Towards Creativity-Aware Project Management –

An Initial Study on Creativity in Research Projects

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Abstract

Creativity is a key resource in research projects where uncertainty is high and working methods and outcomes are only loosely defined. Project management has to ensure that it encourages, channels and manages creativity, while, at the same time, optimises the typical constraints of resources, time and scope. This can only be successfully done if emphasis is put on understanding the core of any creative project: the occurrence and nature of creativity. This paper documents an exploratory case study which analyses how creative work is distributed along various project phases and how it can be characterised and attributed. Two types of creativity within research projects have been identified: Creativity of the technical project lead to create and manage the project vision and creativity of the subject matter experts to generate research results. An understanding of their differences and implications helps project managers in the definition of a suitable management approach for research projects.

Keywords

Project Management, Managing Creativity, IS Research Projects, Exploratory Case Study

INTRODUCTION

Innovation, like many business functions, requires specific project management practices and related techniques and tools. A major challenge in this respect is the adaptation of commonly accepted conventional knowledge and methodologies to specific project needs (Dvir et al. 2003; Shenhar 2001). Central phenomena which hinder the application of established approaches in IS research projects are their problem-solving nature, the unknown outcome at the project start and the increased complexity of required solutions (Erno-Kjolhede 2000; vom Brocke and Lippe 2010). To produce an innovative research result, a high amount of creativity is required as this essentially lies behind problem-solving and problem-finding (Amabile et al. 1996; Runco 2004). Creativity is commonly associated with the ability of a person to perform innovative thinking and results in the generation of original and valuable products, services, processes, or ideas (Amabile 1983; Woodmann et al. 1993). IS research activities aim at solving existing questions or problems by adding novel knowledge in terms of theories or artefacts (Creswell 2009). Each research project needs to follow a definite set of plans and procedures (research design) in order to achieve scientifically acknowledged results (Creswell 2009; Hevner et al. 2004; March and Smith 1995). Nevertheless, most time is spent on idea generation and verification, a highly unpredictable and creative activity. An important factor for the generation of creative results is the flexibility of a creative person to cope with the information boom, arising opportunities, and changes in technological advances (Runco 2004).

Consequently, project management is concerned with the question on how such projects can make use of established management and controlling mechanisms without defeating creativity and researchers' motivation. The goal is to on one hand support the flexibility required to facilitate innovation and creativity and on the other hand to avoid failures arising from such risk-taking in the project (Erno-Kjolhede 2000). The development of this "balancing" project management method requires a deeper understanding of the nature and role of creativity in IS research projects as an initial step. Ideally project managers should understand which are creative and less creative phases, what are the characteristics of such phases and the researchers working on them, and adapt their project management style accordingly. Thus, this paper presents an initial explorative study to answer the following research questions:

- *Research Question 1:* How much time is devoted to creative work in research projects?
- *Research Question 2:* How is the creative work distributed along various project phases?
- *Research Question 3:* How can creativity in research projects be characterised and attributed?

In the context of this paper, research projects are defined as "a temporary organisation to build and evaluate new theories or artifacts under a pre-defined research objective and with constraints on costs and time" (vom Brocke and Lippe 2009). Although often referred to concertedly, a clear distinction of research and development projects is necessary for any future work towards a dedicated project management approach. Development projects are profit-driven, usually end in market ready products and have well defined goals and development methods. Research projects are characterised by their problem-solving nature and unknown outcomes and working methods at the project start (Turner and Cochrane 1995). They also contain development task, however these serve as a proof-of-concept for research results and are not directly aimed at the customer. A particular focus within this paper will be on collaborative research projects, where the work is jointly executed in a consortium of project partners from industry and academia. Projects of this type are steadily increasing and generally follow a more stringent project management approach than purely academic research. Awareness of activity planning and assigned responsibilities is thus higher than in purely academic research and project managers are usually well aware of the limitations of traditional project management approaches.

This work is motivated by Seidel (2009). Seidel focussed on business processes and developed a theory of creativity to conceptualise the phenomenon in this context (Seidel 2009, Seidel 2009b). Furthermore he developed strategies and actions that organisations can apply to successfully design and execute business process in a creative industry or environment.

The empirical evidence is derived from a case study. Data collection is based on document analysis and expert interviews from which qualitative data is obtained and analysed in comparison to the literature. The findings are discussed with respect to the generation of a creativity-aware project management style. The result is expected to guide project managers in decisions regarding (i) the extent to which existing project management methods and tools can be used and (ii) where and which adaptations are necessary to successfully manage creativity in research projects.

LITERATURE REVIEW

The start of being scientific about creativity is commonly associated with a speech of J. P. Guildford in 1950 to the American Psychological Association (Guilford 1950). He proclaimed creativity as an important research field and argued convincingly about it as an essential "natural resource" (Runco 2004). The field experienced an advance in interest in the late 1950th as a response to the "sputnik shock". The launch of a Russian satellite was accompanied by the fear to fail against the Soviet Union in technological innovation. Related research work at that time focussed on discovering and describing the nature of creative people (e.g. (Barron 1955; MacKinnon 1965; Osborn 1957)). Since then the concept of creativity has been studied in a variety of disciplines, for example in psychology, educational research, clinical research, neuroscience, and sociology (Runco 2004; Styhre and Sundgreen 2005). In addition multi-level models of creativity have emerged (Amabile et al. 1996; Drazin et al. 1999; Woodmann et al. 1993). Multi-level in this context refers to creativity at individual, group and organisational level. Individual creativity is concerned with understanding creative behaviour of a certain character and the products of such behaviour (Barron and Harrington 1989; Sternberg 2006). At a higher level, group creativity is explained as a combination of lower level efforts (Amabile et al. 1996; Drazin et al. 1999). Organisational creativity finally is defined as 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., p. 293).

The underlying definition of creativity in literature preliminary focuses on the outcome and describes it as novel and valuable. Hereby, the outcome of a creative task can vary from an idea to a complex product. For example, Amabile et al. (1996) define **c**reativity as "the production of novel and useful ideas in any domain" (Amabile et al. 1996, p.1155). Novelty distinguishes between radical newness (where even the problem space is ill-defined) and the new combination of existing elements or solutions (Couger and Higgins 1993). The focus on the results of the creative process rather than the process itself has been subject to discussion. According to Drazin et al. (1999) it provides a static view rather than explaining the development of creativity over time (Drazin et al. 1999). Thus, they developed a multilevel model for large-scale projects, which explains how the negotiated belief structure about creativity changes over time (Drazin et al. 1999). In summary, the definition of creativity is based on three aspects: a) radical newness or novel combination of elements, b) usefulness and value of the result, and c) the evolvement of creative behaviour over time. Four widely spread perspectives on creativity can be distinguished, namely (i) the creative process, (ii) the creative product, (iii) the creative person, (iv) and the creative situation or press, which is commonly referred to as the 4P-model of creativity (Runco 2004; Styhre and

Sundgreen 2005; Woodmann et al. 1993). The creative process refers to the steps usually taken to achieve a creative result and provides models for creative thinking. The product view focuses on the characteristics of results that are required to classify them as creative (Couger and Higgins 1993). Here, the nature and the measurement of the outcome are of interest. The creative person analyses the character, abilities and motivation of creative people. The level of creativity also strongly depends on the environment and its influence. This is described as press or creative place. These four perspectives were firstly introduced by Rhodes (1961) to structure a literature review on creativity (Rhodes 1961) and have subsequently been used in literature.

Within this paper we focus on creativity of individual researchers and creativity within project boundaries. This can be compared to group or organisation level. We will base our analysis on all four perspectives, as *"an understanding of organizational creativity will necessarily involve understanding (a) the creative process, (b) the creative product, (c) the creative person, (d) the creative situation, and (e) the way in which each of these components interacts with the others" (Woodmann et al. 1993, p.294).* Another strength of the 4P-model is that it can be applied to the overall organisation as well as any subsets, such as a project (Couger and Higgins 1993). In addition to the four perspectives, will focus on the time component and explain "how the dynamic process of creativity unfolds over time" to answer our first research question (Drazin et al. 1999). Not within the scope of this paper are the relationships of creativity and the wider scope of management at company or department level.

RESEARCH METHODOLOGY

Empirical evidence to answer the research questions is derived from a case study. SAP Research, the research department of SAP, was selected as the case site for the study. It has a long experience in collaborative research projects and is currently running over 50 such projects of different sizes and volume. Thus, it offers projects of different contextual factors (such as the life cycle phases, size and volume, duration, etc) to be simultaneously analysed within the case. In this respect our work can be differentiated from other studies on creativity, such as Drazin et al. (1999) which only focus on one particular project context (e.g. large-scale projects).

A case study is an empirical investigation of a current phenomenon or a specific situation within its real-world context (Eisenhardt 1989; Leonhard-Barton 1990; Meredith 1998; Yin 2002). Yin (2002) further argues that case studies are particularly useful and supportive in situations where the researcher uses "how" or "why" research questions (Yin 2002). This research explains how creativity appears in IS research projects and how creative steps and people can be characterised. As such, it is in an initial phase and aims at deepening the understanding of a certain phenomenon. A case study provides a suitable research method to solve the research questions and address their explorative character. With regards to the specific steps to be carried out during the case study research process, this research work follows the four phases proposed by Yin (2002): design, data collection, analysis, and reporting (Yin 2002). The design links the collected data to the initial research question and thus provides a "logical plan for getting from here to there, where here may be defined as the initial set of questions to be answered, and there is some set of conclusions (answers)" (Yin 2002, p. 20). Three research questions have been presented which aim at understanding the role of creativity in research projects with a focus on the topic areas of (i) creative process, (ii) product, (iii) person, and (iv) press. Thus, research projects form the unit of analysis within this study.

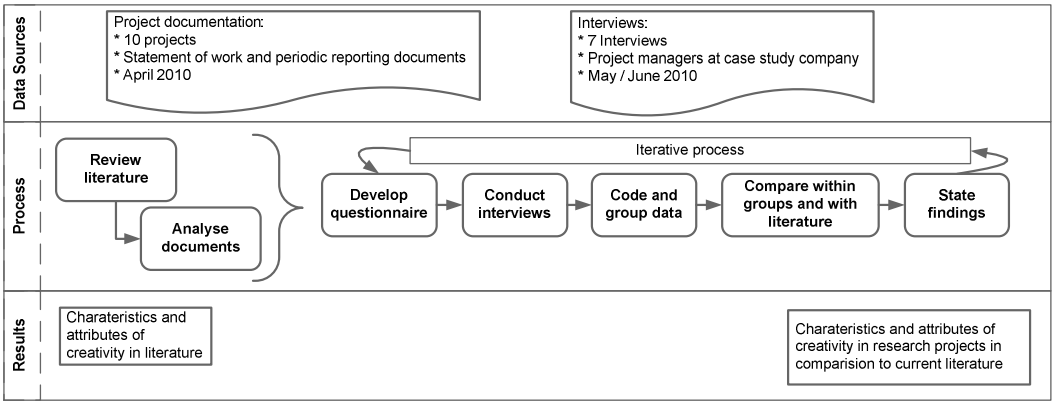

Figure 1: Data collection and analysis process

Empirical data was obtained through seven semi-structured expert interviews with senior project managers. Documents were collected for 10 research projects that ended, or expected to end, between 2006 and 2012. Closed, running and newly starting projects were included in the sample to cover the full project life-cycle. See Figure 1 for an illustration of the overall data collection and analysis process. Documents analysed consisted of

statements of work and periodic reports for each project and included the final project report for terminated projects. Document analysis provided an initial understanding of the set-up of research projects, the distribution of creative phases and the expected outcomes in each project. The knowledge gained was combined with the results of the literature analysis to develop the questionnaire for the interviews. The interviewees were purposely selected to be senior researchers that work as technical project managers on a certain project. They were expected to have an understanding of the creative activities performed within their project and an ability to judge the novelty and usefulness of such activities. On average, each interview lasted one hour. To create an open atmosphere where different directions could be discussed and explored, the interviews were not recorded, but notes were taken and transcribed. The interviews were semi-structured with a set of basic questions which were refined based on the discussion of each interview. The basis for the analysis of the data formed the previously conducted literature review and the therein identified four perspectives on creativity (as defined in the literature review). As a first step, the interview notes were grouped into process, product, person and place related answers. Within each category, the interview results were coded and the relation to the literature was indicated. Here the interview results confirmed, detailed or disproved aspects from the creativity literature. The analysis of codes and categories stopped when saturation was achieved and further analysis was deemed to be of marginal value. The findings were documented and presented to the interviewees to be checked for correctness. The overall process had a strong iterative character, as always two interviews were conducted, coded, grouped and analysed before the questions were refined and the next set of interviews started. The outcome is presented in the next section.

FINDINGS

The findings of the study will be discussed in relation to the research questions that were posed in the beginning of this paper. Generally, all interviewees considered creativity as the ability to develop new research results or to combine existing technologies in a novel way. One interviewee described creativity as a process, which starts with a broad topic area and ends in the creation of a concrete, original solution. It was also agreed that creativity is a central source of innovation and that no research project can be successfully conducted without being creative: *"Creativity is the human property behind innovation"* (Interviewee 1). A distinction was made between implementation projects (also known as piloting projects) in which emerging technologies are deployed and tested in a new environment, and research projects in which these are developed. In terms of appropriateness and usefulness, this was commonly associated on one hand with the generation of business value from the results, e.g. through dissemination and exploitation activities. On the other hand, a creative idea was only considered as valuable if validity was proven, e.g. through a demonstrator or pilot implementation.

Research Question 1: How much time is devoted to creative work in research projects?

Research projects are commonly expected to include a high amount of creative steps and produce creative ideas to ensure novelty and to cope with serendipitous output, uncertainty and ill-defined goals. However, administrative and routine tasks also need to be performed by project members. Thus our first question aimed at determining how much of the work-load falls into the first category and thus requires special or at least varied management attention. The interviewees were asked to estimate the time spent on creative work within their projects. The following table depicts the results within the case study.

Table 1. Amount of creative work in research projects (in % of time spend on creative tasks)

Interviewee	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Project size	Small	Medium	All	Medium	Large	Medium - Large	All
% of time	50% - 60%	40%	60%	20% - 30%	30%	40%	N/A

These findings are further discussed in the next section.

Research Question 2: How is it distributed along various project phases?

Projects can be divided into various phases, from the initial initiation to the formal closing. These phases are commonly referred to as the project life-cycle (Kerzner 2006; Project Management Institute 2004). Research projects, and in particular collaborative research projects, start with a proposal phase. In this case study the proposal phase consists of determining the research questions and project idea and presenting a preliminary work plan to various stakeholders. The interviewees commonly described this phase as the most creative, together with the beginning of the execution phase. They described the collaborative development of the research vision and technological and scientific objectives as requiring a large amount of creative thinking. Further project details (such as the legal framework, budget details and duration, etc) are settled in the second phase of the project life-cycle, that is, the negotiation and planning phase. This phase was linked in the interviews to mostly

administrative, managerial and legal tasks and thus does not require much creative thinking. Analysis of project documentation revealed that execution is divided into various intermediate phases, such as requirements and use case definition, concept development, design, implementation and testing. Depending on the project set up, these phases occur either in a sequence or in iterations. The need for creativity was described as high in the beginning and then steadily decreasing with ups and down depending on the general work plan. Most interviewees named the definition of innovative scenarios and their translation into technical requirements, architecture and concept development as creative phases during execution. Implementation and testing on the other hand do not require much creativity and should rather serve as documentation and proof-of-concept for the creative ideas developed in the first phases. Even more, creativity was seen as counter-productive for the progress and success of these activities by the senior researchers. This was especially mentioned by project leads which manage larger projects and teams. The same applies for the final project phase (closing phase) and for the project management processes of planning and monitoring / controlling.

Research Question 3: How can creativity in research projects be characterized and attributed?

The development of distinctive characteristics of creativity in research projects will be based on the 4P-model and examine the creative process, persons, product, and the creative environment.

- *Creative Process* in Research Projects:

The creative process describes how creators think, feel, work or experience and seek ways of enhancing creative abilities (Runco 2004). Various creative thinking models have been developed in literature that theorise how creative thinking proceeds and how creative ideas emerge over time (e.g. (Isaksen and Trefflinger 1985; Osborn 1957; Wallas 1926)). While each model has its own focus and was developed to address certain shortcomings in other models, some general themes can be identified. The process is combined of various steps of different imaginative and analytical granularity and is usually carried out in iterations. These findings from literature were confirmed by the interviewees, which described creative thinking as a mixture of inspiring, chaotic idea generation and focussed knowledge generation and documentation. The creative thinking process starts with a preparation phase in the beginning, which is aimed at the definition of the issue and a collection of relevant knowledge to solve it (Isaksen and Trefflinger 1985). This was described as particularly important for research projects, as opposed to e.g. creativity in arts. Only if the existing body of knowledge in terms of current solutions and technologies is well understood, researchers can work on creative improvements and innovations. The "middle phase" of the process is rather chaotic and strongly dependent on the creative person, problem and environment. In the end, as it was stressed in most interviews, the creative process needs to be driven to the implementation, documentation and communication of ideas. *"Successful innovation cannot be achieved purely by imagining new things; they need to be made reality and turned into verified solutions"* (Interviewee 7). In general, this process would take place every time a creative solution is required.

In addition to describing the process of how they come up with creative ideas, the interviewees were asked to describe the general undertakings or activities that were considered as creative. Here, two types of creative work were identified:

- "Classical research": These tasks aim at solving concrete research problems through the development of a dedicated solution. These activities are much focused and are usually worked on by a single researcher or a smaller group. Typical activities that were named here correspond to the creative activities identified for the execution phase, particularly the definition of innovative scenarios and their translation into technical requirements, architecture and concept development, design steps and the analysis of innovative business models.
- Technical project management: Project management was differentiated into an administrative part (which was understood as *"all the classical project management tasks, such as planning, risk management, monitoring/controlling, etc."* (Interviewee 4)), and a technical part, which is mostly concerned with scope management. In addition to the first category of focussed research tasks, technical management is also associated with creative thinking and sense-making. The creative tasks were described as the collaborative definition of a research vision and objectives, their constant revision, the building of a shared meaning and its communication, the translation of vision into action, sense-making and the combination of singe results into overall research framework. This view can also be found at Simon (2006) which describes the technical project manager as a sense-maker, web-weaver, game-master and flow-balancer (Simon 2006).

This differentiation of two types of creative tasks was repeatedly discussed during the interviews as it also leads to different output types and requires a different personality of a creative person.

- *Creative Product* in Research Projects:

As already discussed, two conditions are considered as central in literature to determine whether an outcome is creative or not: novelty and usefulness (Amabile et al. 1996; Runco 2004; Sternberg 2006; Woodmann et al. 1993). Concerning IS research projects, the general outcome are solutions for IS-related problems. Accepted solutions in the community are constructs, models, methods or instantiations (Hevner et al. 2004; March and Smith 1995) and theories (Kuechler and Vaishnavi 2008). Our study revealed a list of "creative products" that were commonly identified as resulting from collaborative research projects. Again, these can be distinguished into results developed within the research activities and results stemming from technical management effort. The following table depicts the findings from the interviews and document analysis.

Table 2. Creative Product in Research Projects

Results from research activities	**Results from management activities**
• Artefacts (constructs, models, methods or instantiations): most common artefacts are solution architectures, design specifications, and concepts • Innovative use cases and business models • Novel technologies	• Project vision (emerging over time) • Technical / scientific objectives (emerging over time) • Breakdown of overall vision into "researchable" parts (work packages, concepts, architecture components, etc) = high level work breakdown structure • Definition of suitable output format for research activities • Integrated representation of parts (e.g. overall architecture)
= Documented and verified single project results	= Successful, integral "whole"

An important point that was explicitly mentioned by most interviewees was again the documentation and communication of results. An outcome is only useful, and therefore fulfilling the second condition, if it is documented and communicated within the project and the outside community (e.g. conference publication). The definition of a suitable "output format" of a certain tasks or phase was described as a non-trivial, sometimes even creative task of the technical project manager. However, the implementation and verification phase was described as not producing creative results, but promoting the usefulness of the creative ideas developed before. As an example, a creative result would be a documented design specification, which however is only being considered as useful and thus creative if it is implemented and tested. Yet, the code and testing report are not creative results.

- *Creative Person* in Research Projects:

„In its narrow sense, creativity refers to the abilities that are most characteristic of creative people" (Guilford 1950). Numerous research reports exist concerning the nature and personal characteristics of creative people. Barron & Harrington (1981) claim that creative individuals have a set of stable core characteristics that consists of a "high valuation of aesthetic qualities in experience, broad interests, attraction to complexity, high energy, independence of judgement, autonomy, intuition, self-confidence, ability to resolve antinomies or to accommodate apparently opposite conflicting traits one's self concept and finally, a firm sense of self as 'creative'" (Barron and Harrington 1981). These character traits were largely confirmed in the case study whereas open-mindedness and an independent, pro-active working style were mentioned as being the most common and essential to produce innovative results. Further characteristics, with particular reference to researchers, are defined as including an orientation towards profession or even academic recognition rather than project work (Clarke 2002), (Brown 1993); high individual spirit and thus low team orientation (Brown 1993); orientation towards things not people (Clarke 2002); and motivating and rewarding scientists differ as main drivers are academic recognition and professional growth and challenging work environment (Clarke 2002). However, these findings were not strongly confirmed in the case study. The reason for this might be industrial environment rather than an academic institution. Personality research often includes intrinsic motivation as a key driver for creativity (Amabile 1983; Runco 2004) which was confirmed by the interviewees. The analysis has shown that in parallel to the findings of the creative process and products, two roles can be distinguished that a creative person, in particular the project manager can take up: technical project manager and researcher. Each project would have one technical project manager, usually a senior researcher. This person would be responsible for the technical management activities as described earlier in this section. The technical project manager would also be concerned with less creative activities, such as management and administrative tasks, dissemination, communication and stakeholder management. Researchers focus on the single problems and can be senior researchers, junior researchers, PhDs or students. PhDs and students were described as the "most creative" in each project, as they spend most of their time on research activities as opposed to more administrational tasks.

- *Creative Press* in Research Projects:

The concept of press is used to describe the influence of external factors on the creative process or on creative people (Runco 2004). Various studies have been conducted to explain the relationship of human beings and their environment. Witt and Beorkrem (1989) identified a set of factors that positively influence creativity: "Freedom,

autonomy, good role model and resources, encouragement specifically for originality, freedom from criticism, and "norms in which innovation is prized and failures not fatal" (cited from Runco (2004). A comprehensive model to assess perceived stimulants and obstacles to creativity is developed by Amabile et al. (1996) (Amabile et al. 1996). Within the case study, all respondents raised flexibility as the most important factor with regards to enhancing creativity. *"To be creative a large amount of flexibility is required"* (Interviewee 7). Flexibility was further broken down into a 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*" (Interviewee 2). Especially when being stuck with a certain problem, interviewees reported that they would frequently leave the office and that a change of environment would generate new ideas. Thus, the environment of a creative organisation has to adapt itself to the creative process and person. An important second factor is the time component. While in some cases pressure was identified to lead to a faster completion of later phases of the creative process (such as documentation), sufficient time to think and explore was seen as crucial for the generation of new ideas. Time is required especially for the preparation and illumination phase. This 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 contrary 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 only has one thing to focus on"* (Interviewee 1). Not mentioned by the interviewees where creativity hemming factors, such as lack of management attention and respect for originality.

DISCUSSION

The study was aimed at contributing to a creativity-aware project management method and thus the findings will be discussed in this context. Three sub-themes can be identified and are presented in the order in which they were documented in the findings section.

- Approximately half of the time in research projects is allocated to creative tasks

Without doubt research projects require a high amount of creativity. The attempted quantification within the case study revealed an average of 50% of the project time; a very high amount if looked at from a project management perspective. Creative work is hard to plan and associated with a high possibility of failure. This needs to be taken into account in all project management processes. On one hand, especially scope and risk management need to appropriately manage the highly creative tasks. For example, an experienced technical project manager is required, who can assess the feasibility of the vision and proposed concepts and technologies. Short development cycles can help turning ill-defined steps and results into concrete deliverables early in the project (Turner and Cochrane 1993). On the other hand, 50% of the tasks were considered as rather administrative or routine. These should be planned and monitored rigorously following strict project management methods, something that is likely to be forgotten in the light of the unpredictable tasks.

- The distribution of creativity along project phases contradicts with the general staffing level

Concerning the distribution of creativity across various project phases, an interesting phenomenon can be found when comparing the described level of creativity to the typical staffing level across the project life-cycle. This is depicted in the following figure:

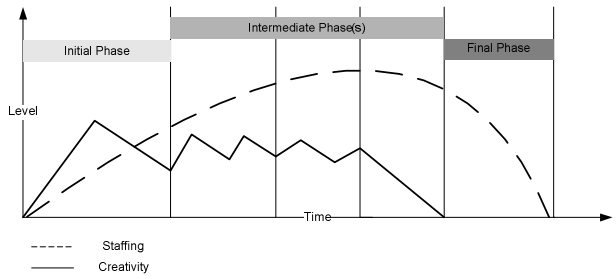

Figure 2: Comparison of Project Staffing and Creativity Levels based on (Project Management Institute 2004)

The findings have shown that most creativity is required in the initial project phase to understand the state of the art, determine the problem space and define the vision and objectives. Here the most creative person is the technical project lead which is concerned with sense-making activities (Simon 2006). However, this phase usually has the lowest staffing level as the project has not yet started and only single researchers are assigned to proposal writing. Further creativity peaks can be found in the beginning of the execution phase, again a situation where the project is usually not fully staffed and hiring is running in parallel to the project activities. From a

project management perspective it is thus necessary to staff the project accordingly, which means to ensure that the highly creative people, such as the technical project manager and senior researchers are taken on board early on. Further staff, such as developers are only required later in the project.

- Creative idea generation belongs into early phases of a research project as at later project phases it hinders successful project completion and should be prevented

For later project phases, such as implementation and testing it was explicitly mentioned that creativity is an impediment to the completion of these phases. If too many creative ideas are still emerging and developing in the later phases of the project, these can hinder the timely delivery of already developed ideas. Researchers tend to lose interest in ideas once they have emerged and rather look into the development of "yet another advancement", than focussing on the implementation of the first creative result. Thus, project management needs to channel and direct creativity throughout the overall project life-cycle. A creativity-enhancing atmosphere is constructive in early phases, while in later phases the project lead should develop a more rigid work plan and re-direct project staff to it. Innovative ideas need to be assessed in term of their importance and influence on the project and can then either be shifted into more conceptual phases in case of a iterative model or into follow-up research projects.

- Combination of creative person, product and process into the 4Ps model for creativity in IS Research Projects

The findings related to the 4Ps model can be summarised into a conceptualisation of creativity in research projects which is based on the fundamental differentiation between "project lead creativity" and "researcher creativity". The following figures depicts the corresponding 4P model for creativity in IS research projects.

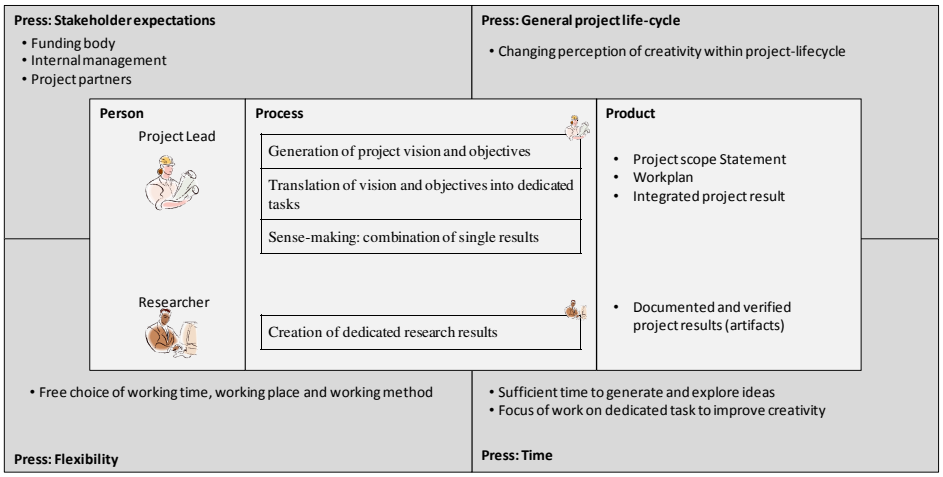

Figure 3: 4P-Model for Creativity in IS Research Projects

The management tasks of the technical project lead occur constantly during project initiation and execution and are hard to predict and specify. They are mostly concerned with sense-making in terms of the vision and objectives, transforming this into dedicated research tasks and integrating the results. The second category of classical research activities produces the actual project results and the work is performed as dedicated tasks within execution. From the findings of the study, various management recommendations can be derived to deal with creativity in research projects:

- Technical project management requires a substantial amount of time and resources, is running in parallel to the other project activities, and is hard to plan and measure in terms of concrete project results.
- It is important to assign a project lead that not only has technical knowledge, but can cope with the "political" challenges inherent to this work. This person should be part of the initial staffing plan to account for the increased creativity at project start.
- Research tasks can be included as part of the work plan and resources and time can be associated. Further decomposition however is not advised to not obstruct flexibility. Also risk management should be aware that the outcome can be negative and/or further time is required to get to usable results. It is recommended to pre-define the output format of these activities to ease a later integration into the overall project artefact.
- For the creative phases, project management needs to foster flexibility in terms of free choice of working time, working place and working method and time to think and explore.

- For later project phases which focus on the implementation and testing of the research results, more stringent project management approaches need to be used and creativity needs to be channelled away from these phases.

CONCLUSION

To successfully manage research projects, project management in concerned with finding a balance between the flexibility and freedom required for creativity and strict techniques to manage the related risks. This study has added a relevant level of analysis to the phenomenon of creativity in research projects which can be used for the development of such a "balancing project management method". The work on creative tasks is mainly done during the initiation phase where vision and objectives are defined and during certain phases in execution, namely the definition of innovative scenarios and their translation into technical requirements, architecture and concept development. Related activities can be generally distinguished into imaginative thinking that is required to solve a certain research problem and the sense-making and creative leadership abilities required from the technical project manager. The study results allowed us to formulate an initial set of guidelines for the creativity-aware management of research projects to support managers in the challenging task of controlling this project type.

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