The impact of organizational context and competences on innovation ambidexterity

Sébastien Brion, Caroline Danièle Mothe, Mareva Sabatier

The impact of organizational context and competences on innovation ambidexterity

Sébastien Brion, Caroline Mothe, Maréva Sabatier

IREGE, Université de Savoie

Research into organization theory contains abundant evidence of the positive effects of ambidexterity on a firm's performance, and of the influence of organizational context on ambidexterity. The present research tests whether organizational context affects innovation ambidexterity. Our results, based on a dataset of 108 large innovative firms, show that firms combining exploration innovation and exploitation innovation should adopt long-term practices that favor risk taking and creativity, and thereby build an organizational context suited to innovation ambidexterity. Competences were found to have a strong moderating effect. These results have important managerial and theoretical implications. In the case of innovation, firms that simultaneously pursue exploitation and exploration activities should carefully consider how they combine competences and organizational context.

Keywords: ambidexterity; competences; exploitation; exploration; innovation; organizational context

Introduction

Recent work has advocated the superiority of ambidexterity (He and Wong, 2004; Jansen *et al.*, 2005; O'Reilly and Tushman, 2004). However, research into the concept of ambidexterity is still in its infancy and has, until now, concentrated on showing that firms that use only one hand show lower performance than those that use both hands[1]. To the best of our knowledge, no studies have examined how firms can simultaneously combine exploitation and exploration strategies to achieve superior innovation, which is a prerequisite for sustained performance (He and Wong, 2004). This observation led us to look at the antecedents of innovation ambidexterity.

Since March's pioneering article (1991), the conceptual distinction between exploration and exploitation has been widely used in a number of fields outside organizational learning, including innovation management (e.g., Cheng and Van de Ven, 1996; He and Wong, 2004; Jansen *et al.*, 2005; O'Reilly and Tushman, 2004; Smith and Tushman, 2005). A consensus seems to emerge that firms should develop the capacity to explore new technological paths while continuing to exploit their existing competences (e.g., Levinthal and March, 1993; March, 1991; O'Reilly and Tushman, 2004; Tushman and O'Reilly, 1996). An appropriate balance between these two activities is seen as necessary for a firm to be both competitive in mature markets - where costs, efficiency and incremental innovation are essential – and innovative in terms of product development for emerging markets - where experimentation and flexibility are needed (Tushman and O'Reilly, 1996). The capacity to simultaneously pursue these two contradictory objectives (Smith and Tushman, 2005) is called ambidexterity.

Previous research has resulted in a number of conflicting perspectives on how to simultaneously separate and integrate exploration and exploitation activities. It has been shown that firms need to combine contradictory management practices in order to create an organizational context that is favorable to ambidexterity (Ghoshal and Bartlett, 1994; Gibson and Birkinshaw,

[1] We thank an anonymous reviewer for suggesting this idea.

2004). In line with Ghoshal and Bartlett (1994), organizational context is viewed as being created and renewed by management; therefore, it is highly dependent on managerial actions and practices. However, questions remain about the nature of the organizational context managers should develop in order to encourage ambidexterity for innovation, and about the antecedents of combining exploration and exploitation innovation activities. The present research is an attempt to fill this gap. It also analyses the moderating effect of competences (Gilsing and Nooteboom, 2006), thereby following Mom, Van Den Bosch and Volberda's (2007) recommendation to look at the impact managers have on innovation through the actions they take and the competences they try to develop.

As well as defining ambidexterity and innovation, the following section outlines the theoretical background to our research and advances hypotheses on the effect of organizational context on innovation ambidexterity, and on the moderating role of competences. After providing details of the sample set, data collection method and measures, we present our empirical findings. This is followed by a discussion of the results and suggestions for further research.

Literature Review and Hypotheses

Ambidexterity and Innovation

The present research focuses on exploitation and exploration activities that are intended to promote innovation. In line with He and Wong (2004), we define exploration innovation in terms of activities aimed at entering new product-market domains, whereas exploitation innovation is considered to encompass activities aimed at improving an existing product-market position. Exploration usually generates radical (or discontinuous) innovation; exploitation tends to produce more incremental innovation (O'Reilly and Tushman, 2004; Tushman and Anderson, 1986). We provide a brief review of the difficulties and tensions involved in combining exploration and

exploitation activities, and show how the literature solves these difficulties in terms of structure and/or organizational context.

Finding the right balance between exploration and exploitation activities is not easy, but it is essential for a firm's survival (March, 1991). The question of whether these activities are antithetical or complementary has not yet been resolved. It is difficult to imagine how an organization can combine efficiency in managing current activities and efficacy in experimentation and risk management, as they are based on different competences and organizational capabilities (Christensen and Overdorf, 2000; Benner and Tushman, 2003). The imperatives of short-term survival through the effective employment of current assets and capabilities, and of long-term success through the development of new capabilities have even been viewed as paradoxical (Gilsing and Nooteboom, 2006). However, dealing with these contradictions – that is to say, being "ambidextrous" - is likely to improve performance.

Research into ambidexterity has therefore tried to analyze how exploration and exploitation should be combined. There is still no consensus, and different ways of achieving ambidexterity have emerged, especially in terms of organizational structure (Duncan, 1976; O'Reilly and Tushman, 2004) and/or the creation of a specific organizational context (Gibson and Birkinshaw, 2004). "Structural" ambidexterity can be viewed in terms of R&D organization (Duncan, 1976; Benner and Tushman, 2003; Argyres and Silverman, 2004; Tirpak *et al.*, 2006) or in terms of the separation of exploration and exploitation activities (O'Reilly and Tushman, 2004). However, developing an appropriate organizational structure is not the only way of achieving ambidexterity. Gibson and Birkinshaw (2004) argue that ambidexterity might best be achieved through individuals, thereby challenging traditional and ingrained ideas about the difficulties human beings have in devoting their time and energy to paradoxical objectives, such as the tradeoff between efficiency and flexibility (Adler *et al.*, 1999). Gibson and Birkinshaw (2004) define "contextual ambidexterity" as the individual behavioral capacity to demonstrate both alignment and adaptability. This type of ambidexterity depends on the systems, incentives and processes that shape

individual behaviors in an organization, and these features define the organizational context (Ghoshal and Bartlett, 1994). Hence, the organizational context, which is created through tangible and concrete managerial actions, emphasizes the role of managers in strategic processes – a theme that has led to much debate between researchers who view management as primordial and those who assign it a lesser role (Burgelman, 1983).

The present research examines the relationship between organizational context and innovation, focusing on innovation ambidexterity. First, we identify the main dimensions of a firm's organizational context as an antecedent of innovation ambidexterity. Second, we analyze the moderating role of the different types of competence.

Organizational context as an antecedent of innovation ambidexterity

Organizational context has been defined as "*the systems, processes, and beliefs that shape individual-level behaviours in an organization*" (Gibson and Birkinshaw, 2004, 212). In line with previous research, we focused on general managers (Barnard, 1938; Ghoshal and Bartlett, 1994) and on the systems and incentives they implement in order to operate ambidextrously. General managers are required to achieve a pragmatic balance between fundamentally different requirements (Burgelman, 1983). As competition and complexity intensify, managers no longer face a simple choice between favoring routine processes that ensure efficient exploitation, and introducing non-routine processes and exploration tasks that favor innovation; rather, they are required to implement management practices and create the context needed to allow the simultaneous pursuit of both objectives (Volberda, 1996). Flexibility requires task autonomy, variety and creativity, whereas efficiency requires formal rules, hierarchical controls and high levels of standardization, formalization and specialization (Adler *et al.*, 1999). Mechanisms for managing the conflict between efficiency and flexibility are dependent for their success on the broader organizational context (Adler *et al.*, 1999), which is largely created by the firm's management team.

Since the pioneering work of Barnard (1938), there has been a long history of research into how managers can create contexts that enhance organizational performance (e.g., Chandler, 1962; Porter, 1991; Rumelt *et al.*, 1991). Although the strategic management literature of the 1980s and 1990s did not highlight the link between performance and management, recent organizational research (e.g., Ghoshal and Bartlett, 1994; Gibson and Birkinshaw, 2004; Smith and Tushman, 2005) has tended to rebuild this bridge, arguing that management plays a leading role in developing rules, characteristics and tools, and, more generally speaking, the organizational context. Hamel (2009) recently stressed the importance of this argument when he asked: "How in an age of rapid change do you create organizations that are as adaptable and resilient as they are focused and efficient?" (p. 92). This question highlights the dilemma and contradictions of the managerial task, which should go "beyond today's bureaucracy-infused management practices" (p. 92).

The present research was designed to further our understanding of how management can create an organizational context in which it is possible to pursue flexibility and the search for new knowledge, while simultaneously promoting efficiency and the use of existing knowledge (Levinthal and March, 1993). Believing that "*traditional control systems ensure high levels of compliance but do so at the expense of employee creativity, entrepreneurship, and engagement*", Hamel (2009, p. 93) encourages firms to overcome the "*discipline-versus-innovation trade-off*". Organizational leaders must deal with this trade-off and overcome potential problems caused by contradictory organizational alignments (Ghoshal and Bartlett, 1994; Smith and Tushman, 2005; Tushman and O'Reilly, 2007):

> *"Although these trade-offs can never entirely be eliminated, the most successful organizations reconcile them to a large degree, and in so doing enhance their long-term competitiveness (…). Alignment activities are geared toward improving performance in the* ***short term****. Adaptability activities are geared toward improving performance in the* ***long term****. Thus, if a business unit focuses on one of these at the expense of the other, problems and tensions will inevitably arise"* (Gibson and Birkinshaw, 2004, 209/212)

Hence, an organizational context should simultaneously favor short-term efficiency and long-term discovery. When trying to resolve the exploration/exploitation dilemma, management has the

difficult task of creating the most appropriate short- and long-term focused organizational contexts in order to achieve ambidexterity for innovation.

In line with Gibson and Birkinshaw (2004) and with the literature on innovation management, we consider a firm's organizational context to consist of four dimensions: performance management, formalization, creativity and risk-taking. As performance management and formalization tend to focus on short-term goals, these two dimensions were grouped together in a variable called "short-term organizational focus". Conversely, creativity and risk-taking are mostly related to long-term goals, and were grouped together in a variable called "long-term organizational focus".

The following section presents each of these four dimensions and explains why they were combined into two aggregate variables. It also outlines support (Toulmin, 1969) for our claim that both short-term organizational focus (H1a) and long-term organizational focus (H1b) have an impact on innovation ambidexterity.

Short-term organizational focus: performance management and formalization

Short-term organizational focus includes both performance-oriented management and formalization. We believe there is a positive link between short-term organizational focus and innovation ambidexterity, a position that is supported by the literature on organization theory (Cardinal, 2001; Deshpande and Zaltman, 1982; Ghoshal and Bartlett, 1994; Gibson and Birkinshaw, 2004; Jansen *et al.*, 2005; Mintzberg, 1979; Snell, 1992).

Organizational contexts favoring performance-oriented management should be based on administrative mechanisms that give employees clear and tangible objectives (Gibson and Birkinshaw, 2004). Performance-oriented management reinforces existing mechanisms and routines through the setting of general guidelines and objectives. Written procedures enable employees to deal with most situations, and standard procedures allow each employee to carry out his/her job

(Deshpande and Zaltman, 1982; Jansen, 2005). Such "management by objectives" is often based on a decentralized organization and a collectively shared identity.

However, Snell (1992) observed that management control should not be limited to management by objectives, arguing that it should be complemented by a formalization of rules and procedures. Furthermore, Jansen *et al.* (2005) showed that ambidextrous organizations need formalization, that is to say, decision-making based on formal systems, established rules and prescribed procedures (Mintzberg, 1979). Formalization has often been considered part of behavior control (Snell, 1992), where control refers to "*any process by which managers direct attention, motivate and encourage organizational members to act in desired ways to meet the firm's objectives*" (Cardinal, 2001, p. 22). Formalization and procedures are top-down behavior-control systems that regulate subordinates' actions (Snell, 1992). Standard procedures are best suited for common and foreseeable situations and these procedures should be formalized, that is to say, put in writing (Snell, 1992). Cause-effect knowledge (Ouchi and Maguire, 1975) and "task programmability" (Eisenhardt, 1985) are prerequisite to the use of formal behavior-control systems.

Where formal systems are absent, and as all actions cannot be standardized *a priori*, managers may also have to apply output control (Snell, 1992), that is to say, performance-oriented management. Instead of translating managerial intentions into standard operating procedures, performance-oriented management sets targets and objectives for subordinates to pursue. Indeed, there is a theoretical complementarity between formalization and performance-oriented management: *Ex-ante* behavior-control systems are useful for preventing errors and setting formal rules and procedures; however, too much behavior control may be costly and inefficient in regulating performance (Snell, 1992). Performance-oriented management is reactive and provides *ex-post* control (Flamholtz, 1979).

Previous research indicates that formalization and performance management can be grouped together into a single variable, which we have called "short-term organizational focus". The short-term organizational focus can enhance exploitation innovation by improving current products and

processes (Jansen *et al.*, 2005). However, high degrees of bureaucratic control inhibit experimentation, creativity and innovation (Aiken and Hage, 1971). As exploitation innovation is essential to pursuing innovation ambidexterity, we postulated that:

H1a: The higher the "short-term organizational focus" (performance management and formalization), the higher the innovation ambidexterity

Long-term organizational focus: creativity and risk taking

An organizational context focused on short-term performance should be balanced by the creation of a context focused on long-term performance. This requires creativity and risk-taking. We believe there is a positive relationship between long-term organizational focus and innovation ambidexterity. This position is supported by the literature on innovation management (Amabile and Conti, 1999; Dewar and Dutton, 1986; Kremen Bolton, 1993; O'Reilly and Tushman, 2004; Tushman and O'Reilly, 2007).

It is widely accepted that creativity is a major component of innovation (e.g., Amabile *et al.*, 1996; Ford, 1996), and organizational creativity is considered a subset of the broader domain of innovation (Woodman *et al.*, 1993). However, the literature contains very few empirical studies of the link between the two concepts. Creativity is fostered by giving autonomy to employees and teams (e.g., Amabile *et al.*, 1996; Baylin, 1985): the freedom to choose which problems to work on and to pursue them independently of directives is seen as a prerequisite of innovation (Baylin, 1985). Giving autonomy to a firm's R&D team and, in general, to the people in charge of innovation is a necessary (though not sufficient) condition for innovation.

Similarly, exploring new possibilities requires risk taking, even though its returns are uncertain and often negative (March, 1991; O'Reilly and Tushman, 2004). Managerial attitudes and practices can influence the nature of innovation (Amabile and Conti, 1999), as pro-change managerial attitudes are needed to support the adoption of radical innovation (Dewar and Dutton,

1986). Managers should encourage risk taking by setting an example and by tolerating failure. In a study of the effects on innovation of the organizational downsizing of the work environment, Amabile and Conti (1999) reported that acceptance of risk taking is the most crucial factor in promoting innovation.

Firms are stimulated to take risks and innovate as a response to decreased performance (Kremen Bolton, 1993). A number of studies have indicated a connection between these two items, as innovation requires a climate in which "calculated risks" are taken (Souder, 1987). Firms should take careful and controlled risks with the objective of improving ultimate performance. In addition, the literature provides evidence for strong links between risk taking and creativity (Amabile and Conti, 1999). A similar observation was made by Tushman and O'Reilly (2007): managers should emphasize long-term orientations and exploration activities through creativity and risk taking. We therefore advanced the following hypothesis:

H1b: The higher the "long-term organizational focus" (creativity and risk taking), the higher the innovation ambidexterity.

The Moderating Role of Competences

Recent research into innovation (Benner and Tushman, 2003; Danneels, 2002; Dougherty and Hardy, 1996; Gilsing and Nooteboom, 2006; O'Reilly and Tushman, 2004; Smith and Tushman, 2005) has used the exploration/exploitation construct because it encompasses aspects linked to competences (Gilsing and Nooteboom, 2006). For these authors, exploration innovation refers to strategies based on new technological or marketing competences (Benner and Tushman, 2003; Danneels, 2002), whereas exploitation innovation covers strategies based on accelerating innovation processes that use existing technological and marketing competences.

Following in the footsteps of Gatignon *et al.* (2002), we looked at the specific effects on innovation of competence exploration and competence exploitation, that is to say, of enhancing

existing competences and acquiring new competences. Different notions have been used to describe these two types of competences. For example, Dosi *et al.* (2000) used the terms static and dynamic competences, where static competences are aimed at replication and dynamic competences represent skills for learning and resource reconfiguration. Palacios Marques *et al.* (2006) referred to "distinctive competencies" when talking about assets "*that seek to combine the exploitation of organisational procedures and norms with exploration*" (p. 91), before distinguishing two dimensions: Schumpeterian competences for radical growth and the development of new abilities, and continuous improvement competences for incremental growth and the strengthening of existing capabilities.

The symbiotic relationship between competences and innovation through new product development or technology management has been extensively studied (e.g., Clark and Fujimoto, 1991; Leonard-Barton, 1992; Tushman and Anderson, 1986; Van de Ven, 1986). However, the link between innovation and competences remains uncertain and/or ambiguous. For example, it is still unclear whether innovation outcomes are driven by competences or whether competences are a type of innovation outcome, or both. In addition, little research has been carried out into "how" firms (through their managers) transform resources and competences to create value (Sirmon *et al.*, 2007).

The introduction of such processes of knowledge and competence creation, absorption, integration and reconfiguration (Verona and Ravasi, 2003) is largely the responsibility of managers. Previous research into the key role of strategic leadership has been mostly conceptual and has not investigated the way leaders create and manage competences (Adner and Helfat, 2003; Eisenhardt and Martin, 2000; Teece *et al.*, 1997; Teece, 2006). Management plays a crucial role in developing innovation ambidexterity, as it develops the objectives, goals, methods, processes and procedures that enhance competence exploitation and it identifies favorable opportunities for new technological or marketing competences, thus favoring exploration innovation (Teece, 2006).

Although the effect of management (through organizational context) on innovation and the impact of competences on innovation have been well documented, we believe that these links are more subtle and that competences have a moderating effect on the relationship between context and ambidexterity. The effect of competences on the link between context and innovation, and thus between context and ambidexterity, has, however, not been tested. It is still unclear whether competences act as a determinant of innovation, or whether they reinforce one or more aspects of the organizational context. While most studies have focused on the impact of competences on innovation, we stress the key role of managers in the determination and creation of a context that is suited to ambidexterity, and in the development of the most suitable competences.

We believe that organizational context and competence management act in conjunction, and that poor combinations can lead to sub-optimal performance with respect to innovation ambidexterity. Hence, it is important to develop the right competences in order to reinforce the beneficial effect of organizational context on innovation. More specifically, an organizational context with a short-term focus, that is to say, a context that favors exploitation, must be combined with competence exploitation. Thus, we hypothesized that ambidexterity increases when the short-term organizational focus is coupled with competence exploitation:

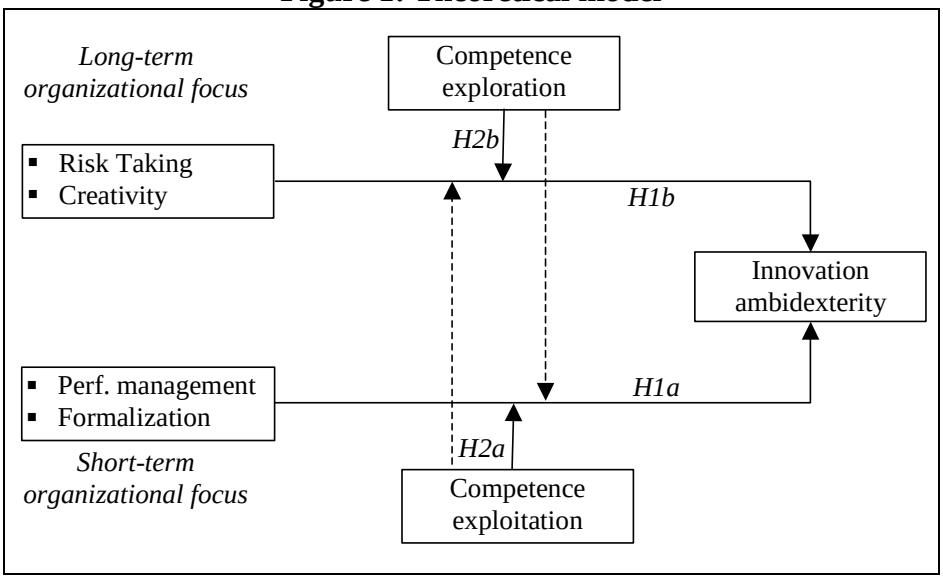
H2a: Competence exploitation moderates the positive relationship between short-term organizational focus and innovation ambidexterity.

Similarly, an organizational context with a long-term focus, that is to say, a context that favors exploration, must be combined with competences related to that aspect of development. Therefore, we hypothesized that innovation ambidexterity increases when the long-term focus is coupled with competence exploration:

H2b: Competence exploration moderates the positive relationship between long-term organizational focus and innovation ambidexterity.

Figure 1 shows the theoretical model on which the present study was based.

Figure 1: Theoretical model



NB: the two dotted lines correspond to complementary analyses (slope tests) that are presented in the discussion

Methods

Data Collection

Questionnaires were sent to the managing directors of the 482 large firms (firms with more than 250 employees, as defined by the OECD) in the Rhône-Alpes region[2] of France. Responses were received from 188 of these firms. In order to filter out firms that are not innovative, the managers were asked the following question "Has your firm developed a new product or service during the last 3 years?" Firms who gave a negative answer to this question were eliminated from the sample, leaving 119 innovative firms. Removing responses with missing data resulted in a final sample of 108 firms, which corresponds to a response rate of 22%. As this sample was statistically representative in terms of sector distribution in the Rhône-Alpes region (F Test sig. at 99%), our results can be used to make general inferences about firms in the Rhône-Alpes region, but not about French firms in general. The firms in the sample were classified as manufacturing firms (48%),

[2] See http://www.panorama.rhone-alpes.cci.fr/4_2_a_entreprises.html (accessed on 12 March 2009)

service firms (34%), and Others (18%)[3]. The "Others" category included a very heterogeneous mixture of organizations, ranging from non-merchant services and non-governmental organizations to assistance to elderly people. The sample included firms from many different business sectors.

Very few empirical studies have included both industrial and service firms in their sample (Gatignon *et al.*, 2002; Gibson and Birkinshaw, 2004; McGrath, 2001) and most research has concentrated on manufacturing companies in order to explore innovation, R&D activities and organization (Argyres and Silverman, 2004; He and Wong, 2004; Sidhu *et al.*, 2007). Some studies have focused on one specific industry (e.g., pharmaceuticals, Cardinal, 2001; Gilsing and Nooteboom, 2006; or electronics, Atuahene-Gima, 2005) or on the service sector (e.g., financial services, Jansen *et al.*, 2006). By having a large sample of industrial and service companies we were able to determine whether or not ambidexterity is linked to a firm's business sector. Questionnaires were only sent to firms' head offices and participating firms were sent three successive reminders over a one-month period.

We collected most of our data using a single survey instrument and a single informant. Potential concerns resulting from common-method and single-informant biases were addressed using the procedures and statistical tests recommended by Krishnan *et al*. (2006). Hence, we included procedural remedies in order to protect respondent anonymity in the questionnaire, to reduce item ambiguity through survey pretests[4], to separate scale items for the independent and dependent variables, and to obtain data for the control variables from a secondary source[5]. Statistical remedies included triangulation of survey data with data obtained from the secondary source and from field interviews that were undertaken during an exploratory qualitative study on

[3] T-tests showed no significant difference between sectors for any of the considered variables.
[4] The questionnaire was pre-tested on 12 R&D managers in order to ensure the validity of the measures. These 12 responses were not integrated in our final data.
[5] For each response, we checked the sector and the size of the firm in the Kompass business directory, in order to obtain missing data and to check the validity of the data.

innovation and management practices in a large domestic appliances group (X, Y, Z, 2008)[6]. These procedures allowed us to be confident that neither common method nor single informant bias was a serious problem in our study.

Measurements and Questionnaire Development

Appendix A shows the measures and their sources. All the items on the questionnaire required seven-point Likert-style responses (from 1= "Strongly agree" to 7 = "Strongly disagree"). We ran six confirmatory factor analyses based on the normal-theory maximum-likelihood procedure, grouping measures of theoretically related constructs to ensure acceptable parameter estimate-to-observation ratios. A single-step modification approach was adopted (Kaplan and Wenger, 1993). We also checked the theoretical relevance of each new link created in the model (Cox and Wermuth, 1996) and the goodness-of-fit for the six latent constructs. Descriptive statistics are given in Appendix B.

(a) Dependent Variable. Innovation ambidexterity has two main dimensions, which were measured using two scales (He and Wong, 2004). Following the addition of a covariance between the two items and using the largest Modification Index criterion (Jöreskog and Sörbom, 1984), confirmatory factor analyses gave a good model fit for the two variables. For exploitation innovation, "Enhance existing product quality" correlated with "Introduce slightly different products". Theoretically, incremental product innovation is mostly due to quality enhancement. For exploration innovation, "Introduce new product generations" correlated with "Offer totally new products for the market". Again, this link seems logical, as most new products are created in order to generate new markets and, conversely, few new markets are created with old products.

The literature describes several ways of measuring ambidexterity (He and Wong, 2004). The interaction effect (ambidexterity score calculated as the product of the exploitation and exploration

[6] We used interview notes to validate our creativity and risk-taking measures. Two PhD students categorized the interview responses (using 5-point scales), in order to determine the extent to which each of the four creativity items existed in R&D teams. We repeated this procedure for the other multi-item measure (risk-taking construct). The correlation between the creativity scale obtained from the survey and the interview notes coded by the independent raters was 0.68 ($p < .05$). The same was done for risk-taking (0.70, $p < .05$). No discrepancy was noted regarding variable content, thus allowing us to be quite confident about our scales.

innovation scores) was used to search for antecedents of the level of ambidexterity reached by firms (as well as to run simple slope tests to analyze the moderating effects of competences).

(b) Moderating variables. Competence exploitation and competence exploration constructs were based on previous research (Atuahene-Gima, 2005). Appendix A shows a very good fit index. "Reinforce the search for solutions that are close to existing ones" correlated with "Enhance skills that improve productivity of current innovation operations", showing that the implementation of known solutions is linked to skill enhancement (and vice-versa). Firms tend to focus on existing competences to search for solutions in the neighborhood of existing expertise. For competence exploration, two items involved with external research and partnerships are correlated. As firms essentially look for complementary external competences (Teece, 1986), the distinction between technological and market competences is secondary.

(c) Independent Variables. Structural relations between dimensions were highlighted by using a second order factorization (Hair *et al*., 1998) after checking (a) for the theoretical relevance of the construct (Chin, 1998), and (b) that the confirmatory second order factorization model fit better than the confirmatory factor independent model.

Short-term organizational focus. This variable is composed of formalization and performance-oriented management. As would be expected, the two items "There are standard procedures each person has to follow in performing his/her job" and "Written procedures are available to deal with whatever situation arises" are correlated. A second order factorization carried out to construct a single latent variable for short-term focus gave a better model fit index than the independent model (see Appendix A).

Long-term organizational focus. This variable is composed of creativity and risk-taking. The two items "Be willing to take risks" and "Consider taking risks as a way to improve performance" are correlated. Statistical analysis confirmed the correlation between these two variables. After improving the model by adding two significant links (see Appendix A), the second order factorization confirmatory model gave a better fit than the independent model.

(d) Control Variables. As described in section 4 below, we controlled for firm size, separating small and large firms (more than 250 employees[7]), and for type of industry.

Results

In order to identify the determinants of ambidexterity intensity, we followed the direction suggested by recent research on innovation (Atuahene-Gima, 2005; Danneels, 2002; Nerkar, 2003) and looked for a positive interaction between the two types of innovation. We also calculated an ambidexterity score (called *ambi*) by multiplying the exploitation innovation score by the exploration innovation score (He and Wong, 2004; Gibson and Birkinshaw, 2004). This multiplicative interaction reflects the fact that exploitation and exploration innovations are non-substitutable and interdependent.

Two models (OLS regressions) were drawn up in order to study the determinants of ambidexterity scores and to test our hypotheses. Model (a) estimates the effects of activity sector, organizational context and competences on ambidexterity scores. Model (b) includes the crossed effects of context and competences. The regression results are given in Table 1.

Table 1. Determinants of Ambidextrous Firms

	Model (a)		Model (b)	
	Coef.	Student t	Coef.	Student t
Constant	1.31	*1.03*	0.84	*1.36*
Industry sector	0.26	*1.39*	0.09	*1.09*
Other sector	0.18	*0.91*	0.02	*0.73*
Services sector	Ref.		Ref.	
mgt_st: Short-term organizational focus	**0.12**	***2.09*********	**0.17**	***1.96*********
mgt_lt: Long-term organizational focus	**2.98**	***2.96**********	**2.91**	***2.52**********
comp_exploit: Competence exploitation	**0.13**	***1.91********	**0.18**	***1.97*********
comp_explor: Competence exploration	**1.26**	***2.13*********	**1.06**	***2.41*********
mgt_lt x comp_exploit			**-0.53**	***2.31*********
mgt_st x comp_exploit			**0.89**	***2.08*********
mgt_lt x comp_explor			**1.02**	***3.66**********
mgt_st x comp_explor			**-0.77**	***2.08*********
R^2	**0.35**		**0.55**	
Fischer test	4.68		8.48	
Observations	108		108	

Note: Figures in italics are White robust standard errors with: *=significant at 10%; **=significant at 5%; ***=significant at 1%.

[7] European Union (http://europa.eu/eur-lex/pri/fr/oj/dat/2003/l_124/l_12420030520fr00360041.pdf - 12 January 2007).

The two models show there is no significant effect of sector of activity on ambidexterity. More interestingly, the regressions highlighted the fact that both short-term organizational focus and long-term organizational focus increase ambidexterity scores. These results support H1a and H1b. Econometric results allowed us to analyze this effect: long-term organizational focus (risk taking and creativity) is much more efficient in producing ambidexterity than short-term organizational focus (performance-oriented management and formalization). Furthermore, both competence exploitation and short-term organizational focus positively affect ambidexterity.

The most interesting result – that the interactions between context and competence management have significant effects on ambidexterity – appears in model (b). Including the crossed effects of organizational context and competences increased R^2 by 20 points. The results of a Fisher test for restrictions ($F = 7.38$; $p < 0.01$) led us to prefer model (b). Hence, ambidexterity scores are not only affected by organizational context and competences individually, but also by combinations of organizational context and competences. Ignoring these crossed effects produces less efficient estimations of ambidexterity scores. Some combinations (long-term organizational focus plus competence exploration and short-term organizational focus plus competence exploitation) lead to higher ambidexterity scores. Other combinations have negative impacts on innovation ambidexterity. This supports H2a and H2b and confirms that a complementary managerial focus is more efficient for ambidexterity than the development of separate, and potentially inadequate, competences and organizational context.

Discussion

The present research examined the antecedents for innovation ambidexterity. A study of 108 large, innovative firms, carried out using OLS regressions and slope tests, showed that the firms that perform best (in terms of combining exploration and exploitation innovations) focus on risk taking and creativity. In addition, competence exploration and competence exploitation have a strong moderating effect. Taken together, our results highlight the importance of management's ability to

orchestrate and integrate contradictory innovation activities (O'Reilly and Tushman, 2007) through an adequate combination of context and competences.

Contributions

Long-term organizational focus (risk taking and creativity) increases innovation ambidexterity more than short-term organizational focus (performance-oriented management and formalization). Our results also indicate that competences have a heterogeneous effect: competence exploration has a greater impact on ambidexterity scores than competence exploitation.

Simple slope tests were conducted to obtain further insight into these relationships. Based on estimated coefficients of model (b) (direct and crossed effects of context and competences), these tests allowed us to graphically represent linear and estimated relations between ambidexterity scores and short-term or long-term organizational focus, according to the levels of competence exploitation and competence exploration. Adopting the method of Aiken and West (1991), we split competences into two groups - a high group (two standard deviations above than the mean, solid line) and a low group (two standard deviations below the mean, dashed line), and plotted the estimated relationship between organizational context and ambidexterity (see figures 2 and 3).

Figure 2. Interaction of Organizational Context and Competence Exploitation

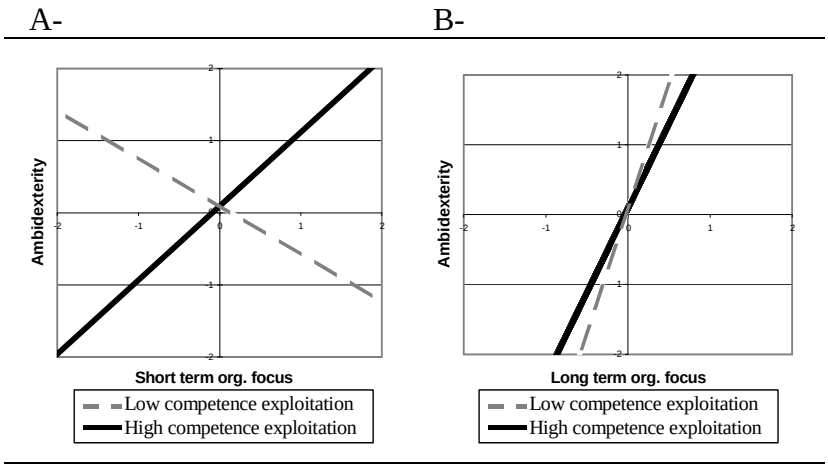


Figure 3: Interaction of Organizational Context and Competence Exploration

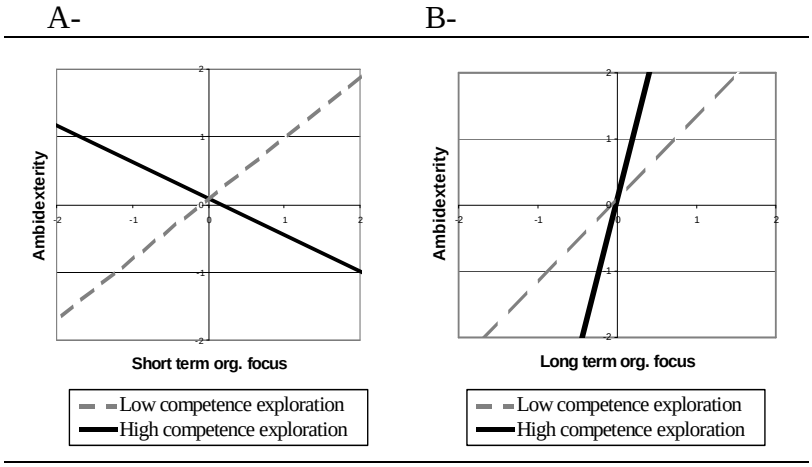


Figure 2-A shows that short-term organizational focus has a strong positive effect on ambidexterity scores at higher levels of competence exploitation (simple slope: b=1.96, t=3.91, p<.01). However, it has a negative effect on lower levels of competence exploitation (simple slope: b=-1.62, t=2.39, p<.05). Conversely, long-term organizational focus has a positive effect on ambidexterity (figure 2-B), whatever the level of competence exploitation (simple slope: b=1.84, t=2.12, p<.05 for low levels of competence exploitation and simple slope: b=1.07, t=2.32, p<.05 for high levels).

As can be seen from Figure 3-A, short-term organizational focus has a negative effect on innovation ambidexterity when levels of competence exploration are high (simple slope: b=-1.20, t=3.75, p<.01). The reverse relationship was found when competence exploration is low (simple

slope: b=1.53, t=2.69, p<.01). Interestingly, as Figure 3-B shows, long-term organizational focus always has a strong positive effect on ambidexterity (simple slope: b=4.72, t=3.90, p<.01 for high levels of competence exploration and simple slope: b=1.10, t=3.78, p<.01 for low levels).

Figures 2 and 3 confirm that organizational context positively influences ambidexterity scores when adequate competences are developed. Short-term organizational focus only has a positive impact on ambidexterity when competence exploitation is high. Similarly, the positive effect of long-term organizational focus on ambidexterity is much stronger when competence exploration is high.

Implications for theory

Our analysis of the determinants of innovation ambidexterity contributes to two main research streams: innovation management and organization theory. By providing evidence of the strong impact of organizational context on innovation ambidexterity, our findings emphasize the key role of managers, first highlighted by Barnard (1938). Firms should ensure managers create an appropriate context, as developing supportive short- and long-term organizational focuses increases ambidexterity scores for large firms. However, the most effective way of enhancing ambidexterity is to give long-term aspects, such as creativity and risk taking, higher priority than short-term aspects, such as formalization and performance-oriented management. This result is consistent with the findings of Adler *et al.* (1999) in that effective management appears to be a precondition for consistent organizational and long-term performance. Such investment should focus on enhancing flexibility and innovation to avoid short-term pressures.

Our results also support the view that managers play a dominant role in the development of a firm's competences (O'Reilly and Tushman, 2007). The incentives given by managers to develop either competence exploration or competence exploitation moderate the link between context and ambidexterity. Thus, competence development should be closely linked to the firm's organizational context. Incentives given to employees through the management practices underlying organizational

context are not independent from the way management deals with competences. Competence exploration can only be developed in organizational contexts that promote creativity and risk taking, whereas competence exploitation can only be developed in organizational contexts that promote performance and short-term goals. Developing new competences strengthens the positive effect of long-term organizational focus. It is essential for firms to emphasize the development of new competences over immediate output in order to avoid core rigidities (Leonard Barton, 1992). However, incentives to develop competence exploration weaken the effect of short-term organizational focus on ambidexterity. Concentrating on exploration and the search for variety while simultaneously trying to implement formalization causes inefficiency (Adler *et al.*, 1999). Greater variety is usually not associated (and is incompatible) with continuous processes and routines (Safizadeh *et al.*, 1996).

Our findings on the moderating impact of competence exploitation differ from previous results. Competence exploitation has a very low moderating effect on long-term organizational focus but a strong moderating effect on short-term organizational focus. In fact, the effect of short-term organizational focus becomes negative when incentives for developing competence exploitation are low. This reinforces the observation that, in order to achieve innovation ambidexterity, senior management should develop a strictly coherent organizational context that combines adequate context creation and competences.

More generally speaking, having stressed that the creation of a long-term organizational focus oriented towards risk, creativity and entrepreneurship is more valuable for ambidexterity than concentrating on short-term profit targets, we suggest that theory should develop "holistic measurement systems" to include such critical factors for success as "building new growth platforms" (Hamel, 2009, 94). The present research provides a link between the competence-based view and the literature on organizational theory and management practices. This link will facilitate research into whether the creation of an organizational context predetermines the competences that

will be developed, or vice-versa. The processes that occur between context and competences still need to be explored.

Limitations and Suggestions for Future Research

The present study has two main limitations that should be addressed through further research. First, we used a single key-informant approach, with the same respondents providing information for both the independent and the dependent variables in the regression analysis. Previous research has shown high correlations between perceived and objective measures of performance (Venkatraman and Ramanujam, 1986), and the near absence of correlation inflation for self-reported data (Crampton and Wagner, 1994). As in other similar studies (Mom *et al.*, 2007, Krishnan *et al.*, 2006), and even though few individuals within a firm are knowledgeable enough to provide information on all innovation characteristics and outcomes, we ensured that the data collected related to the organization as a whole and not just to the individual respondent. We also applied procedural and statistical remedies in order to ensure that neither common-method nor single-informant biases were a serious problem in the study.

Second, it was difficult to make comparisons within a single type of activity due to the relatively small size of the sample. In addition, the study is limited to one region, Rhône-Alpes, and the results may not be generally applicable to innovation activities in other parts of France. Consequently, no general inferences can be made from our results. Although a larger sample would have increased the statistical power of our analyses, our sample was large enough to establish significance in the results and to obtain reliable models. Further work using larger datasets and a multi-region comparison approach is needed in order to investigate whether our results remain valid for different activity sectors.

Conclusion

The present study investigated the determinants of innovation ambidexterity, a facet that has not been addressed by previous research, which has concentrated on the link between ambidexterity and performance (He and Wong, 2004) or on the determinants of contextual ambidexterity (Gibson and Birkinshaw, 2004). The fact that several observed variables have significant impacts on the innovation ambidexterity scores of large firms has strong methodological implications: Treating ambidexterity as exogenous ignores the fact that ambidexterity scores depend on observed covariates. This may generate biases when analyzing the link between ambidexterity and performance, for example.

By highlighting the need to adopt a managerial approach to innovation, the present study suggests that managers should concentrate on long-term management, rather than on short-term management. Research into how managers can continually explore, develop and reconfigure the competences needed to strengthen the positive effects on innovation ambidexterity of long-term organizational focus is still in its infancy. Further analysis of organizational context and the incentives required to build associated competences may be particularly fruitful for researchers and practitioners.

Appendix A - Confirmatory Factor Analysis of Measures

Exploitation innovation **χ^2 = 1.228 (*p* = 0.268); RMSEA = 0.03; GFI = 0.996; IFI = 0.998; NNFI = 0.985; α = 0.652**			
		SRW[a]	CR[b]
Exploitation innovation (He and Wong 2004)	During the last 3 years, your firm was able to… 1. Enhance existing product quality (c1↔c2) [c] 2. Introduce slightly different products 3. Make production processes more flexible 4. Reduce production costs or consumption	 0.425 0.392 0.656 0.694	 8.164 8.353 4.941 4.235
Exploration innovation **χ^2 = 2.918 (*p* = 0.88); RMSEA = 0.10; GFI = 0.992; IFI = 0.990; NNFI = 0.936; α = 0.754**			
		SRW[a]	CR[b]
Exploration innovation (He and Wong 2004)	During the last 3 years, your firm was able to… 1. Introduce new product generations (c1↔c2) [c] 2. Offer totally new products for the market 3. Enter new technological fields 4. Sell to new customers in new markets	 0.702 0.875 0.510 0.477	 5.962 2.245 8.368 8.535

Competence exploitation **χ^2 = 1,90 (*p* = 0.168); RMSEA = 0.07; GFI =0.996; CFI = 0.997; IFI = 0.997; NNFI = 0.981; α = 0.827**			
		SRW[a]	CR[b]
Competence exploitation (Atuahene-Gima 2005)	Systems in the firm encourage employees to... 1. Upgrade current knowledge and skills for familiar products or technologies 2. Upgrade skills in product processes in which the firm already possesses experience 3. Reinforce the search for solutions that are close to existing ones (c3↔c4) [c] 4. Enhance skills that improve productivity of current innovation operations	 0.869 0.797 0.486 0.674	 3.548 5.475 8.706 7.758
Competence exploration **χ^2 = 0.456 (*p* = 0.500); RMSEA = 0.00; GFI = 0.999; CFI = 1.000; IFI = 1.003; NNFI = 1.019; α = 0.767**			
		SRW[a]	CR[b]
Competence exploration (Atuahene-Gima 2005)	Systems in the firm encourage employees to... 1. Acquire new technologies and skills 2. Adopt new managerial and organizational skills that are important for innovation 3. Locate partners to have access to new markets (c3↔c4) [c] 4. Find partners that provide access to new technological practices	 0.768 0.691 0.491 0.639	 4.566 6.170 8.111 6.942

[a] Standardized regression weights; [b] Critical ratio of variance; [c] Item x (here c1) is correlated with item y (here c2)

Short-term organizational focus Second Order Factorization Model: χ^2 **= 38.204 (*p* = 0.004); RMSEA = 0.08; GFI = 0.954; CFI = 0.967; IFI = 0.968; NNFI = 0.949;** α **= 0.791** [d]				
Variable	Scale items	α	SRW[a]	CR[b]
Formalization (Cardinal 2001, Deshpande and Zaltman 1982, Jansen 2005, Snell 1992)	Please indicate the degree to which you agree with the following propositions related to your firm: 1. There are standard procedures each person has to follow in performing his/her job (c1↔c2)[c] 2. Written procedures are available to deal with whatever situation arises 3. There is strict enforcement of written rules and procedures 4. Employees are constantly checked on for rule violations	**0.882** 0.695 0.771 0.868 0.744	 8,241 7,420 2,257 7,900
Performance-oriented management (Cardinal 2001, Gibson and Birkinshaw 2004, Snell 1992)	Systems in the firm encourage employees to... 1. Reach challenging and aggressive short-term goals 2. Be held accountable for their performance 3. Be rewarded or punished based on rigorous measurement of business performance 4. Use their appraisal feedback to improve their performance	**0.787** 0.748 0.795 0.719 0.517	 6.434 5.578 6.923 8.526

Long-term organizational focus Second Order Factorization Model: χ^2 **= 18,050 (*p* = 0.321); RMSEA = 0.02; GFI = 0.975; CFI = 0.997; IFI = 0.997; NNFI = 0.995;** α **= 0.874** [e]				
Variable	Scale items	α	SRW[a]	CR[b]
Creativity (Amabile *et al.*, 1996, Gibson and Birkinshaw, 2004)	Please indicate the degree to which you agree with the following propositions related to your firm: 1. It gives everyone sufficient authority to do their job ($c1_{creativity}$↔$c1_{risk}$) 2. It values creativity and new ideas 3. It encourages experimentation on innovation projects 4. It issues creative challenges to their people ($c4_{creativity}$↔$c1_{risk}$)	**0.769** 0.524 0.801 0.894 0.565	 8.823 6.729 4.164 8.704
Risk taking (Gibson and Birkinshaw, 2004)	Systems in the firm encourage employees to... 1. Be willing to take risks (c1↔c3) [c] 2. Treat failure as a learning opportunity 3. Consider taking risks as a way to improve performance 4. Have access to resources for innovation with no certainty of success	**0.847** 0.698 0.897 0.818 0.622	 8.018 4.017 6.318 8.523

[a] Standardized regression weights; [b] Critical ratio of variance; [c] Item x (here c1) is correlated to item y (here c2)

[d] Short-term organizational focus confirmatory independent model: χ^2 = 46,162 (*p* = 0.000); RMSEA = 0.10; GFI = 0.940; CFI = 0.940; IFI = 0.956; NNFI = 0.935

[e] Long-term organizational focus confirmatory independent model: χ^2 = 55,947 (*p* = 0.000); RMSEA = 0.18; GFI = 0.870; CFI = 0.829; IFI = 0.831; NNFI = 0.748

Appendix B. Descriptive Statistics

Variables	Mean	Sd.	1	2	3	4	5
Industry	0.48	-					
Services	0.34	-					
Other sectors	0.18	-					
Exploitation Innovation	1.40	0.62					
Exploration Innovation	1.99	0.61					
1. Ambidexterity score	2.61	1.05	1.0000				
2. Short-term organizational focus	0.97	0.28	0.2848	1.0000			
3. Long-term organizational focus	1.71	0.71	0.0877	0.2062	1.0000		
4. Competence exploitation	1.39	0.54	0.3600	0.5159	0.4416	1.0000	
5. Competence exploration	2.99	0.96	0.1034	0.3408	0.6263	0.4751	1.0000

References

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

Adner, R. and Helfat C.E. (2003). Corporate effects and dynamic managerial capabilities. *Strategic Management Journal*, 24, 1011-1025.

Aiken, M., and Hage J. (1971). The organic organization and innovation. *Sociology*, 5, 63-82.

Aiken, L.S. and West S.G. (1991). *Multiple Regression: Testing and Interpreting Interactions*. Sage Publications, Newbury Park, CA.

Amabile, T.M., R. Conti, H. Coon, J. Lazenby and Herron M. (1996). Assessing the work environment for creativity. *Academy of Management Journal*, 39, 1154-1184.

Amabile, T.M. and Conti R. (1999). Changes in the work environment for creativity during downsizing. *Academy of Management Journal*, 42, 630-640.

Anderson, P. and Tushman M.L. (1990). Technological discontinuities and dominant designs: A cyclical model of technological change. *Administrative Science Quarterly*, 35, 604-633.

Argyres, N.S. and Silverman B.S. (2004). R&D, Organization structure, and the development of corporate technological knowledge. *Strategic Management Journal*, 25, 929-958.

Atuahene-Gima, K. (2005). Resolving the capacity-rigidity paradox in new product innovation. *Journal of Marketing*, 69, 61-83.

Barnard, C. (1938). *The Functions of the Executive*. Harvard: Harvard University Press.

Baylin, L. (1985). Autonomy in the industrial R&D lab. *Human Resource Management*, 24, 129-146.

Benner, M.J. and Tushman M.L. (2003). Exploitation, exploration, and process management: The productivity dilemma revisited. *Academy of Management Review*, 28, 238-256.

Burgelman, R.A. (1983). A model of the interaction of strategic behavior, corporate context, and the concept of strategy. *Academy of Management Review*, 8, 61-71.

Cardinal, L.B. (2001). Technological innovation in the pharmaceutical industry: The use of organizational control in managing research and development. *Organization Science*, 12, 19-37.

Chandler, L.V. 1962. *Strategy and Structure: Chapters in the History of American Industrial Enterprise*. Cambridge: MIT Press.

Cheng, Y.T. and Van de Ven A.H. (1996). Learning the Innovation Journey: Order out of Chaos? *Organization Science*, 7, 593-614.

Christensen, C.M. and Overdorf M. (2000). Meeting the Challenge of Disruptive Change. *Harvard Business Review*, 78, 66-76.

Chin, W.W. (1998). Issues and Opinion on Structural Equation Modeling. *MIS Quarterly*, 22, 7-17.

Clark, K.B. and Fujimoto T. (1991). *Product development performance: strategy, organization, and management in the world auto industry*, Boston: Harvard Business School Press.

Cox, D.R. and Wermuth N. (1996). *Multivariate dependencies-Models, analysis and interpretation*, London: Chapman & Hall.

Crampton, S.M. and Wagner J.A. (1994). Percept-percept inflation in micro-organizational research: An investigation of prevalence and effect. *Journal of Applied Psychology*, 79, 67-76.

Danneels, E. (2002). The dynamics of product innovation and firm competences. *Strategic Management Journal*, 23, 1095-1121.

Deshpande, R. and Zaltman G. (1982). Factors affecting the use of market research information: A path analysis. *Journal of Marketing Research*, 19, 14-31.

Dewar, R.D. and Dutton J.E. (1986). The adoption of radical and incremental innovations: An empirical analysis. *Management Science*, 32, 1422-1433

Dosi, G., Teece, D.J. and Winter, S. (2000). *The Nature and Dynamics of Organizational Capabilities*, Oxford, Oxford University Press.

Dougherty, D. and Hardy C. (1996). Sustained product innovation in large, mature organizations: Overcoming innovation-to-organization problems. *Academy of Management Journal*, 39, 1120–1153.

Eisenhardt, K.M. (1985). Control: Organizational and Economic Approaches. *Management Science*, 31, 134-149.

Eisenhardt, K.M. and Martin, J.A. (2000). Dynamic capabilities: what are they? *Strategic Management Journal*, 21, 1105–1121.

Flamholtz, E.G. (1979). Organizational control systems as a managerial tool. *California Management Review*, 22, 50-59.

Ford, C. 1996. A theory of individual creative action in multiple social domains. *Academy of Management Review*, 21, 1112-1142.

Gatignon, H., M.L. Tushman, W. Smith and Anderson P. (2002). A structural approach to assessing innovation: Construct development of innovation locus, type, and characteristics. *Management Science*, 48, 1103-1122.

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

Gilsing, V. and Nooteboom B. (2006). Exploration and exploitation in innovation systems: The case of pharmaceutical biotechnology. *Research Policy*, 35, 1-23.

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

Gupta, A.K., K.G. Smith and Shalley C.E. 2006. The interplay between exploration and exploitation. *Academy of Management Journal,* 49, 693-706.

Hair, J.F., R.E. Anderson, R.L. Tatham and Black W.C. (1998). *Multivariate Data Analysis with Readings*. Upper Saddle River: Prentice-Hall.

Hamel, G. (2009). Moon Shots for Management, *Harvard Business Review*, February, 91-98.

He, Z.-L. and Wong P.K. (2004). Exploration vs. exploitation: An empirical test of the ambidexterity hypothesis. *Organization Science,* 15, 481–494.

Jansen, J.J.P. (2005). *A Multiple-level study of absorptive capacity, exploratory and exploitative innovation and performance*. Unpublished doctoral dissertation, RSM Erasmus University, Rotterdam, Netherlands.

Jansen, J.J.P., Van den Bosch F.A.J and Volberda H.W. (2005). Exploratory innovation, exploitative innovation, and ambidexterity: The impact of environmental and organizational antecedents. *Schmalenbach Business Review*, 57, 351-363.

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*, 52, 1661–1674.

Jöreskog, K.G. and Sörbom D. 1984. *LISREL-VI: Analysis of Linear Structural Relationships by the Method of Maximum Likelihood*. Mooresville: Scientific Software Inc.

Katila, R. and Ahuja G. (2002). Something old, something new: A longitudinal study of search behavior and new product introduction. *Academy of Management Journal*, 45, 1183–1194.

Kaplan, D. and Wenger R.N. (1993). Asymptotic independence and separability in covariance structure models: Implications for specification error, power, and model modification. *Multivariate Behavioral Research,* 28, 467-482.

Kremen Bolton, M.K. (1993). Organizational innovation and substandard performance: When is necessity the mother of innovation ? *Organization Science*, 4, 57-65.

Krishnan, R., Martin, X., and Noorderhaven N.G. (2006). When does trust matter to alliance performance? *Academy of Management Journal*, 49(5), 894-917.

Lawrence, P. and Lorsch J. (1967). Differentiation and Integration in Complex Organizations. *Administrative Science Quarterly*, 12, 1-30

Leonard-Barton, D. (1992). Core capabilities and core rigidities: A paradox in managing new product development. *Strategic Management Journal,* 13, 111-125.

Levinthal, D.A. and March J.G. (1993). The myopia of learning. *Strategic Management Journal,* 14, 95-112.

March, J.G. (1991). Exploration and exploitation in organizational learning. *Organization Science*, 2, 71-87.

March, J.G. (1996). Continuity and change in theories of organizational action. *Administrative Science Quarterly*, 41, 278-287.

McGrath, R.G. (2001). Exploratory learning, innovative capacity and managerial oversight. *Academy of Management Journal,* 44, 118–131.

Mintzberg, H. (1979). *The Structuring of Organizations*. Englewood Cliffs: Prentice-Hall.

Mom, T.J. M, Van Den Bosch, F.A.J. and Volberda, H.W. (2007). Investigating Managers' Exploration and Exploitation Activities: The Influence of Top-Down, Bottom-Up, and Horizontal Knowledge Inflows. *Journal of Management Studies*, 44, 910-931.

Nerkar, A. (2003). Old is gold? The value of temporal exploration in the creation of new knowledge. *Management Science*, 49, 211–229.

O'Reilly C.A. and Tushman M.L. (2004). The ambidextrous organization. *Harvard Business Review*, 82, 74-81.

O'Reilly C.A. and Tushman M.L. (2007). *Ambidexterity as a dynamic capability: Resolving the innovator's dilemma*, Research Paper N°1963, Stanford.

Ouchi, W.G. and Maguire M.A. (1975). Organization control: Two functions. *Administrative Science Quarterly*, 20, 559-569.

Palacios Marques, D., Garrigos Simon, F.J. and Devece Caranana, C. (2006). The Effect Of Innovation On Intellectual Capital: An Empirical Evaluation In The Biotechnology And Telecommunications Industries, *International Journal of Innovation Management*, 10(1), p. 89-112.

Park, S.H., R. Chen and Gallagher S. (2002). Firm resources as moderators of the relationship between market growth and strategic alliances in semiconductor start-ups. *Academy of Management Journal*, 45, 527–545.

Pfeffer, J. and Salancik G.R. (1978). *The External Control of Organizations: A Resource Dependence Perspective*. New York: Harper.

Porter, M.E. (1991). Towards a dynamic theory of strategy. *Strategic Management Journal*, 12, 95-117.

Rumelt, R.P., D. Schendel and Teece D.J. (1991). Strategic management and economics. *Strategic Management Journal*, 12, 5-29.

Safizadeh, M.H., L.P. Ritzman, D. Sharma and Wood C. (1996). An empirical analysis of the product-process matrix. *Management Science*, 42, 1576-1591.

Sidhu, J.S., H.W. Volberda and Commandeur H.R. (2007). The multifaceted nature of exploration and exploitation. *Organization Science*, 18, 20-38.

Sirmon, D.G., M.A. Hitt and Ireland R.D. (2007). Managing firm resources in dynamic environments to create value: Looking inside the black box. *Academy of Management Review*, 32, 273-292.

Smith, W.K. and Tushman M.L. (2005). Managing strategic contradictions: A top management model for managing innovations streams. *Organization Science*, 16, 522-536.

Snell, S.A. (1992). Control theory in strategic human resource management: the mediating effect of administrative information. *Academy of Management Journal*, 35, 292-327.

Souder, W.E. (1987). *Managing New Product Innovations*. Lexington Books, MA.

Teece, D.J. (1986). Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy. *Research Policy*, 15, 285-305.

Teece, D.J., G. Pisano and Shuen A.. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18, 509-533.

Teece, D.J. (2003). *Explicating dynamic capabilities: Asset selection, coordination, and entrepreneurship in strategic management theory*. WP, University of California, Berkeley.

Teece, D.J. (2006). *Explicating dynamic capabilities: The nature and microfoundations of (long run) enterprise performance*. WP, University of California, Berkeley.

Toulmin, S. (1969). *The Uses of Argument*, Cambridge, England: Cambridge University Press

Tushman, M.L. and Anderson P. (1986). Technological discontinuities and organizational environments. *Administrative Science Quarterly,* 31, 439–465.

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

Tushman, M.L. and O'Reilly C. (1997). *Winning Through Innovation*. Boston: Harvard Business School Press.

Van de Ven, A.H. (1986). Central problems in the management of innovation. *Management Science*, 32, 590-607.

Venkatraman, N. and Ramanujam V. (1986). Measurement of business performance in strategy research: A comparison of approaches. *Academy of Management Review,* 11, 801-814.

Verona, G. and Ravasi D. (2003). Unbundling dynamic capabilities: an exploratory study of continuous product innovation. *Industrial and Corporate Change*, 12, 577-606.

Volberda, H.W. (1996). Toward the flexible form: How to remain vital in hypercompetitive environments. *Organization Science*, 7, 359-374.

Woodman, R.W., J.E. Sawyer and Griffin R.W. (1993). Toward a theory of organizational creativity. *Academy of Management Review*, 18, 293-321.

X, Y, Z, 2008.