptualizes the concept of creativity exhaustively. Future research should investigate a broader sample of cases and build on the results presented in this paper in order to incorporate additional principles of managing creativity-intensive research projects into existing PM methods and tools.

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Tables

Table 1

Interview	Interviewee information	Interview information	Project information
I1	Position: Project manager Work experience: < 5 years	Date: 12.05.2010 Duration: 1hr Format: In person	Budget: 3.0mio € Start: 01.02.2010 Duration: 36 months Status: In initiation Goal: Development of a sustainability solution for companies Role of SAP: Coordinator Partners: 9 partners (3 universities, 1 research institute, 5 industry partners) Documents analyzed: Statement of work
I2	Position: Project manager Work experience: < 5 years	Date: 12.05.2010 Duration: 40mins Format: In person	Budget: 5.0mio € Start: 01.03.2008 Duration: 36 months Status: Running Role of SAP: Partner Goal: Development of innovative visual programming environment Partners: 6 partners (3 universities, 3 industry partners) Documents analyzed: Statement of work, 2 progress reports
I3	Position: Business development manager	Date: 19.05.2010 Duration: 50min Format: Phone	Budget: 3.4mio € Start: 01.02.2006 Duration: 36 months

	Work experience: > 5 years	interview	Status: Closed Role of SAP: Coordinator Goal: Development of process management approach for public sector Partners: 12 partners (3 universities, 4 industry partners, 5 public administrations) Documents analyzed: Statement of work, 3 progress reports
I4	Position: Project manager Work experience: < 5 years	Date: 20.05.2010 Duration: 45mins Format: In person	Budget: 8.4mio € Start: 01.07.2008 Duration: 24 months Status: Running Role of SAP: Partner Goal: Solving advanced challenges of service orientation Partners: 17 partners (5 universities, 10 industry partners, 2 research institutes) Documents analyzed: Statement of work, 1 progress report
I5	Position: Project manager Work experience: > 5 years	Date: 01.06.2010 Duration: 1hr10mins Format: In person	Budget: 18.6mio € Start: 01.09.2010 Duration: 36 months Status: In initiation Role of SAP: Partner Goal: Development of internet-of-things architecture Partners: 20 partners (6 universities, 14 industry partners) Documents analyzed: Statement of work
I6	Position: Project manager	Date: 14.06.2010 Duration: 50mins Format: Phone	Budget: 10.0mio € Start: 01.01.2010 Duration: 6months

	Work experience: < 5 years	interview	Status: In initiation Role of SAP: Partner Goal: Solve acceptance issues stemming from Electric Vehicle's limited range Partners: partners (2 universities, 9 industry partners) Documents analyzed: Statement of work
I7	Position: Research manager Work experience: > 10 years	Date: 15.06.2010 Duration: 1hr Format: Phone interview	Budget: 10.5mio € Start: 01.02.2009 Duration: 36 months Status: Running Role of SAP: Coordinator Goal: Methodology to support the construction of smart products Partners: 10 partners (5 universities, 1 research institute, 4 industry partners) Documents analyzed: Statement of work, 1 progress report
Core interview questions:			
• Which activities would you consider as most creative? • How would you describe/characterize these activities? • Which characteristics of creativity can be found mainly/only in IS research projects? • To which extent can creative tasks be described and planned? • Which phases would you consider as most creative and why? • What are the main project results and when would you consider them as creative? • Who are the creative people in the project and who works on less creative tasks? • Which character traits would you use to describe these people (the creative ones)? • Which internal and external conditions are required for creative work in your projects?			

Table 2

Interviewee	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Project size	Small	Medium	Large	Medium	Small	Large	Large
% of time spent on creative work in project	50% - 60%	40%	60%	20% - 30%	30%	40%	No answer
Small: 0-5mio € budget Medium: 5- 10mio € budget Large: above 10mio € budget							

Table 3

Details on…	Perception of project managers		Relation to current literature
	General findings		
… how creative tasks are embedded in the overall project life-cycle	• Level of creativity varies throughout the project (creative tasks comprise 20% to 60% of the project work) and alternates creative and administrative tasks • Most creative tasks occur in the following phases of collaborative research projects: o Proposal phase o In the conceptual phases of execution		Confirmation of theory of "pockets of creativity" by Seidel et. al (2009, 2010)
... concrete steps of the creative thinking process within each creative task	• Mixture of inspiring, chaotic idea generation and focused work: o Knowledge generation: generate the knowledge that is required to conduct the creative work, considered as very important step, particularly for research work o Idea generation: perform actual creative thinking and idea development o Implementation/documentation: document the results to complete overall process and ensure usefulness of work • Process is time consuming		Confirmation of general steps in creative thinking models (e.g. (Isaksen & Trefflinger, 1985, Osborn, 1957, Wallas, 1926))
…the nature and personal characteristics of creative people	• Independent working style • Interest in topic is important • Self-motivated		Confirmed: independent working style, sense of self as creative, broad interest in topic (Barron & Harrington, 1981) Confirmed: Intrinsic motivation as a key driver for creativity (Amabile, 1983, Runco, 2004)
…factors positively influence creativity	• Freedom and flexibility: free choice of working time, working place and working method • Multi-disciplinary teamwork • Focus of work on dedicated topic • Sufficient time to complete thinking process		Confirmed: Freedom (Witt & Beorkrem, 1989) Confirmed: Sufficient time is crucial for generation of creative ideas (Amabile, et al., 1996)
	Research tasks	Technical management task	
… characteristics of creative tasks	• Aimed at solving actual research problems through the development of a	• Aim at technical leadership, vision management and sense-making	

	dedicated solution • Occur at pre-defined points in project plan • Determinable in terms of the expected research goal, start date and an indication of time-frame • Long-running (can take up to several weeks or even months)	(integration) • In parallel to research tasks, occur continuously throughout the project • Emerge spontaneously • Are hard to plan and estimate	
… typical tasks and examples	• Main tasks dependent on research method and process • Examples: o Requirements analysis o Use case definition o Development of IS architecture	• Vision development • Translation of vision into work-items • Sense-making and integration of results	Confirmation of technical project manager as sense-maker, no confirmation of web-weaver, game-master and flow-balancer (Simon, 2006)
… typical products and examples	• Solutions to research problems: • Examples: o IS tools and methods o As-is and to-be processes • Development of IS architecture • New technologies which integrate different single research results from various project partners • Research outcome can also be negative	• Products often not tangible for each single tasks • Products can be made measurable by using overarching project results o Vision management: vision/scope document, project proposal o Translation of vision into tasks: work-plan o Sense-making: integrated project result	Confirmation of artifacts (Hevner, March, Park, & Ram, 2004; March & Smith, 1995) No confirmation of theories (Kuechler & Vaishnavi, 2008)
.. role of people that perform creative work	• Researchers, (PhD) students	• Technical project manager	

Table 4

Creative task	PM implications
Research work:	• Derive concrete sub-tasks from applied research method (Alexander, 2002) • Apply guidelines and tools for the management of research work (e.g. Alexander, 2002, Conforto & Amaral, 2010, Gokhale & Bhatia, 1997)
Technical management work: • Vision development • Translation of vision into work-items • Sense-making and integration of results	• Include as long-running work-item in each work-plan with dedicated resources of the technical project manager • Include checkpoints to measure their fulfillment • Provide freedom in execution (Sundström & Zika-Viktorsson, 2009), grant trust (Brattström, et al., 2012) • Require high co-ordination effort to include diverse thinking of different partners in collaborative research project • Require special skill-set and abilities of project manager (outlined in text)
Knowledge generation	• Important phase which should be included in project plan with sufficient time • Definition of tasks, responsibilities and timelines possible (e.g. steps of a literature review, staff trainings, etc.) • Provide firmness in execution through structured processes and more formal PM approaches (Sundström & Zika-Viktorsson, 2009)
Idea/solution generation	• Most chaotic and unstructured task which cannot be de-composed • Provide freedom in execution (Sundström & Zika-Viktorsson, 2009), grant trust (Brattström, et al., 2012) • Use of emergent approaches for their management (Conforto & Amaral, 2010)

Implementation/documentation	• Development of creative ideas in this phase considered as hindering and thus should be channeled away • Manage with planned styles to thrive to completion (Lewis, et al., 2002). • Provide firmness in execution through structured processes and more formal PM approaches (Sundström & Zika-Viktorsson, 2009)