EXPLOIT AND EXPLORE: TWO WAYS OF CATEGORIZING INNOVATION PROJECTS

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ABSTRACT
Innovation is vital to companies, but also difficult to perform since there are many ways to approach the subject. Typically, a balance between all issues related to innovation is suggested in literature. The empirical study presented in this paper elaborates on two strategies for innovation projects, namely to exploit existing solutions and to explore a market to develop breakthrough solutions. This is done for the purpose to discuss management implications, and thereby also make those transparent for innovation projects. The result indicates that managerial implications for radical innovation projects are to provide internal legitimacy for the projects intentions, to provide for a clear view of balancing aspects by using concepts that fit into opposite ends on a continuum, and to preserve a rich information base about users.

Keywords: Innovation, concept development, innovation projects, engineering management

1 INTRODUCTION
Innovation is commonly emphasized as utterly important for companies to stay competitive. A company's ability to introduce new products and services is a key success factor for sustaining a competitive advantage [1]. However, it is also argued that companies are lacking methods, tools and processes to scan markets and to find opportunities beyond their existing businesses [2]. Even though, as sometimes described in success stories, innovations can spur out from a moment of creativity, firms cannot survive waiting for this to happen. Rather, innovations have to come from conscious, purposeful and hard collaborative work. But, such work is also complex in its nature. When should the team think 'out of the box' and when should they think 'inside the box'. How can they intentionally do that? What internal sources should be used? Where to find the needed external ones? How could these benefit the project? Where can we find innovation opportunities? Why searching for opportunities? And, how high are the risks? These are just a few examples of questions from which an innovation project embarks. Typically, at the early starting point for innovation projects, very little information is accessible, and thus can be described as a wicked design problem [3]. The team members should from this ill-structured situation find guidance for what they should do and who the users might be [4].
Typically, product development rely upon an idea that lead-users [5][6], or early adopters [7] e.g. users finding their own solutions to problems, could contribute to innovation practices. A recommended approach to guide innovation efforts is to find and understand human needs [9]. Many years ago, it was suggested that engineers, product developers and designers should interact, observe and talk with people since they are the ones that should find solutions [8]. This has been a hard sell, but as qualitative approaches has gained interest and also respect in development firms, understanding user needs has become part of the engineers' responsibilities [9].
The implementation of qualitative human-oriented approaches in the field of engineering, in turn introduces possibilities for structured innovation processes. Two main types could be discerned, one that support a stepwise, incremental, change and another that support disruptive, radical change [10]. Managers in product development organizations have a challenge in a *"mental balancing act"* of exploiting existing capabilities and exploring radically new products and services. That is, companies have to look backward attending to what is, and have to prepare for the future [11].
In this paper, incremental innovation and radical innovation projects in a manufacturing company are studied for *the purpose to discuss management challenges*, and thereby also make those transparent for innovation projects.

2 METHOD

The study in this paper is part of a research project, which aims to contribute to an increased comprehension of how the company manage innovation projects (descriptive research focus) and how they can improve the implementation of innovations (prescriptive research focus). The company has a background as a leading firm of technological innovations and is active as a producer of high durable consumer products. Recently, the company has gone through a stage of re-organisation and new ownership. The company is adapting to the principles of lean production [12] in order to create efficient development and manufacturing processes. In line with this, a main concern is how to implement all great ideas/innovations in the products. As is, many ideas do not reach the implementation stage.

In general, the approach to generate data is inspired of an action research approach [13][14]. Being closely linked to the day-to-day practices enables an action research approach, thus the research project is a joint academia-industry project where open access is provided. Basically, action research is performed when the connection between theory and practice is sought for, and when such understanding is wanted to bring about changes. The researcher and the company representatives should cooperate in the transformation processes. The research project has been active for two years.

In particular, the study presented in this paper investigates an as-is state, i.e. resulting in a description of what is perceived by the respondents. Thus, data is qualitative in its nature. Data has been generated in a focus group workshop which focused on the topic of explore and exploit [15][16] approaches of innovation projects. Six of the participants were homogeneous in such terms that they were engineers (from the same company), had a position as project managers and were assigned to perform innovation activities. Each participant was a manager of a certain area and worked in projects that are defined as dealing with advanced technology. Also, two managers from research and development at the company participated in the workshop. One of the authors of this paper acted as a moderator for the workshop. The workshop lasted for 2.5 hours.

The explore/exploit model [16], which is explained in more detail in section 3 in this paper, was adapted to be used as a template for categorization of the projects, but also to direct the work towards the topic. The redesigned model used in the workshop is described in detail in section 4. The workshop started with an introduction of the model, as well as a framework of innovation theory to clarify the topic. After this, the participants were allocated time to work individually to categorize their projects as fitting best into either the ‘explore’ or the ‘exploit’ area. There is a methodological benefit of such an approach, namely that domination by one person in the group is delimited [17]. But also, since no preparation beforehand was asked for, this time allowed the participants to come up to speed with the topic and their individual contribution to the study.

A first analysis of the data generated in the workshop was done in cooperation with the participants. The workshop ended with a summarising dialogue, which had a two-folded result. First, it located and mapped the internal projects and provided an additional company specific view on these. Second, it served as a base to identify challenges for innovation projects and innovation teams. The latter result is accounted for in this paper.

3 INNOVATION: A THEORETICAL POINT OF VIEW

From an engineering perspective, innovation is typically described as a new product that has reached a market. Though, from a managerial perspective a description of innovation highlights the *efforts* to create purposeful, focused change in an enterprise’s economic or social potential [2]. By this definition, not only products, but also processes and methods can be innovations since they can contribute to the firm’s economic potential. For example, Popadiuk and Choo [18], describe innovation as an idea that is transformed into a product, process or service that has been *commercialized*. New technology or a combination of technologies that offers worthwhile benefits is yet another way of describing innovation [19]. The Oslo Manual [20] set a minimum requirement for innovation, i.e. the product, process or method must be *new* to the firm and/or new to the market. From this quick browse of definitions it can be seen that innovation points in at least two directions. The first direction highlights the efforts, the processes and activities of innovation, and the second direction points at the outcome of those efforts, e.g. ideas, products, services, processes, methods, technologies. Both these roughly settled directions have ‘new’ in common, that novelty can be both internal (new to the firm) and external (new to the market). Also, a purposeful change in the firm’s economic and social potential and the word ‘commercialized’ indicate what the efforts and/or the

result should do. Accordingly, innovation can point to the activities a team perform and/or to the outcome from the activities. Those activities and/or the outcome have to fulfil some degree of novelty, and have to be beneficial for someone.

3.1 Innovation types

Despite the descriptions of innovation as an intertwined concept, presentation of innovation types or categories often focus on the outcome. For example, Jacoby and Rodriquez [16] suggest three basic types of innovation outcomes, Figure 1.

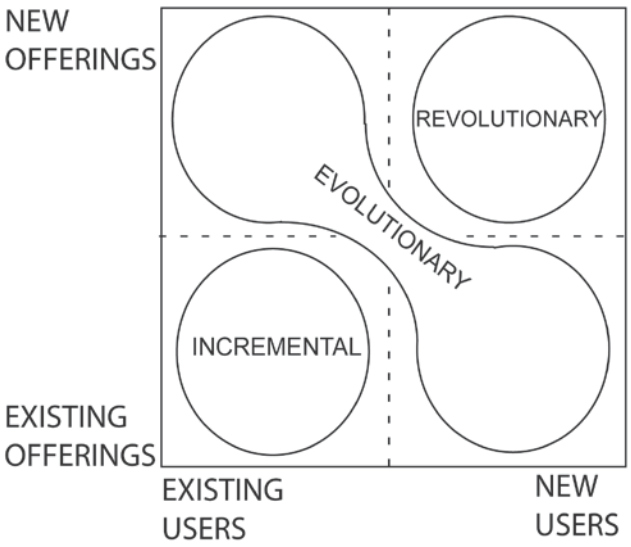

Figure 1. Three basic types of innovation outcomes, from [16]

Looking at Figure 1, the explanation of the three types can be seen:

1. Incremental innovation – existing users and offerings.
2. Evolutionary innovation – existing users and new offerings, or new users and existing offerings.
3. Revolutionary innovation – new users and new offerings.

In addition, it is suggested that these different innovation types require distinct approaches. For example, the opposite corners in Figure 1, incremental and revolutionary innovation have distinct intents, processes and outcomes. Incremental innovation requires people and processes possessing an execution focus. A team for incremental innovation projects is, for example, supported by skills in detail design documentation and navigating through the decision points in classic stage-gate development. Further, the time horizon for the knowledge that is created in these activities is near term [16]. Revolutionary innovation requires people and processes possessing an exploration focus. To support the revolutionary innovation project, the team needs to, for example, have capabilities to understand people, their contexts and goals, but also skills to scan internal and external trends. The tools needed for exploration are totally different, e.g. storytelling to visualize strategies, three-dimensional prototypes such as role-plays. The output of exploration activities is normally a number of qualified set of options and a plan for further investigations and implementation, thus having a long term time horizon [16]. A company's ability to simultaneously exploit and explore enable it to adapt to changing conditions [15], thus makes it viable over time. This ability is commonly referred to as ambidextrous thinking [15].

If the concept of innovation is related to the notion of radicalness [21], the perspective widens to also consider the knowledge needed. Incremental innovation could then be described as containing a low degree of new knowledge, e.g. as in a case of minor improvements or adjustments of an existing product [21]. Conversely, radical innovation contains a high degree of new knowledge, e.g. as in a case of entering a new market and new users. The concept of radical innovation is similar with revolutionary innovation as described by Jacoby and Rodriquez [16].

Radical innovation projects tend to have unpredictable results, and involve a higher degree of uncertainty and risk. But, the potential rewards are also higher [22]. In general, large companies emphasize incremental innovations since they bring about low risk and anticipated reward [23]. So, still, it is argued that executives in large firms are not familiar with the processes of radical innovation, resulting in poorly managed projects [22].
In light of this, two types of innovation, incremental and radical, can serve as end points on a range of different types. In turn, these require to be managed differently. Design thinking [24] emphasizes a different approach to management of innovation projects, and by that the art of innovation focus more on activities and processes than the outcome. In particular, design thinking builds on emphatic and human-centered logic to explore user needs and markets [9].

3.2 Relationship between growth and innovation

Innovation projects must have an economical benefit for companies, otherwise the time, efforts and capital spent on them goes to waste [16]. Jacoby and Rodriquez [16] suggest a tool to understand the ways a company can grow, i.e. benefit from innovation.

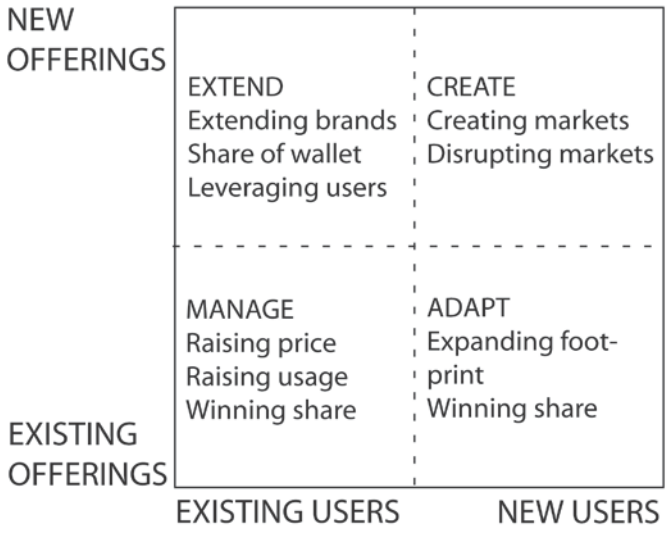

Figure 2. Ways to grow, from [16]

In Figure 2, the left lower corner, the companies existing assets and capabilities (offerings/users) could be the bases for growing, cf. incremental innovation. The upper right corner represents revolutionary innovation activities, and the left upper and right lower corner represents evolutionary innovation activities. In the 'Ways to Grow' diagram the word users are used instead of market. This is done because a market is perceived as the sum of real individuals. Since the objective of innovations is to create value which make life better for people, it is supportive to picture a face, a person, and by that, empathy for a persons' needs and behaviour [16].

3.3 An exploit or an explore strategy to innovation

Jacoby and Rodriquez [16] propose any innovation project to start uncover what kind of perspective the individuals and the organization are applying, i.e. innovation bias. From their work at the design firm IDEO they have found three types of biases (p.11):

1. Human: "How might we become more relevant to people outside our existing markets?"
2. Technology: "How might we leverage this new technology in the marketplace?"
3. Business: "How might innovation allow us to grab share from our competitors in this growing new market?"

Point 1 in the list, is concluded to be solved at early stages in the process to provide attractive user value propositions. Uncovering user needs, not only product requirements, is essential in that process. Point 2 and 3 in the list, are vital in any innovation project, but they are viewed as lenses to enhance and refine the user value proposition as the innovation activities unfold [16]. From this, three perspectives for exploring and exploiting innovation activities can be identified, the recommendation

is to balance all three. Jacoby and Rodriquez [16] suggest that innovation effectiveness can be maximized if a firm *"…understand your desired outcome and then match people, capabilities, and processes to the task at hand."* (p.15).
Examples of variables for exploitation are: *refinement, choice, production, efficiency, selection, implementation* and *execution*. Examples of variables for exploration are: *search, variation, risk taking, experimentation, play, flexibility* and *discovery* [25]. Accordingly, the variables indicate two distinct strategies in the management of innovation projects.

3.4 Innovation projects

A comparison between project management and the management of *innovation* projects shows that there are issues to consider. Typical, project management of a regular project is described as starting from a settled (shared) goal, and there are a lot of tools and techniques to make the process more effective [26]. On the contrary, innovation projects embarks from a vaguely defined idea, cf. wicked problems [3] or fuzzy front end [27]. A first activity for the team is to create a shared design vision; they have to find out what to design, what it should do and who should use it, as well as in what circumstances [4]. This initial stage of innovation project is more experimental and exploratory, and it rarely follows linear guidelines. Further, failure is a built-in possibility, which make the team more active in their risk management [26]. Typically, the idea of an innovation project needs to be sold to top managers, in contrast to project management that normally is a request from higher levels [26]. So, innovation projects are not only challenging the teams' creative skills, but also their managerial competences.

3.5 Innovation opportunities

Innovation is hard and focused work, but commonly processes for innovative work is lacking in organisations. Reasons for that, could be, as discussed above, that the processes as such is not strict linear [26], thus not straightforwardly captured in guiding process models or hard to align with established procedures. Nevertheless, processes of finding innovation opportunities include methodological and hard work [2]. Drucker [2] suggest seven kinds of situations for innovation opportunities (pp.96-100), these are:

1. Unexpected Occurrences – "it should not have happened".
2. Incongruities – clash between assumptions and realities.
3. Process Needs – individual needs put into a larger context.
4. Industry and Market Changes - questioning the way the market is approached, defined or how the firm is organized to serve it.
5. Demographic Changes – happen much more quick than believed.
6. Changes in Perception – seeing the glass as half full or half empty, two sides of the same coin but the preferred mood have an affect on the reality. A change in mood is concrete and can be defined.
7. New Knowledge – longest lead time of all innovation, not one kind of knowledge, but many. A lot of talk, but little action, until all elements suddenly converges.

Yet, to benefit from these opportunities, any firm has to have processes that inspire creative work, knowledge sharing and learning processes.

4 MAPPING OF INNOVATION PROJECTS

The models of Jacoby and Rodriquez [16], *'ways to grow'* and '*innovation outcome'* (Figure 1 and 2 in this paper), was redesigned before the performance of the workshop to fit the purpose of it. The intention was to generate the engineers' perception of the projects for advanced technology innovations and in which category of explore and exploit they could best fit into. The redesign of the models was done because we found them too focused on business management, for example by being built on existing and new *offerings*. There were concerns that the word *offerings* could make the respondents mapping their projects according to a sale perspective, instead new market and existing market was chosen on the base to spur an engineering point of view. But, also the existing and new users were replaced with existing and new technology, mainly due to the assumption that this would make the mapping easier for the respondents. Further, in hindsight, it is likely that the literature on

incremental and radical innovation affected the redesign of the two-by-two model. Typically, literature on those concepts describe radical innovation as new market and new technology, and incremental as existing markets and existing technology [10].
Hence, the explore and exploit corners in the two-by-two model that was used in the workshop evolved from Jacoby and Rodriquez [16] models, but also from innovation management literature. The revolutionary innovation outcome is described using the idea of exploration, and the incremental innovation outcome is described using the idea of exploitation. The evolutionary innovation outcome was omitted from the model, since it was out of scope for the purpose.
Hence, the two-by-two model that was first presented in the workshop consisted of the dimensions: new market/new technology represented by the word 'explore', and existing market/existing technology represented by the word 'exploit', see Figure 3.

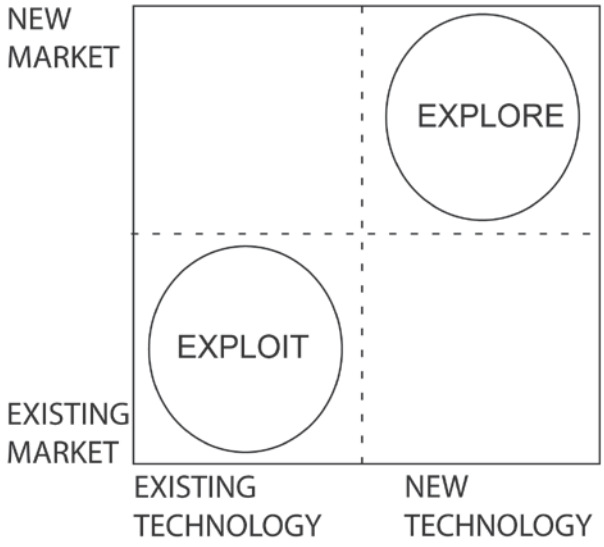

Figure 3. The initial model, adapted from [16]

The workshop was initialized with a short presentation of innovation as described in literature, the focus was on radical/revolutionary and incremental innovation outcomes. After this, the model (Figure 3) was presented. To explain the difference between explore and exploit, March [25] variables was used. Hence, exploit was described using the words: *refinement, choice, production, efficiency, selection, implementation* and *execution*. And, explore was described using the words: *search, variation, risk taking, experimentation, play, flexibility* and *discovery*. The intention of this presentation was to provide for a common ground for mapping the projects.
In order to understand the task they were assigned, the respondents started to discuss the model. *First*, they suggested a change of 'market' into 'users' due to dealing with users directly rather than markets. Thus, the respondents were reasoning in a similar way as Jacoby & Rodriquez [16]. Namely, that in their daily practices they try to understand people/individuals, those people's point of view and how those people would appreciate the innovation.
Second, even though, the term technology is used to assign specific projects within the company, the respondents suggested altering 'technology' into 'functionality'. This provided a more focused view on what the respondents is striving to achieve when performing innovation activities. In relation to users the focus on functionality was suggested to describe a link between users and their needs, i.e. users need a specific functionality rather than require a specific technology. Also, the respondents discussed that there are users that actually are actively searching for new technology (cf. lead-users [5] and early adopters [7]), but emphasized that those were few in comparison to the common user. The respondents concluded that a focus on 'functionality' provided them to go beyond the technology at hand (existing solutions) and made them more innovative, yet also making it more difficult to judge the value of the projects.
Third, the respondents proposed changing 'existing' (technology) into 'expected' (functionality) to describe the exploit corner in the model. The respondents are managers, but also engineers; they are developing concepts, solutions and products. They perceive that even though they might start innovating from an 'existing' solution, their efforts in the projects are aimed to add novelty to that

solution, e.g. improve a feature on a component. The word ‘expected’ describes that such improved solution starts from a specification describing the *expected* outcome of the project, or what users are expecting from the solution.
And, *forth*, the respondents suggested to replace ‘new’ (technology) with ‘excited’ (functionality) to describe the explore corner in the model. The respondents explained that ‘new’ does not indicate a fulfilment of some kinds of user needs, and it was discussed if novelty could point in different directions, e.g. new to the world, new to company or new to users. It was also discussed that only because something is new it does not by default provide added value to the users. Instead, ‘excited’ was decided to capture the idea that innovation projects should be desired by users and that users should be thrilled by it, i.e. wants to buy the product rather than have to be talked into buying it.
Thereby, the initially suggested model was redesigned by the respondents rendering a second two-by-two model. The new model consisted of the dimensions new users/excited functionality represented by the word ‘explore’, and existing users/expected functionality represented by the word ‘exploit’ (see Figure 4).

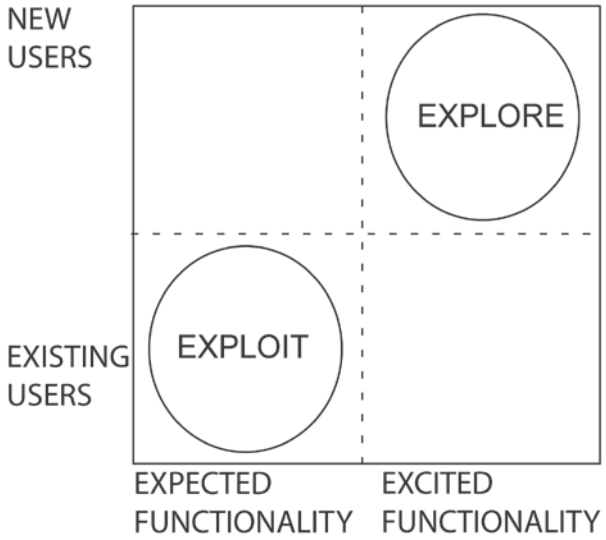

Figure 4. The second model, refined by the respondents

Satisfied with this new agreed model, the participants were first asked to take a moment and individually reflect on where their projects could best fit in before presenting it to the group. One after another a total of 29 projects were displayed and presented by their respective manager as either exploit or explore projects. Some of the projects spurred a discussion when they were displayed on the model, for example one respondent presented a project as a typical exploit project. Upon which another respondent commented:

> *”Are you sure of this classification? When talking about it, it could as well be explore. What you described is really an exciter.”*

The respondent continued to explain that he denoted the project as including experimentation since the concept was untried within the branch. If succeeding, the company would be first on market with the idea, so it was agreed that the project should be mapped as an explore project instead. Finally, 11 projects were perceived as explore, and 18 projects as exploit. The respondents reacted on the result:

> *“This is not so bad. It is really good! It seems like we have a balance between the projects.”*

After some seconds, enjoying the satisfactory result, one respondent raised the question:

> *“How do we know that 11-18 is good? Maybe 18 explore and 11 exploit is a better balance?”*

From these reflecting questions, the respondents discussed the matter. The respondents realized that exploit projects are necessary to reach near-term goals, but those projects will not increase sales figures, i.e. provide growth. Explore projects are long-term investments for future survival, i.e. potential money-makers. One of the respondents first found the thought to only work with explore projects and radical/revolutionary innovations, as appealing, but at a second thought he changed his mind:

> *"In my world, we should only work with such projects. If so, we would be way ahead in all projects. But, those projects are really heavy to run; we might not cope to run so many of them."*

From this, the respondents started to discuss how explore/radical/revolutionary projects have to be managed. The projects' conditions were described, as having an outcome/result that was unpredictable, and having a higher degree of risk and uncertainty. Many of those projects was expected to fail, and the respondents said that it has to be accepted that maybe only one project out of ten will succeed and will be implemented in future products. The fact that explore/racial projects need to be managed differently than exploit/incremental was discussed in the workshop. Over the years, the company have tried different strategies for working with long-term innovation projects, e.g. managed within the established development processes or managed outside it, rendering a perception that their work is considered to be fuzzy and not productive (at least from time to time perceived so by the respondents). The respondents expressed that their explore projects include reasoning and activities which are abstract in the sense that they are explorative and include radical non-existing ideas. This makes it not straightforward to communicate 'productivity' and 'clarity', and sell the ideas internally. The respondents concluded that if only running explore/radical innovation projects, they would probably loose the grip of reality, i.e. the connection to the detail design and realization of the innovations. At worst, they said, they would be considered as "spaced-out chaps".

5 MANAGERIAL IMPLICATIONS AND CONCLUDING REMARKS

The idea that explore/radical innovation projects insist on being differently managed is expressed both in literature and in empirical studies. Projects that are based on an exploit/incremental approach seem to fit into established, and often stage-gated, product development processes. For example, words describing an exploit/incremental project could as well be used to describe product development, e.g. refinement, choice, production, efficiency, selection, implementation and execution [25]. The input for exploit/incremental activities is defined, and the outcome is also in a way clear, cf. the respondents' change of 'existing' to 'expected' in the two-by-two model. Hence, the processes are evident for the incremental innovation team and could therefore guide their activities. Further, the decision points (gates) might be more appropriate for exploit/incremental projects, due to focusing facts, figures, measures and so forth. By this argumentation, the intention is not to explain exploit/incremental activities as easy and straightforward, rather that these activities are commonly more established in manufacturing companies since they align with product development activities. Exploit/incremental activities do include several tough choices and trade-offs, yet the near-term time horizon could provide a sense of confidence for managers. Also, starting from what is 'existing' or 'expected' could make risks more transparent.

The input for explore/radical activities is ill-structured, consequently the outcome is vague and, also, its value is judged by users, cf. the respondents' change of 'new' to 'exited'. This indicates that the activities in explore/radical projects might insist on a process that firmly addresses users and/or their needs in more abstract terms than understanding what they expect/require of the product. An explore/radical project seems to benefit from managing richer user information to inspire the innovation activities. For example, replacing the product biased questions; "What do you like about this product?" or, "What do you dislike about this product?" with more open questions; "Could you tell me something about your lifestyle?" or, "What irritates you the most?".

From this discussion and analysis, new questions arise. The decision points (gates) that are appropriate to manage exploit/incremental projects now seem to challenge explore/radical projects, facts, figures, measures and so forth are not readily available in the beginning. Could this have the implication that explore/radical projects are killed in the first gate? Or, that they transform into exploit/incremental projects? Starting from users and their reality, disregarding existing solutions to open up the design

space and to think 'outside the box' seems to not fit into established product development processes. Yet, it should be noted that the intention with this argumentation is not to emphasize explore/radical activities as calling for a "spaced-out" approach, rather that the long-term time horizon in relation to a fear of failure could hinder the design of breakthrough products.
To conclude, an empirical study where company representatives locate 29 in pipeline advanced technology projects into a two-by-two model of explore/exploit has been presented. Also, the respondents' efforts of adapting the model into their context have been outlined. This was done for the purpose to discuss management challenges in innovation projects. Based on this, three managerial issues for innovation projects could be highlighted:

1. Making the project intentions apparent seems vital to be able to communicate it internally (and externally). This is particularly important to provide legitimacy for explore/radical innovation activities.
2. Despite not being a true view of reality, branding and mapping projects as opposites, e.g. exploit or explore; or incremental or radical, could support managers to find a balance between near-term and long-term innovation goals.
3. A user-oriented approach is at the heart of explore activities, but generates a rich variance of user information. In explore/radical innovation projects preserving this variance are vital for breakthrough products, hence it cannot be managed as in product development.

In the course of this study, a number of future research efforts have been identified. Risk management have not been in focus in this study, yet utterly important. In particular, for radical innovation, risk taking is part of the approach, though in a conscious and active way. Learning by failure and lessons learned approaches are very interesting in this context. How can this be done to inspire exploration activities? Further, user information acquisition in a solution free way is a challenge for engineers, i.e. the generation of qualitative data about humans to learn from them, in opposite of collecting preferences for a certain product. Research about methods and tools that increase such confidence among engineers is needed.
Finally, for our own research efforts we have identified in-depth studies of decision criteria for explore/radical innovation project as the next step.

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