

PLAYING SAFE, PLAYING DEEP

Dagmar Hildebrand¹²

Human Resource Management Department & GRACO Research Group³
ESADE, Universitat Ramon Llull

Jordi Trullen

Human Resource Management Department & GRACO Research Group
ESADE, Universitat Ramon Llull

Alfons Sauquet

Human Resource Management Department & GRACO Research Group
ESADE, Universitat Ramon Llull

Abstract:

New product development (NPD) teams must be ambidextrous to be successful – they must be creative in exploring and playing with new knowledge but also capable of exploiting, integrating and applying existing knowledge in order to move efficiently from ideas to reality. And yet, it is not clear how NPD teams can best accomplish this balance. We analyze this problem by reviewing literature on new product development process and learning, in particular by focusing on two learning mechanisms, namely exploration and exploitation. We then develop a theoretical framework to explain how NPD teams can manage to combine exploration and exploitation within a single new product development process.

¹ Dagmar Hildebrand, Av. de Pedralbes, 60-62, Barcelona, 08034, Spain, Tel.: +34 676.455.631, e-mail: dagmar.hildebrand@alumni.esade.edu

² This work has been partially supported by the “Comisionado para Universidades e Investigación del Departamento de Innovación, Universidades y Empresa de la Generalidad de Cataluña y del Fondo Social Europeo”.

³ Research Group on Learning, Knowledge & Organization

1. INTRODUCTION

New product development is the cornerstone for high technology companies, critical to their ongoing growth (Brown & Eisenhardt, 1995; Hauer, Tellis & Griffin, 2006; Lovelance, Shapiro & Weingart, 2001; Sarin & McDermott, 2004). Increasingly, organizations rely on cross-functional teams in their new product development (NPD) activities (Dension, Hart, & Kahn, 1996; Griffin, 1997). “Product team members are the people who actually do the work of product development. They are the people who transform vague ideas, concepts, and product specifications into the design of new products.” (Brown & Eisenhardt, 1995: 367)

NPD teams are still regarded as following a linear, rational product development process (Brown & Eisenhardt, 1995; Griffin, 1997; Hauser et al., 2006). The traditional perception of this stream of research is “a product that is well planned, implemented, and appropriately supported will be a success” (Brown & Eisenhardt, 1995: 348). This rational perspective is based on the assumption that the NPD process consists of a number of “stages” – frequently articulated as ideation, development, testing, and commercialization – separated by “go” or “no go” gates (Cooper 1990, 1994). Also, research on new product teams strictly separates these phases in (1) “*explore*” as the discovery of something new and uncertain and then in (2) “*exploit*” as choosing one option and going efficiently from ideas to reality (Ancona & Bresman, 2007; Ancona & Caldwell, 1992).

However, recent literature has shown that the innovation process is anything but linear (Brown & Eisenhardt, 1995; Fagerberg, 2006; Hauser et al., 2006; Pavitt, 2006; Tidd, Bessant & Pavitt, 2001; Van de Ven, Polley, Garud & Ventkataraman, 1999). The sub-processes, although distinctive, overlap considerably and often occur concurrently (Pavitt, 2006). Especially for high-complex products in rapidly changing industries, NPD teams engage in a spiral process with many repeating cycles through the stages from “opportunity” to “testing” in order to reduce the failure rate and, importantly, the time to market (Cusumano & Yoffie, 1998). This spiral process has many feedback loops from outside its boundaries and, significantly, the entire process is repeated many times as the product “spirals” to completion. These rapidly changing and repeated stages show the interaction of both learning types in NPD teams, i.e. the exploring of new knowledge through experimenting, and the refinement and efficient application of the gained and pre-existing knowledge. It can be regarded as a continuous interaction and overlapping of both learning activities within the NPD process among the NPD team. According to our state of knowledge, however, no studies have investigated the interaction of these two learning activities in the context of NPD teams.

Recent literature started to discuss different pathways how to achieve a balance between exploration and exploitation at the organizational level, or business unit level (Adler et al., 1999; Benner & Tushman, 2003; Gibson & Birkinshaw, 2004). However, research that examines the interplay of exploration and exploitation at the meso level is relatively scarce (Edmondson, Dollon & Roloff, 2007; Gupta et al., 2006). In line with the few existing studies on the meso level, researchers have only recently begun to acknowledge that even within a single process such as new product development, the exploration and exploitation interplay is highly present (Ancona & Caldwell, 1992; Sessa & London, 2008; Sheremata, 2000; London & Sessa, 2007). Taking this discussion into consideration, our overarching question is *how NPD teams manage to combine exploratory and exploitative learning activities over a single NPD process and, in turn, how this affects the performance of the NPD teams?*

In line with the rational linear NPD process, previous research on teams has asserted that different behaviour framing antecedents are needed in the different phases (“Explore”; “Exploit”) of the NPD processes (Ancona & Bresman, 2007). However, as recent literature shows that these “phases” of the NPD processes overlap considerably and often occur concurrently, and therefore NPD teams frequently engage in exploratory as well as in exploitative learning at the same time, our second research interest is what contextual factors support simultaneous exploratory and exploitative learning in NPD teams? Building on concurrent theories of contextual ambidexterity (Gibson & Birkinshaw, 2004; Jansen, Van den Bosch & Volberda, 2006) and on new product development process theories (Ancona & Bresman, 2007; Sheremata, 2000) we are going to develop a theoretical model and a set of propositions to address these research questions.

In the next section, we want to present a literature review on new product development, and the interplay of exploration and exploitation at the organization and meso level. We will then develop a theoretical model to describe and clarify the relationships between contextual factors, exploratory and exploitative learning in NPD teams and NPD team performance. Finally, we will present implications for theory and practice.

2. LITERATURE REVIEW AND PROPOSITIONS

2.1 New Product Development Process

In innovation literature, the study of new product development processes constitutes an important area of research as, for a long time, the process of product development has remained a neglected area of investigation (Hauser et al., 2006). Also Brown and Eisenhardt noted: “...the actual process of product development is still largely a “black box” (Brown & Eisenhardt, 1995: 375). Although the study of this phenomenon has just recently been embarked on, we have identified three major streams, with each one having a different approach as to how the innovation process should be designed.

The first school of thought considers product development as a rationally planned, step-wise procedure. As the first proponent of this perspective, Cooper (1990, 1994) introduced the concept of the “stage-gate” process which he based on observations from NASA’s phased development efforts. He proposes that new product development should proceed from an initial idea generation phase through a first evaluation phase (Gate 1) in which the promising ideas are evaluated in terms of technical and market success conditions. These approved ideas then proceed to stage 2, where a more detailed product concept is developed. Once the product concepts of stage two have been approved against other competing product concepts in the successive gate, the approved product concept is converted into “material reality”, again followed by a fourth gate in order to assess the outcome so far. Then, in stage five, this materialized product concept is subjected to first technical tests and validation, and after another assessment gate, this product is launched. This formalized procedure is based on the assumption that each stage can be accomplished more or less independently from earlier or later phases (Fonseca, 2002).

However, the stage gate approach of NPD has recently been challenged, as some researchers have started to argue that such a linear process as put forward by Cooper (1990, 1994) would exclude the many feedback loops that happen between the

development stages (Pavitt, 2006). In this vein, researchers have started to suggest NPD processes which comprise these feedback loops and thus take into consideration the interaction between the single stages. The first of these interactive NPD process designs constructs the development process as a routine of overlapping stages (Wheelwright & Clark, 1992). Examples of these overlapping activities are the testing of products which have not yet become fully engineered or still lack some specific features. With this approach, predominantly time efficiencies can be realized as the subsequent stage does not have to wait to start working until the preceding stage has been fully accomplished. In addition to this overlapping strategy, Garnsey and Wright (1990) and Boehm (1988) suggest connecting the development phases via a spiraling procedure in which promising ideas are developed in recurring, iterative feedback loops. In the course of this, the idea spirals many times through the whole development process, allowing for much more feedback than in linear process models. These spirals again support especially the development of products in rapidly changing markets and highly complex products such as software (Hauser et al., 2006).

All in all, when relating these process designs to the concept of exploration and exploitation, the strict separation of these mechanisms is proposed in the stage gate model of Cooper (1990), as he proclaimed that phases - like idea generation (exploration) and concept development (exploitation) - can meaningfully be separated without much interaction. This strict separation, has however, become subject to criticism which resulted in the proposition of different development process designs which prescribe much more interaction between exploratory and exploitative development phases. In fact, authors of these interactive processes argue that both exploratory and exploitative phases have to overlap in order to improve both the speed to market (Hauser et al. 2006) and the overall innovativeness of the development activities (Pavitt, 2006) because “shortcomings and failures that occur at various stages may lead to a reconsideration of earlier steps, and may eventually lead to totally new innovations” (Pavitt, 2006: 9).

In conclusion, not the strict separation, but rather the joint management of exploratory and exploitative development activities is thought to improve team performance in the sense of product innovativeness. Hence, NPD teams have to succeed in simultaneously combining phases which demand exploratory thinking with those phases which call for exploitative learning. But prior to developing concrete propositions about this need to simultaneously pursue exploratory and exploitative activities within a NPD process, we turn to the learning literature in order to see whether there exist learning-related constraints which make it difficult to pursue both exploratory and exploitative learning at the same time.

2.2 Exploratory and Exploitative Learning

Existing studies on exploration and exploitation pointed to the importance of being ambidextrous in order to survive in the long term – which means being capable of achieving a high competence in exploitative learning while also a high competence in exploratory learning (Duncan, 1976; O’Reilly III & Tushman, 2007; Sheremata, 2000; Taylor & Greve, 2006; Tushman & O’Reilly, 1996). Exploration includes the creation or acquisition of new knowledge by increasing variance and generating internal variety (March, 1991; McGrath, 2001). It involves “things captured by terms such as search, variation, risk taking, experimenting, play, discovery” (March, 1991:71). Exploitation, in contrast, is regarded as the use and development of things already known (March, 1991). Exploitative behaviour is variance-decreasing and efficiency-oriented and

includes things such as “refinement, choice, production, efficiency, selection, implementation...” (March, 1991:71).

The debate on exploration and exploitation has at the same time focussed on different levels of analysis: The traditional literature on these concepts regards exploration and exploitation as an organization-wide phenomenon where, typically, the operations departments are engaged in exploitative learning while the R&D and product development departments are considered as the exploratory part of organizations (e.g. Benner & Tushman, 2002). However, a second stream of literature departs from this traditional view and identified that the exploration and exploitation interplay also exists within a single *organizational process*, such as the change process (Crossan et al., 1999, 2003) or within a *single team process*, such as a new product development project (Ancona & Bresman, 2007; Ancona & Caldwell, 1992; Sheremata, 2000). While new product development is regarded as purely exploratory in traditional literature, Sheremata (2000) argues that, even in this “exploratory part” of the organization, project teams have to simultaneously pursue exploratory and exploitative learning activities. She defines exploration [centrifugal forces]⁴ as “structural elements and processes that increase the quality and quantity of ideas, knowledge, and information” (Sheremata, 2000: 395), whereas she defines exploitation [centripetal forces] as “structural elements and processes that integrate dispersed information, knowledge, and ideas into collective action” (Sheremata, 2000: 398). Correspondingly, also Ancona & Bresman (2007) and Ancona & Caldwell (1992) distinguish within NPD process activities between exploration and exploitation by defining exploration as the discovery of something new and exploitation as choosing one option and going from ideas to reality.

If one compares these views on exploration and exploitation with March’s (1991) classic definitions of these concepts, both show strong similarities. In terms of exploitation, March (1991) directs one’s attention to variance-decreasing, efficiency-oriented learning orientation. In their definitions, Sheremata (2000) and Ancona & Bresman (2007) also regard exploitation as narrowing down and focussing the activities (or collective actions) on specific ideas in order to further implement them. In parallel, March (1991) characterizes exploration as variance-increasing activities through search, discovery and novelty. Here too, the perspectives of Sheremata (2000) and Ancona & Bresman (2007) resemble March’s view as they both claim that exploration concerns the search for something new through idea generation and distant reach. In this paper, we apply the definitions of Sheremata (2000) and Ancona & Bresman (2007), as we have chosen to study the exploration and exploitation interplay at team level within a single NPD process.

Due to the lack of existing research on this process perspective of exploration and exploitation, we now turn to reviewing traditional exploration and exploitation literature. The literature on the debate of exploration and exploitation can be divided into two different schools of thought (Gupta et al., 2006; Knott, 2002), namely research assuming that (1) exploration and exploitation lie at *two ends of a continuum* that involve trade-offs and require different organizational capabilities (March, 1991), and (2) exploration and exploitation are not substitutes at all, but are in fact orthogonal or even *complementary* (Bierly III & Daly, 2007; Gibson & Birkinshaw, 2004; Knott, 2002).

⁴ Jansen et al. (2006) also regard centrifugal and centripetal forces as suggested by Sheremata (2000) as exploration and exploitation respectively.

The first school of thought regards these two learning activities as *imperfect substitutes*, meaning that an incremental increase in one strategy will come at an increasing cost to the other strategy (Gupta et al., 2006; Knott, 2002). It is based on the assumption that both learning types are iteratively self-reinforcing, meaning that because of the uncertain outcomes of exploratory activities, a frequent outcome is failure which again encourages the organization to proceed in searching to find even newer ideas (“failure trap”). Equally, because of the often early and tangible successes of exploitative learning, organizations feel supported in their activities and thus proceed in learning exploitatively, which might lead to a “success trap” (March, 1991). Because of the fundamentally different characteristics of exploration and exploitation, researchers have discussed how a separation of both activities can enable the organization to pursue both. This structural separation can be achieved either through (1) separated processes that are strictly individual business units which are loosely coordinated by upper management (Benner & Tushman, 2003; Tushman & O’Reilly III, 1996; O’Reilly III & Tushman, 2007 for a review), or through (2) punctuated equilibrium, also called timely cycling between long periods of exploitation and short bursts of exploration (Adler et al., 1999; Burgelman, 2002; Siggelkow & Levinthal, 2003).

Recently, a second school of thought emerges in this debate, namely that exploration and exploitation are orthogonal or even *complementary to each other* (Bierly III & Daly, 2007; Knott, 2002). By studying Toyota’s product development units, Knott (2002) empirically showed that exploration and exploitation are positively rather than negatively (imperfect substitutes) related to each other. In so doing, Knott (2002) argued that the product development units were able to explore new knowledge and technologies while they also learnt how to become more efficient (exploitation) in their product development activities. Additionally, by studying small and medium-sized manufacturing companies, Bierly III & Daly (2007) empirically supported the findings of Knott (2002). The authors arrived at the conclusion that “... our findings of high correlation between exploration and exploitation suggest that firms can simultaneously pursue exploration and exploitation and the organizational barriers discussed in the literature appear to be exaggerated” (Bierly III & Daly, 2007: 508). Gibson & Birkinshaw (2004) also empirically supported the assumption that exploration and exploitation are complementary to each other. The authors conceptualized the simultaneous management of exploration and exploitation as *contextual ambidexterity* “defined as the capacity to simultaneously achieve alignment [exploitation] and adaptability [exploration] at a business-unit level.”(Gibson, & Birkinshaw, 2004: 209) According to the authors, ambidexterity is best achieved through “a business unit context that encourages individuals to make their own judgments as to how best divide their time between the conflicting demands for alignment and adaptability.” (Gibson, & Birkinshaw, 2004: 211). The authors found that ambidexterity mediated the relationship of organizational context (antecedents of ambidexterity) in which members simultaneously (1) were inspired by leaders to achieve objectives, (2) were disciplined by leaders to meet expectations, (3) supported each other, and (4) trusted each other, and performance. “Encouraging a supportive organizational context that generates simultaneous capacities for alignment and adaptability may be a key source of competitive advantage for leaders in the 21st century.” (Gibson, & Birkinshaw, 2004: 223)

Literature that examines the interplay of exploration and exploitation at the *meso level* is relatively scarce (Gupta et al., 2006). Among the few existing studies, we also identified at team level studies that regard exploration and exploitation as either

substitutes or complements. By initially treating exploratory and exploitative activities as two ends of a continuum, Taylor & Greve (2006) conducted empirical investigation by studying groups involved in the creation and publishing of comic books whether team compositional factors (diversity of knowledge and experience working together) that lead to exploratory team behaviour differ from those that lead to higher mean performance. Contrary to their expectations, the study showed that innovations with extreme success or failure (exploration) were affected by factors similar to those affecting high-performance innovations (exploitation). These findings therefore support the perspective that exploration and exploitation are complementary (Gupta et al., 2006). In conformity with this previous study, Gilson, Mathieu, Shalley & Ruddy (2005) found that service teams that felt empowered by the use of creative problem solving (exploration) as well as standardized routines and procedures had the highest level of team effectiveness. The authors concluded that “teams should be encouraged to be creative in tandem with using standardized work practices in order to maximise both performance and customer satisfaction.” (Gilson et al., 2005: 530)

However, these few studies which have been conducted at the meso level are merely focussed on revealing *that* exploration and exploitation are complementary and can even be achieved simultaneously in teams. On the other hand, they are silent about *how* teams can combine and succeed in simultaneously managing exploratory and exploitative phases within a single development project. In conclusion, by taking the above outlined discussion on the benefits of the complementary and even simultaneous management of explorative and exploitative learning into consideration we propose the following:

Proposition (1): NPD teams will show greater degrees of innovativeness if they manage to combine and even pursue simultaneously exploratory and exploitative learning.

2.3 Antecedents of Exploration and Exploitation in NPD Teams

The upper discussion provokes our second research question *what factors support simultaneous exploratory and exploitative learning in NPD teams?* Previous research on contextual ambidexterity (Gibson & Birkinshaw, 2004) shows empirically that a context⁵ characterized by “*discipline*”, “*stretch*”, “*support*” and “*trust*” supports exploration and exploitation simultaneously as it encourages the individuals and groups to make their own judgments “as to how best divide their time between conflicting demands between adaptability [exploration] and alignment [exploitation]” (Gibson & Birkinshaw, 2004: 211). In other words, this context is regarded by the authors as “systems, processes, and beliefs that shape individual-level behaviours in the organization” and allows the meta-capabilities of exploration and exploitation to simultaneously flourish, and thereby sustains business-unit performance. These behaviour-shaping attributes (discipline, stretch, support, and trust) of this context are created and reinforced by a variety of micro- and macro level actions undertaken by leaders. Also Jansen et al., (2006) propose that “*informal social relations*” within a single unit support exploratory as well as exploitative activities, and therefore expand the concept of contextual ambidexterity by one more attribute. According to the authors,

⁵ Gibson & Birkinshaw (2004) build on a previous study on organizational effectiveness by Ghoshal & Bartlett (1994). Ghoshal & Bartlett (1994) defined an organizational context in terms of these four attributes (discipline, stretch, support, and trust) that leads to initiative, cooperation, and learning.

the “results suggest that managers may develop densely connected social relations within their units to increase unit’s contextual ambidexterity.” (Jansen et al., 2006)

In the following, we apply these behaviour-shaping attributes to the specific context of this study, namely to the interplay of exploratory and exploitative learning of NPD teams in the NPD process. These relations are illustrated in Figure 1.

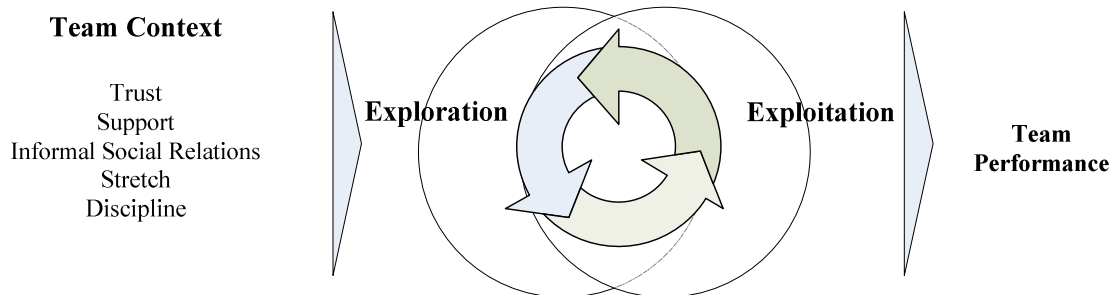


Figure 1: Predicted Relations

Trust describes a shared perception by team members of the nature of the group and its members regarding the psychological climate, emotional disposition of the group, and the degree to which members will share sensitive information. In addition, trust relates to team members’ ability to feel safe to openly admit, analyze and learn from errors, challenge authority, and to take challenging or controversial positions without team members’ fear of serious repercussions (Edmondson, 1999; Edmondson, 2002; Edmondson & Mogelof, 2006). Recent studies also associate trust with a high degree of team members’ “voice” in how to carry out team’s purpose (Carson, Tesluk & Marrone, 2007) or “involvement in decision making” (Ghoshal & Bartlett, 1994). Recent research discusses the fact that trust helps teams to combine and generate new underlying knowledge for exploratory learning (Adler et al., 1999; Wong, 2004). Besides this, West & Anderson (1996) and Edmondson (2002) argue that an open and safe team environment stimulates exploration by freeing up people to suggest novel or unorthodox ideas. Research has also shown that to pursue exploitative, variance-decreasing activities, a high-trust mode is needed (Adler et al., 1999). Additionally, Edmondson (1999; 2002) argues that a high level of psychological safety encourages manufacturing teams in their routine work to engage in exploitative (incremental) learning as it diminishes people’s fear to speak up about errors.

Ghoshal & Bartlett (1994) associate *support* with a greater availability of resources, and the guidance and help of management in the sense of coaching instead of exercising authority. Research on innovation teams (Edmondson & Mogelof, 2006) shows that, if resources are plentiful, there is less anxiety and concern about competing with other teams for scarce funds, opportunities, or access. These can lead to a higher level of psychological safety which in turn encourages teams to combine and generate new knowledge as teams are relieved from the pressure to come up with “quick wins”. In other words, the abundance of resources provides slack which is often considered to be critical for creative, knowledge generating processes (Zirger & Maidique, 1985). Besides financial support, Blazevic & Lievens (2004) argue that management support increases exploratory learning as the management can motivate an innovation team to engage in the search for new knowledge within the team. Also research on teams that engage in efficiency-oriented activities follows a similar line of argumentation and states that support increases exploitative activities, too. By studying manufacturing work teams, Edmondson (1999) for example empirically tested the positive relationship

between contextual support and team leader coaching on psychological safety that, in turn, supported exploitative learning behaviour in teams.

Informal social relations refer to personal linkages between people within the organization (Jansen et al., 2006). Connectedness increases team members' opportunities for informal hall talk and also accessibility to organizational knowledge sources (Atuahene-Gima, 2003; Jaworski & Kohli, 1993). It helps individuals to generate and combine new knowledge in exploratory activities (Atuahene-Gima, 2003; McFadyen & Cannella, 2004). Also team boundary spanning literature suggests that external ties help team members to obtain new knowledge and ideas in order to deal with novel issues (Ancona & Bresman, 2007; Ancona & Caldwell, 1992). To engage in exploitative activities, team members need to efficiently draw and integrate the newly obtained knowledge. Thereby, connectedness ensures that an NPD team can get feedback from others (Clark & Fujimoto, 1990) that in turn leads to a deeper understanding and further refinement and improvement of the existing knowledge (Rowley, Behrens & Krackhardt, 2000).

The fourth contextual behaviour shaping attribute is *discipline*. According to Ghoshal & Bartlett (1994), discipline is constituted by the development of clear performance standards and expectations, a system of open and fast-cycle feedback, and consistency in the application of sanctions. In the existing literature on ambidexterity at the organizational level, it has already been noted that a lack of consistency of actions and statements would be detrimental to an ambidexterity-supporting context (Adler et al., 1999). Adler et al. (1999) refer to the fact that in their in-depth case study, top management was very careful in acting according to the statements which they made towards the organization. According to Adler et al. (1999), this consistency positively influenced the ability of this organization to pursue both exploration and exploitation. In addition, open and fast-cycle feedback is still not consistently shown to be positively connected to both exploration and exploitation. For example, Gibson & Birkinshaw (2004) found that feedback is important to achieve ambidexterity at the business unit level, though March (2006) states that feedback actually reduces variety and thus works counter to exploration. March notes: "...feedback-based adaptation favours exploitation" (March, 2006: 206). And he continues: "...students of exploration in organizational settings have described several less random mechanisms [to secure exploration]. These include...buffers of action from immediate feedback (e.g. organizational slack, inattention), and modes of action that are unresponsive to feedback." (March, 2006: 206) Thus, we can summarize that the development of clear performance standards and expectations, and consistency in the application of sanctions will be positively related to simultaneously pursuing exploration and exploitation in NPD teams, but that a system of open and fast-cycle feedback needs further empirical investigation in order to arrive at a final conclusion as to whether this element really is positively related to a coexistence of exploration and exploitation.

Finally, Ghoshal & Bartlett (1994) define *stretch* as "an environment in which individuals voluntarily stretch their own standards and expectations." (Ghoshal & Bartlett, 1994: 98) Here, especially creating a shared vision (Ghoshal & Bartlett, 1994: 98) has to be taken into consideration as a driver for ambidexterity in NPD teams. A common vision is generally seen as crucial in order to bring together the different activities of exploitation and exploration (Tushman & O'Reilly, 1996). According to Van Looy et al. (2005), "The presence of overarching concepts allows spanning a variety of perspectives and technical competencies, while at the same time generating sufficient 'mobilizing' power to result in joint action." (Van Looy et al., 2005: 210).

Thus, stretch, understood as the creation of a shared vision, is also regarded as a key success factor in our conceptual framework.

Overall, an ambidextrous supporting NPD team context needs the joint existence of the above outlined five behaviour-shaping attributes, i.e. discipline, stretch, support, trust and informal social relations. Therefore, we state the following second proposition:

Proposition (2): The more a team context is characterized by an interaction of stretch, discipline, support, trust and social relations, the higher the simultaneous exploratory and exploitative learning in NPD teams.

3. IMPLICATIONS FOR RESEARCH AND MANAGEMENT

Although we have proposed that the simultaneous management of exploratory and exploitative learning during the NPD process of NPD teams increases the performance in terms of innovativeness, we have not suggested that this is easy. Exploitation increases efficiency, whereas exploration decreases it by the discovery of something new and uncertain (Ancona & Bresman, 2007; Sheremata, 2000). We have therefore proposed that development organizations should apply a context characterised by stretch, discipline, support, trust, and informal social relations to support the simultaneous management of both activities within one NPD process.

The central contribution of this work is our model which provides answers to the often stated question of how ambidexterity can be achieved (Gupta et al., 2006; Holmqvist, 2003, 2004; Edmondson et al., 2007). This we did by designing a model which includes those antecedents which have been found to positively influence ambidexterity at the organizational level (Gibson & Birkinshaw, 2004; Jansen et al., 2006). We then provided a rationale indicating why these factors will also most likely work similarly in the NPD team context. We believe that, through this effort, we provide a first step towards a better understanding of the study of simultaneous exploration and exploitation at the meso level which has been neglected to date.

Further, one of the primary contributions and implications of this study for both researcher and NPD managers is to reinforce the value of an iterative NPD process in contrast to the traditional linear NPD process. We believe that as a result of analysing different research streams on NPD processes through the lens of recent learning theories, we will provide a sharper delineation of the benefits an iterative innovation process can offer to organizations in comparison to the traditional linear process. More specifically, we have presented a rationale to the reader that enables additional gains in terms of speed to market and overall innovativeness to be achieved through parallel or overlapping exploratory and exploitative NPD activities.

One obvious limitation of this study constitutes its conceptual character. Future interactive cycles of testing and theory development are needed to verify and refine our model. Additionally, future research may expand our model by identifying additional team contextual antecedents that support the simultaneous management of exploration and exploitation. It may, for example, be promising to review leadership style with regard to the interplay of exploration and exploitation in NPD teams. Tushman & O'Reilly (1996) have already noted that the most effective leaders for ambidextrous organizations are those who adapt their transformational and transactional behaviours to the individual situation. Future research should, therefore, investigate leadership style in more detail by taking our five attributes into consideration.

In addition, it is interesting to know whether different learning modes, as put forward by Kasl et al. (1997), can be meaningfully related to teams who are capable of simultaneously pursuing exploration and exploitation. Kasl et al. (1997) propose that teams can engage in fragmented, pooled, synergistic, and continuous learning modes. Whether there actually is a link between these modes and exploratory and exploitative learning has, however, not yet been investigated (Yorks & Sauquet, 2003).

4. REFERENCE LIST

Adler, P. S., Goldoftas, B. and Levine, D. I. (1999), "Flexibility versus efficiency? A case study of model changeovers in the Toyota production system", *Organization Science*, vol. 10, pp. 43-68.

Ancona, D.G. and Bresman, H. (2007), *X-Teams: How To Build Teams That Lead, Innovate, And Succeed*, Harvard Business School Press, Boston.

Ancona, D.G. and Caldwell, D. F. (1992), "Bridging the boundary: external activity and performance in organizational teams", *Administrative Science Quarterly*, vol. 37, pp. 634-665.

Atuahene-Gima, K. (2003), "The effects of centrifugal and centripetal forces on product development speed and quality: How does problem solving matter?", *Academy of Management Journal*, vol. 46, pp. 359-373.

Benner, M. J. and Tushman, M. L. (2003), "Exploitation, exploration, and process management: The productivity dilemma revisited", *Academy of Management Review*, vol. 2, pp. 238-256.

Bierley III, P. E. and Daly, P. S. (2007), "Alternative knowledge strategies, competitive environment, and organizational performance in small manufacturing firms", *Entrepreneurship Theory and Practice*, vol. July, pp. 493-516.

Blazevic, V. and Lievens, A. (2004), "Learning during the new financial service innovation process. Antecedents and performance effects", *Journal of Business Research*, vol. 57, pp. 374-391.

Boehm, B. (1988), "A spiral model of software development and enhancement", *IEE Computer Society*, vol. 21, pp. 61-72.

Brown, S. L. and Eisenhardt, K. M. (1995), "Product development: Past research, present findings, and future directions", *Academy of Management Review*, vol. 20, pp. 343-378.

Burgelman, R. A. (2002), "Strategy as vector and the inertia of co-evolutionary lock-in", *Administrative Science Quarterly*, vol. 47, pp. 325-327.

Carson, J. B., Tesluk, P. E. and Marrone, J. A. (2007), "Shared leadership in teams: An investigation of antecedent conditions and performance", *Academy of Management Journal*, vol. 50, pp. 1217-1234.

Clark, K. and Fujimoto, T. (1990), *Product Development Performance: Strategy, Organization, And Management In The World Auto Industry*, Harvard Business School Press, Boston.

Cooper, R. G. (1990), "Stage-gate systems: A new tool for managing new products", *Business Horizon*, vol. 33, pp. 44-54.

Cooper, R. G. (1994), "Third-generation new product processes", *Journal of Product Innovation Management*, vol. 11, pp. 3-14.

Crossan, M. M. and Berdrow, I. (2003), "Organizational learning and strategic renewal",

Strategic Management Journal, vol. 24, pp. 1087-1105.

Crossan, M. M., Lane, H. W. and White, R. E. (1999), "An organizational learning framework: From intuition to institution", *Academy of Management Review*, vol. 24, pp. 522-537.

Cusumano, M. A. and Yoffie, D. B. (1998), "Competing on internet time: Lessons from netscape and its battle with Microsoft", The Free Press, New York.

Denison, D. R., Hart, S L. and Kahn, J. A. (1996), "From chimneys to cross-functional teams: Developing and validating a diagnostic model", *Academy of Management Journal*, vol. 39, pp. 1005-1024.

Duncan, R. B. (1976), "The ambidextrous organization: Designing dual structures for innovation", in Kilmann, R. H., Pondy, L. R. and Slevin, D. (Eds.), *The management of Organizations*, New York: North-Holland, vol. 1: 167-188.

Edmondson, A. C. (1999), "Psychological safety and learning behavior in work teams", *Administrative Science Quarterly*, vol. 44, pp. 350-383.

Edmondson, A. C. (2002), "The local and variegated nature of learning in organizations: A group-level perspective", *Organization Science*, vol. 13, pp. 128-146.

Edmondson, A. C. (2003), "Speaking up in the operating room: How team leaders promote learning in interdisciplinary action teams", *Journal of Management Studies*, vol. 40, pp. 1419-1452.

Edmondson, A. C. and Mogelof, J. P. (2006), "Explaining psychological safety in innovation teams: organizational culture, team dynamics, or personality?", Thompson, L. and Choi, H.-S. (Eds.), *Creativity and Innovation in Organizational Teams*, Lawrence Erlbaum Associates, London.

Edmondson, A. C., Dollon, J. R. and Roloff, K. S. (2007) "Three Perspectives on Team Learning: Outcome Improvement, Task Mastery, and Group Process", Working paper. Harvard Business School.

Fagerberg, J. (2006), "Innovation: A guide to the literature", in Fagerberg, J., Mowery, D. C. and Nelson, R. R. (Eds.), *The Oxford Handbook of Innovation*, Oxford University Press, New York, pp. 1-27.

Fonseca, J. (2004), *Complexity And Innovation In Organizations*, Routledge, London and New York.

Garnsey, E. and Wright, S. M. (1990), "Technical innovation and organizational opportunity", *International Journal of Technology Management*, vol. 5, pp. 267-281.

Ghoshal, S. and Bartlett, C. A. (1994), "Linking organizational context and managerial action: The dimensions of quality of management", *Strategic Management Journal*, vol. 15, pp. 91-112.

Gibson, C. B. and Birkinshaw, J. (2004), "The antecedents, consequences, and mediating role of organizational ambidexterity", *Academy of Management Journal*, vol. 47, pp. 209-226.

- Gilson, L. L., Mathieu, J. E., Shalley, C. E. and Ruddy, T. M. (2005), "Creativity and standardization: Complementary or conflicting drivers of team effectiveness?", *Academy of Management Journal*, vol. 48, pp. 521-531.
- Griffin, A. (1997), "The effect of project and process characteristics on product development cycle time", *Journal of Marketing Research*, vol. 34, pp. 24-35.
- Gupta, A. K., Smith, K. G. and Shalley, C. E. (2006) "The interplay between exploration and exploitation", *Academy of Management Journal*, vol. 49, pp. 693-706.
- Hauser, J., Tellis, G. J. and Griffin, A. (2006), "Research on innovation: A review and agenda for marketing science", *Marketing Science*, vol. 25, pp. 687-717.
- Holmqvist, M. (2003), "A dynamic model of intra- and inter-organizational learning", *Organization Studies*, vol. 24, pp. 95-123.
- Holmqvist, M. (2004), "Experiential learning process of exploitation and exploration within and between organizations: An empirical study of product development", *Organization Science*, vol. 15, pp. 70-81.
- Jansen, J. J. P., Van Den Bosch, F. A. J. and Volberda, H. W. (2006), "Exploratory innovation, exploitative innovation, and performance: Effects of organizational antecedents and environmental moderators", *Management Science*, vol. 52, pp. 1661-1674.
- Jaworski, B. J., and Kohli, A. K. (1993), "Market orientation: Antecedents and consequences", *Journal of Marketing*, vol. 57, pp. 53-70.
- Kasl, E., Marsick, V. A. and Dechant, K. (1997), "Teams as Learners. A research-based model of team learning", *The Journal of Applied Behavioral Science*, vol. 33. pp. 227-246.
- Knott, A. M. (2002), "Exploration and exploitation as complements", in Choo, C.W. and Bontis, N. (Eds.), *The Strategic Management Of Intellectual Capital And Organizational Knowledge*, Oxford University Press, Oxford, pp. 339-358.
- London, M. and Sessa, V. I. (2007), "How groups learn, continuously", *Human Resource Management*, vol. 46, pp. 651-669.
- Lovelance, K., Shapiro, D. L. and Weingart, L. R. (2001), "Maximizing cross-functional new product team's innovativeness and constraint adherence: A conflict communications perspective", *Academy of Management Journal*, vol. 44, pp. 779-793.
- March, J. G. (1991), "Exploration and exploitation in organizational learning", *Organization Science*, vol. 2, pp. 71-87.
- March, J. G. (2006), "Rationality, foolishness, and adaptive intelligence", *Strategic Management Journal*, vol. 27, pp. 201-214.
- McFadyen, M.A. and Cannella, A. A. (2004), "Social capital and knowledge creation: Diminishing return of the number and strength of exchange relationships", *Academy of Management Journal*, vol. 47, pp. 735-746.
- McGrath, R. G. (2001), "Exploratory learning, innovative capacity, and managerial

oversight”, *Academy of Management Journal*, vol. 44, pp. 118-131.

O'Reilly III, C. A. and Tushman, M. (2007), “Ambidexterity as a dynamic capability: Resolving the innovator’s dilemma”, Working paper. Harvard Business School.

Pavitt, K. (2006), “Innovation processes”, in Fagerberg, J., Mowery, D. C. and Nelson, R. R. (Eds.), *The Oxford Handbook of Innovation*, Oxford University Press, New York, pp. 86- 114.

Perretti, F. and Negro, G. (2006), “Filling empty seats: How status and organizational hierarchies affect exploration versus exploitation in team design”, *Academy of Management Journal*, vol. 49, pp. 759-777.

Rowley, T., Behrens, D., Krackhardt, D. (2000), “Redundant governance structures: An analysis of structural and relational embeddedness in the steel and semiconductor industries”, *Strategic Management Journal*, vol. 21, pp. 369-386.

Sarin, S. L. and McDermott, C. (2003), “The effect of team leader characteristics on learning, knowledge application, and performance of cross-functional new product development teams”, *Decision Sciences*, vol. 34, pp. 707-739.

Sessa, V. I. and London, M. (2008), “Group learning: An introduction”, in Sessa, V. I. and London, M (eds.), *Work Group Learning*, Lawrence Erlbaum Associates, London, pp. 3-13.

Sheremata, W. A. (2000), “Centrifugal and centripetal forces in radical new product development under time pressure”, *Academy of Management Review*, vol. 25, pp. 389-408.

Siggelkow, N. and Levinthal, D.A. (2003), “Temporarily divide to conquer: Centralized, decentralized, and reintegrated organizational approaches to exploration and adoption”, *Organization Science*, vol. 14, pp. 650-669.

Taylor, A. and Greve, H. R. (2006), “Superman or the fantastic four? Knowledge combination and experience in innovation teams”, *Academy of Management Journal*, vol. 49, pp. 723-740.

Tidd, J., Bessant, J. and Pavitt, K. (2001), *Managing innovation: integrating technological, market and organizational change*, Wiley, Chichester.

Tushman, M. L. and O'Reilly, C.A. (1996), “Ambidextrous organizations: Managing evolutionary and revolutionary change”, *California Management Review*, vol. 38. pp. 8-30.

Van De Ven, A., Polley, D. E., Garud, R. and Ventkatataman, S. (1999), *The Innovation Journey*, Oxford University Press, New York.

Van Looy, B., Martens, T. and Debackere, K. (2005), “Organizing for continuous innovation: On the sustainability of an ambidextrous organization”, *Creativity and Innovation Management*, vol. 14, pp. 208-221.

Wheelwright, S. C. and Clark, K. B. (1992), *Revolutionizing Product Development*, The Free Press, New York.

Wong, S.-S. (2004), "Distal and local group learning: Performance trade-offs and tensions", *Organization Science*, vol. 15, pp. 645-656.

Yorks, L. and Sauquet, A. (2003), "Team learning and national culture: Framing the Issues", *Journal of Studies in International Education*, vol. 5, pp. 7-39.

Zirger, B.J. and Maidique, M.A. (1985), "The new product learning cycle", *Research Policy*, vol. 12, p. 299-313.