Ambidextrous innovation

Research into the relation between organizational antecedents and ambidexterity on a department level with transactional and translational leadership style as moderating variables

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Graduation group Innovation in the supply chain
Date            29-Jun-2010
Table of content

Chapter 1  Introduction ................................................................................................................ 6

Chapter 2  Conceptual framework and hypotheses ................................................................. 9
  Willingness to cannibalize ........................................................................................................ 10
  Constructive conflict ................................................................................................................ 11
  Environmental scanning .......................................................................................................... 12
  Slack resources ....................................................................................................................... 13
  Moderating effect of leadership style ..................................................................................... 15

Chapter 3  Analytical Method ................................................................................................. 21
  Research field .......................................................................................................................... 21
  Choice of method .................................................................................................................... 22
  Data collection ......................................................................................................................... 23
  Organizational antecedents (independent variables) ............................................................ 25
  Exploration, exploitation and ambidexterity (dependent variables) ..................................... 25
  Leadership style (moderating variables) ................................................................................ 26
  Control variables ..................................................................................................................... 27

Chapter 4  Analysis and results ............................................................................................... 29

Chapter 5  Conclusion, discussion and recommendations ..................................................... 36

Chapter 6  References ............................................................................................................. 41

Chapter 7  Appendix ............................................................................................................... 46
  Questionnaire ......................................................................................................................... 46
  Correlation classification ......................................................................................................... 48
Summary

Innovation is essential for sustaining a competitive advantage in today’s changing environment and intensifying competition (Roberts 1999; Gibson and Birkinshaw 2004; He and Wong 2004; Prajogo 2006). In the pursuit of innovation firms can focus on exploiting existing competencies or exploring new ones. Exploitative innovation is essential for generating short term results and due to the more certain outcomes it has had the primary focus of many firms (Rappaport 2005; Christensen, Kaufman et al. 2008). However, in order to ensure long term survival, firms need to explore new options in order to be ready for future changes in the environment. The challenge for firms is to ensure that current activities are run efficiently to satisfy the short term demands, and at the same time be prepared for the future to retain long term competitiveness. The ability to pursue exploration as well as exploitation is referred to as organizational ambidexterity. Even though previous research has confirmed that ambidexterity results in sustainable advantages which improves a firm’s competitiveness (Jansen, van den Bosch et al. 2005), few studies have examined the drivers of ambidexterity. This research focuses on organizational values and practices that enable the management of conflicting demands of exploration and exploitation. It includes four organizational antecedents that have proven to affect explorative innovation but have not been researched in the context of ambidexterity (Danneels 2008). In addition, leadership style is assumed to moderate the relation between these antecedents and ambidexterity. Leadership affects the organizational learning process by communicating a vision that can maximize the creativity of individuals by affecting team and organizational conditions that foster innovation (Ford 1996; Mumford, Scott et al. 2002; Shalley and Gilson 2004). Even though previous research has indicated the importance of leadership style in the context of innovation, literature on leadership in the context of achieving ambidexterity is scarce. The aim to further develop knowledge on how to achieve ambidexterity is addressed by investigating the following research questions:

- How do organizational antecedents affect ambidexterity within a unit?
- How does leadership style moderate the relation between organizational antecedents and ambidexterity?

The hypothesized relationships between the constructs included in our model have been studied using quantitative data obtained in pharmaceutical industry. Finding support for drivers of ambidexterity is of particular importance to this industry since it struggles with obtaining a level of innovation required for long term survival (Munos 2006). This research has been performed in different departments belonging to the same pharmaceutical company, Merck & Co., Inc. The hypothesized relationships have been tested using a questionnaire. The analyses were performed on a data set of 162 respondents after elimination of data on the basis of quality (respondents with double answers or overlooked reversed questions were
removed) and Rasch analysis. All variables showed sufficient internal consistency or reliability with the exception of variable willingness to cannibalize, meaning that the results concerning willingness to cannibalize are unreliable.

The results indicate that willingness to cannibalize, constructive conflict, scanning and slack are positively and significantly related to ambidexterity. The most interesting findings concern the results found for explorative innovation and exploitative innovation separately. The results for exploration and exploitation suggest that the four organizational antecedents affect ambidexterity via a different route. Willingness to cannibalize and constructive conflict are positively related to exploitative innovation but not to explorative innovation. In contrast, scanning and slack are related to explorative innovation but not to exploitative innovation. This proposes an interesting approach for managers. When strategy implies that exploitative innovation needs to be increased our data suggest that the most effective way would be to increase the preparedness to reduce the actual or potential value of its investments and encourage the debate of ideas, beliefs and assumptions. When strategy implies that explorative innovation needs to increase, managers are better of encouraging scanning the environment for opportunities and maintaining a strategic slack of human capacity.

The data did not support the hypothesized positive moderating effects of transformational leadership or the hypothesized negative moderating effects of transactional leadership. In fact, the data did not show any significant moderating effects of leadership style in the relation to ambidexterity. Reasons for the deviating results for leadership style have been sought in the complexity of the relation between leadership style and innovation. Previous research has used different approaches to test the relationship between leadership style and innovation. Next to the proposed moderating properties of leadership style (Jansen, George et al. 2008), leadership style has also been researched as a direct variable to innovation (Jansen, Vera et al. 2009). Another possibility is that leadership directly effects the organizational antecedents of ambidexterity.

Using our data, the addition of leadership style as a direct independent variable resulted in significant positive relations between both leadership styles and ambidexterity. Also the adjusted R\(^2\) increases from 21% to 25% which indicates increased predictability of ambidexterity (see table 10). Even though the explanatory level of the model increases when leadership style is added, the results deviate from previously published results. For example transactional leadership is found to have a direct positive relationship with exploration where previous research argues and finds support for a negative relationship (Jansen, Vera et al. 2009).
Another complicating factor is that leadership is present on many levels within an organization and the antecedents tested differ in their perceived strategic importance. The question is which levels of leadership and potential relations should be considered when researching leadership in the context of innovation. Looking at the amount of possibilities of ways in which leadership can effect innovation, future research into organizational antecedents of innovation should take the perceived strategic level of an organizational antecedent into account and the hierarchical levels of leadership affecting this antecedent either directly or as a moderator for the relation to ambidexterity.

Previous literature on organizational ambidexterity has highlighted the challenge of creating organizational values and practices that enable the management of conflicting demands within one unit (Bledow, Frese et al. 2009). This research contributes to existing literature by showing that willingness to cannibalize, constructive conflict, scanning and slack are positively related to ambidexterity on a departmental level. More specifically, it suggest that increasing willingness to cannibalize and constructive conflict is especially useful for increasing exploitation whereas increasing scanning and slack will increase exploration.
An important driver of business performance is the ability to innovate (Roberts 1999; Gibson and Birkinshaw 2004; He and Wong 2004; Prajogo 2006). Changing environments and intensifying competition make innovation essential for sustaining competitive advantage (Kim and Mauborgne 1999). Due to the pace of change firms are increasingly confronted with a tension between exploiting existing competencies and exploring new ones (Floyd and Lane 2000). A focus on extending existing products and services for current markets (Jansen, van den Bosch et al. 2006) is the safer option because of the more certain short term outcomes. Due to a short term focus and avoidance of risk, exploitative innovation has been the focus of many firms (Rappaport 2005; Christensen, Kaufman et al. 2008). It is essential for generating short term results but has the risk of resulting in a competence trap (Ahuja and Lampert 2001) which makes firms inflexible and unable to respond to changes in the environment (Sorensen and Stuart 2000). Too much emphasis on exploitation can therefore be detrimental to the long term competitiveness of a firm. In contrast, a focus on exploring new knowledge to develop products and services for emerging customers and markets sacrifices short term gains in order to insure long term survival (Jansen, van den Bosch et al. 2006). Excessive exploration however results in over sensitivity to short term variations and local errors (Volberda and Lewin 2003). It can prevent a firm from taking the short term advantages of exploitation. The challenge for firms is to both ensure current activities are run efficiently to satisfy the short term demands and be prepared for the future to retain long term competitiveness. The ability to pursue exploitation as well as exploration is referred to as organizational ambidexterity.

Several studies have focused on the competitive benefits of ambidexterity and found that achieving high levels of both exploration and exploitation results in sustainable advantages which improves a firms’ competitiveness (Jansen, van den Bosch et al. 2005, Gibson and Birkinshaw 2004, He and Wong 2004). Research into the drivers of ambidexterity found that decentralization and densely connected social relations helps achieving ambidexterity (Jansen, van den Bosch et al. 2005, Tushman and O’Reilly 1996). Gibson and Birkinshaw (2004) found that the four behavioral framing attributes stretch, discipline, support, and trust are positively related to the level of ambidexterity. Our understanding of how to achieve ambidexterity through organizational antecedents however is still limited, which is surprising considering the importance of achieving ambidexterity for generating short term results and long term survival.

The aim of this research is to extend our understanding on how ambidexterity can be achieved. It tries to accomplish this by testing the relation between four informal organizational antecedents and ambidexterity. These antecedents are willingness to cannibalize which refers to the extent to which a firm is prepared to reduce the actual or potential value of its investments, constructive conflict which refers to
the debate of ideas, beliefs and assumptions by employees leading to mutual interest and understanding, scanning which refers to the activity of learning events and trends in the organization’s environment and which facilitates opportunity recognition and slack which refers to the reserve of resources that is in excess of what is needed for the immediate continuation of the firm’s operations. By testing these antecedents on unit level this research focuses on creating organizational values and practices that enable the management of conflicting demands of exploration and exploitation within one unit (Bledow, Frese et al. 2009). In other words, using the typology suggested by Simsek (2009), this research focuses on independent ambidexterity meaning that it exists harmoniously within a single organizational unit.

Leadership affects the organizational learning process by communicating a vision that can maximize the creativity of individuals by affecting team and organizational conditions that foster innovation (Jansen, Vera et al. 2009; Ford 1996; Mumford, Scott et al. 2002; Shalley and Gilson 2004). Even though previous research has indicated the importance of leadership style in the context of innovation, literature on leadership in the context of obtaining ambidexterity is scarce. Leadership has been proposed to moderate the relationship between senior team attributes and organizational ambidexterity (Jansen, George et al. 2008). Our research follows this approach and tests the moderating properties of leadership style on the relation between the organizational antecedents and ambidexterity (see figure 1 for conceptual model). Jansen (2008) did not find support for the suggested moderating effect of leadership. As an explanation for the lack of moderating effect he suggested that the hierarchical level of the test group he used was too high. He suggested that the importance of leadership on the effectiveness of organizational members should be tested on a lower hierarchical level. A suggestion incorporated in this research.

![Overall conceptual model](image)

A much used classification of leadership style is that of Bass (Avolio and Bass 2004). Bass identified two main types of leadership, transformational leadership and transactional leadership both comprising several underlying leadership properties. Transformational leadership has been characterized as one who articulates a vision of the future that can be shared with peers and subordinates, intellectually stimulates subordinates and pays high attention to individual differences among people. Transactional leadership
exchanges rewards contingent upon a display of desired behaviors (Waldman, Bass et al. 1987). This research includes both transformational as well as transactional leadership.

The aim to further develop knowledge on how to achieve ambidexterity is addressed by investigating the following research questions;

- How do the four organizational antecedents discussed affect ambidexterity?
- Does leadership style moderate the relation between these organizational antecedents and ambidexterity, and if so how?

By developing and testing the proposed model, this research contributes to existing literatures in several ways. First, previous literature on organizational ambidexterity has highlighted the challenge of creating organizational values and practices that enable the management of conflicting demands within one unit (Bledow, Frese et al. 2009). Few studies however have actually tested the drivers of ambidexterity. This study tests the level of organizational antecedents and ambidexterity and discusses the potential relations found. Secondly, previous literature has highlighted the importance of transformational leadership as a moderator for the relation between antecedents and ambidexterity. However, the hierarchical level used to test leadership style was argued to be too high to find a significant moderating effect. This research tests the potential moderating effect of leadership style on a low hierarchical level and includes transactional leadership, a leadership style never before tested in the context of ambidexterity.

This research has been performed using quantitative data to examine the relationship between the constructs. As research subject the pharmaceutical industry was chosen. Even though the pharmaceutical industry has produced innovations in the past that resulted in major contributions to public welfare it is generally known that this industry today struggles with obtaining a level of innovation required for long term survival (Munos 2006). Finding support for drivers of innovation is therefore particularly of importance to this industry. This research has incorporated different organizational units ranging from pure R&D type departments to production units. All units tested are located in The Netherlands and belong to the same, currently largest, pharmaceutical company.

This essay starts with a literature review which specifies the theoretical domains of the constructs and a conceptual model that hypothesizes relationships between the constructs (chapter 2). This is followed by a chapter devoted to the analytical method explaining in more detail the quantitative method used including the development of the questionnaire and the collection of quantitative data (chapter 3). Chapter four focuses on the results which are presented in nine different models evaluating all postulated hypotheses. The last chapter provides the conclusions, discussion and recommendations for future research (chapter 5).
Chapter 2  Conceptual framework and hypotheses

In the context of organizational learning the distinction between exploration and exploitation has been made to describe two distinct types of innovation (March 1991). Exploration refers to radical innovations that are designed to meet the needs of emerging customers and markets (Danneels 2002). It departs from established systems of production, and opens up new linkages to markets and users, offers new designs, and develops new channels of distribution (Abernathy and Clark 1985). Exploration is captured by terms as search, variation, risk-taking experimentation, play, flexibility and discovery (March 1991). It requires new knowledge or departure from existing knowledge (Levinthal and March 1993; McGrath 2001). Conversely, exploitation refers to incremental innovations that are designed to meet the needs of existing customers or markets (Danneels 2002; Benner and Tushman 2003; Jansen 2005). It involves change that builds on established competence and focuses on improving established designs, expanding existing products and services, and increasing the efficiency of existing distribution channels (Abernathy and Clark 1985). Exploitation includes refinement, production, efficiency, and execution and in doing so creates reliability (March 1991; Holmqvist 2003).

The ability to pursue both explorative as well as exploitative innovation is referred to as organizational ambidexterity (Jansen, van den Bosch et al. 2005). Ambidexterity indicates a high degree of balance between exploitation and exploration, as its name meaning ‘right on both sides’ suggest (Simsek 2009). It can exists harmoniously within a single organizational unit, referred to as independent ambidexterity or it can be pursued across departments, referred to as interdependent ambidexterity (Simsek, Heavey et al. 2009). From a resource based view the ability to pursue exploitation and exploration simultaneously is considered a valuable, rare and costly to imitate capability. Therefore this ability can be a source of competitive advantage (Simsek 2009). Gibson and Birkinshaw (2004) argued that ambidextrous business units, i.e. business units that are simultaneously adaptive and aligned, obtain superior performance. They surveyed multiple respondents per business unit of large multinational firms and found that ambidexterity is significantly related to higher financial performance. This was supported by He and Wong (2004) who found a positive relation between explorative and exploitative innovation strategies to sales growth rate and a negative relation between the relative imbalance between explorative and exploitative innovation strategies and sales growth rate. While several studies have focused on the competitive benefits of ambidexterity, understanding of antecedents of ambidexterity is still limited. Previous research has shown that organizational units with decentralized and densely connected social relations are able to act ambidextrously and pursue exploratory and exploitative innovations simultaneously (Jansen, van den Bosch et al. 2005). On an executive level, team shared vision and contingency rewards have also been positively linked to ambidexterity (Jansen, George et al. 2008). Tushman and O'Reilly (1996) identified a
decentralized structure, a common culture and vision, and supportive leaders and flexible managers as the key sources of ambidexterity. Gibson and Birkinshaw (2004) have found that the four behavioral framing attributes stretch, discipline, support, and trust that together define organizational context are positively related to the level of ambidexterity.

Most research concerning the relation between organizational antecedents and innovation has focused on radical explorative innovation (Berson and Nemanich 2006, Hannah and Lester 2009). One example is a recent study that has tested the relationship between several organizational antecedents and exploration (Danneels 2008). Of these, the following variables showed to be significantly correlated to this type of innovation;

- willingness to cannibalize which refers to the extent to which a firm is prepared to reduce the actual or potential value of its investments.
- constructive conflict which refers to the debate of ideas, beliefs and assumptions by employees leading to mutual interest and understanding.
- scanning which refers to the activity of learning events and trends in the organization’s environment and which facilitates opportunity recognition.
- slack which refers to the reserve of resources that is in excess of what is needed for the immediate continuation of the firm’s operations.

Since exploitation and exploration are two distinct types of innovation their relation to organizational antecedents can be different. When striving for ambidexterity it is important to understand relations to both exploration and exploitation. Exploitation is essential for generating short term results and should not be overlooked. Exploration is essential to maintain a competitive advantage in the long term (Ahuja and Lampert 2001). Building on the Danneels research we study the relationship between these antecedents and ambidexterity. The next chapters will focus on these antecedents and their proposed relationship to ambidexterity based on the relation to exploration found by Danneels and the relation to exploitation argued in this paper.

**Willingness to cannibalize**

The effects of radical innovation on a firm’s profits can be large, positive, and long-lasting (Geroski, Machin, and Van Reenen 1993). However, radical innovations have the capacity to destroy the fortunes of firms (Foster 1986; Tushman and Anderson 1986). Costly investments made over the years may suddenly become useless because they cannot be applied to a new generation of products. The extent to which a firm is prepared to reduce the actual or potential value of its investments in assets and organizational routines is captured by the term willingness to cannibalize (Chandy and Tellis 1998). Willingness to cannibalize is counteracted by the tendency within many firms to protect assets that produce value.
Previous research has shown that willingness to cannibalize has a strong positive effect on radical product innovation (Chandy and Tellis 1998, Danneels 2008). For example Mols (2001) has found that willingness to cannibalize is positively related to the introduction of new distribution channels which is one of the items used to test explorative innovation.

Exploitative innovation deals with increasing the efficiency of producing and marketing existing products and services and is essential for generating short term results. Due to the more certain outcomes it has been the primary focus of many firms (Rappaport 2005; Christensen, Kaufman et al. 2008). An important incentive for continuously improving the efficiency of processes is the pressure to lower prices to retain competitiveness. This can be achieved for example by changing to larger scale equipment (increased economies of scale) or making changes to the distribution channel. These activities, viewed as exploitative innovations, also lead to cannibalization of current assets. In this line of thought willingness to cannibalize increases exploitative innovation. Chandy and Tellis (1998) state that cannibalization often occurs in the context of incremental new products or line extensions. It is therefore surprising that the relationship between willingness to cannibalize and exploitative innovation has so far not been explored.

The confirmed positive relation between willingness to cannibalize and exploration and the expected positive relation between willingness to cannibalize and exploitation, makes this variable a likely antecedent to ambidexterity. This research investigates the effect willingness to cannibalize has on ambidexterity and postulates the following hypothesis;

Hypothesis 1: Willingness to cannibalize is positively related to ambidexterity.

Constructive conflict

A healthy dose of conflict plays an important role in fostering innovation (Dyer and Song 1998). Constructive conflict refers to the debate of ideas, beliefs and assumptions by employees leading to mutual interest and understanding (Tjosvold 1985). It can lead to energized personnel when members explore opposing views and experience positive change. Constructive conflict has been explored in the context of product development, a form of explorative innovation and found to be positively related to new product development success (Dyer and Song 1998; Varela, Fernandez et al. 2005). Danneels (2008) has found a positive relation between constructive conflict and second order competences, which is defined as the competence to add competences and corresponds to explorative innovation.

Exploitative innovation focuses on improving existing products and processes. All types of innovation start with creative ideas, and it is individuals or groups who generate, promote, discuss, modify, and ultimately realize ideas (Janssen, Vliert and West 2004). Lack of conflict amongst team members results in
overlooked information and observations vital to identify opportunities for exploitation (Souder 1988). Constructive conflict can be a catalyst to vigorous debate and creative thinking (Flanegan 2009). Since constructive conflict stimulates the creation of new ideas, it is suspected to be positively related to exploitative innovation. So far, the relation between constructive conflict on exploitative innovation has not been tested.

Ambidexterity is determined by level of exploration and exploitation. The confirmed positive relation between constructive conflict and exploration and the expected positive relation between constructive conflict and exploitation, makes constructive conflict a likely antecedent to ambidexterity. This research investigates the effect constructive conflict has on ambidexterity and postulates the following hypothesis;

Hypothesis 2: Constructive conflict is positively related to ambidexterity.

**Environmental scanning**

In the process of product innovation including idea generation, evaluation of these ideas, product development and testing and finally product launch, very few initial ideas eventually turn into commercially successful products (Stevens and Burley, 1997). Alignment to the market through capturing the voice of the customer (Cooper, 1999) and pursuing technological innovations, are recognized as influential factors for explaining product innovation success (Borjesson, Sahlsten and Williander 2006). One potential method for improving business alignment to the environment in the early phases of product development is environmental scanning. Environmental scanning refers to the activity of learning events and trends in the organization’s environment, which facilitates opportunity recognition (Barringer and Bluedorn 1999). Monitoring and analyzing the environment enhances the recognition of opportunities in terms of new markets and new technologies (Daft, Sormunen et al. 1988). Knowing the range of technologies available in the market and understanding technological trends is necessary to decide between developing R&D or acquiring technology in the market (Arbusa and Koeders 2007). Previous research has shown that environmental scanning significantly contributes to the firm’s explorative innovation capabilities (Danneels 2008).

Due to time constraints and budget pressures new product development is rarely executed to the extent that no further optimization is needed once a product turns commercial. At best, products need to be maintained but more often processes need to become more efficient by optimizing raw material use, increasing scale or decreasing the amount of waste (like deviations) over time. Achieving these exploitative innovations requires ideas how to do so. Environmental scanning by organizational members brings diverse information into the firm, which may increase the richness of knowledge inside the firm and opens eyes to opportunities of exploitation (Damanpour 1991). This reasoning assumes a positive relation
between environmental scanning and exploitation. Until now, no research has focused on the relation between exploitative innovation and scanning.

Previous research has shown that scanning is positively related to exploration. In this research it is reasoned that scanning is also positively related to exploitation. Combining these relationships environmental scanning becomes a likely positive antecedent to ambidexterity.

*Hypothesis 3: Scanning is positively related to ambidexterity.*

**Slack resources**

Organizational slack represents a reserve of resources that is in excess of what is needed for the immediate continuation of the firm’s operations and is therefore available for innovative activities (Danneels 2008). It is the cushion of actual or potential resources which allows an organization to adapt successfully to internal pressures for adjustment or to external pressures for change in policy (Bourgeois 1981; Lawson 2001). Slack is necessary to cope with environmental change and to innovate for the future (Judge and Blocker 2008).

The concept of organizational slack has received attention because of its potential to foster innovation (Bourgeois 1981; Cyert and March 1963). It has also been argued however that organizational slack is wasteful, inefficient, and accumulates due to the self-serving interests of managers (Jensen and Meckling 1976; Nohria and Gulati 1996; Simon 1957). The opposing notions on the role of slack have led researchers to conclude that when it comes to innovation, slack can be both a blessing and a curse. More specifically, Nohria and Gulati (1997) showed that an inverted U-shaped relationship exists between slack and innovation. Moderate levels of slack were found to positively impact firm innovation, but at some point too much slack had a negative effect. This was confirmed by Danneels who found a linear contemporaneous correlation between slack and explorative innovation and an U shaped correlation between slack and its lagged explorative innovation (Danneels 2008). For R & D intensive firms, recoverable slack appears to have a positive impact on the use of science in innovation such that firms are less worried about the risks of exploration due to the excess resources within the firm. For example, recoverable slack in the sense of employing more scientists than necessary can enhance the innovation process because more people will have the time to engage in the more time consuming process of scientific discovery. In other words, having more scientists than needed implies that they would have more time to explore new technologies as opposed to just focusing on exploiting existing ones.

Research on the relationship between slack resources and exploitative innovation is very limited. Geiger and Makri (2006) stated that the buffering mechanism enabled by available excess resources facilitates
exploration and exploitation innovation processes. Technological knowledge supports an incremental search process where research activities are tightly linked to prior research activities. These local processes involve exploiting existing technologies to develop incremental innovations. Geiger tested the relationship between organizational slack and exploitation and found support for a positive relationship between the two. Geiger used a measure that reflects the extent to which a firm’s patent cites previous patents that belong to a wide set of technologies to test exploitation. An important question arising from testing exploitation using a patent related measure is to what extent are exploitative innovations patented. Exploitation does not necessarily imply using a new or different technology. It is expected that many incremental changes to processes, services and supply chain are never captured in patents. Using a patent related measure only captures a small part of exploitation. A more appropriate way would be to test the level of exploitation directly, asking firm’s members the degree in which exploitation takes place. In this research the relationship between slack and exploitative innovation is tested independent of whether they are captured in a patent. This way we hope to capture exploitation to a greater extent.

Achieving high levels of both exploration and exploitation to obtain an ambidextrous organization will result in sustainable advantages which improves a firms’ competitiveness (Jansen, van den Bosch et al. 2005). Since organizational slack has proved to be an antecedent to both exploitation and exploration it is a likely antecedent to ambidexterity. This research investigates the effect organizational slack has on ambidexterity and postulates the following hypothesis;

**Hypothesis 4:** Organizational slack is positively related to ambidexterity.

This research builds on previous research and tries to increase understanding on how to achieve ambidexterity by the testing antecedents willingness to cannibalize, constructive conflict, scanning and slack. The figure 2 for the model and hypothesis tested.

![Diagram](image1.png)

**Figure 2.** Conceptual model concerning relationships between organizational antecedents and ambidexterity.
**Moderating effect of leadership style**

Exploration and exploitation are closely related to the framework of organizational learning as proposed by Crossan et al (1999). This framework includes four processes; intuiting, interpreting, integrating and institutionalizing. Exploration is concerned with the processes of entrepreneurial intuition and interpretation of new ideas, and exploitation is concerned with institutionalizing learning by embedding information in systems, structure or routines (Crossan and Berdrow 2003). Leaders affect the organizational learning process by communicating a vision that serves as a source for building a shared language or mental model (Brown and Gioia 2002). The ideas behind a vision tend to be embedded in the organizational context and become more appealing for the people within that context (Van Knippenberg and Hogg 2003). This affects the process of learning as learning goals are framed in the organizational context (Berson, Nemanich et al. 2006). This context can maximize the creativity of individuals by affecting team and organizational conditions that foster innovation (Ford 1996; Mumford, Scott GM et al. 2002; Shalley and Gilson 2004).

Leadership literature frequently distinguishes between transactional and transformation leadership according to Avolio and Bass (2004). Transformational leadership embodies four dimensions: intellectual stimulation, individualized consideration, idealized influence and inspirational motivation. Intellectual stimulation is defined as the degree to which leaders stimulate the effort of their employees to be innovative and creative by questioning assumptions, reframing problems and approaching old situations in new ways. Individualized consideration captures the degree to which leaders pay attention to the need of individuals for achievement and growth by acting as a coach or mentor. Idealized influence represents the degree to which leaders are admired, respected and trusted. This dimension includes charismatic behavior that causes followers to identify with the leader. Inspirational motivation is defined as the degree to which leaders articulate and vision and behave in ways that motivate those around them. Transformation leaders are characterized by Burds (1987) as raising consciousness levels about the importance and value of designated outcomes and ways of achieving them. Transformation leadership is associated with motivating employees to do more than they originally thought possible (Avolio and Bass 2004). It has a positive impact on innovation that challenges institutionalized learning (Vera and Crossan 2004).

Transactional leadership embodies two behaviors: contingent reward and active management by exception. Through contingent reward, transactional leadership clarifies who is responsible for achieving performance targets and what the rewards will be when these targets are met. Through active management by exception, leaders monitor performance and take actions when needed (Avolio et al, 1999). Transactional leaders recognize that employees have needs and desires and clarify how those
needs and desires will be met if the employee performs his task. Such motivation to perform will provide a sense of direction and helps to energize. This approach, which is used in most leadership training programs is helpful but limited to first-order competences (Avolio and Bass 2004).

Previous research has tested the moderating effect of leadership style on the relation between senior team attributes and organizational ambidexterity (Jansen, George et al. 2008). Jansen et al (2008) did not find support for the suggested moderating effect of transformational leadership. The explanation for the lack of moderating effect suggested was that the test group he used consisted of high level team members that would already be committed to and perceive shared goals and values as highly important due to their hierarchical position. Jansen suggested that the importance of transformational leaders on the effectiveness of organizational members should be tested on a lower hierarchical level.

Previous research has indicated the importance of leadership in achieving innovation, however research on the relation between leadership style and exploitation is much less developed than that for exploration (Berson, Nemanich et al. 2006; Hannah and Lester 2009). This seems to be an important gap since ambidexterity has been positively linked to performance. Additionally, ambidexterity can be a source of competitive advantage, because it is difficult to achieve and therefore hard to imitate (Sheremata 2000; Benner and Tushman 2003).

**Willingness to cannibalize**

Innovations have the capacity to destroy the fortunes of firms (Foster 1986; Tushman and Anderson 1986). That is why innovations are sometimes hindered by the profits that emerge from current products and services. Firms tend to protect their profits and object to any change or innovation that might threaten them. The extent to which a firm is prepared to reduce the actual or potential value of its investments in assets and organizational routines is captured by the term willingness to cannibalize (Chandy and Tellis 1998). A willingness to cannibalize assets will allow the firm to get ahead with the next generation of innovations. Willingness to cannibalize assets is expected to have a direct positive effect on ambidexterity (hypothesis 1).

Leadership creates a context that influences the way organizational members operate and make decisions (Van Knippenberg and Hogg 2003). Literature concerning leadership frequently differentiates between transformational leadership and transactional leadership. These two types of leadership style create very different contexts and direct organizational members to do different things. Transformational leaders focus on inspiring members to do more that they thought possible. They create a context that promotes change and risk taking. Any type of innovation involves taking to risk of possible failure and without change there
is no innovation. The expected positive relation between willingness to cannibalize and ambidexterity is therefore expected to increase in a pro-change atmosphere created by transformational leaders.

In contrast, transactional leaders focus on irregularities, failures and deviations. They exchange rewards when members display a desired behavior (Waldman, Bass et al. 1987). The context that transactional leaders create, directs attention to current processes and procedures and avoids risk taking (Jansen, Vera et al. 2009). Innovation, especially radical innovations brings along risk of potential failure. So it is expected that the positive relation between willingness to cannibalize and ambidexterity decreases with the level of transactional leadership.

Hypothesis 5: Transformational leadership positively moderates the relation between willingness to cannibalize and ambidexterity.

Hypothesis 6: Transactional leadership negatively moderates the relation between willingness to cannibalize and ambidexterity.

Constructive conflict

A healthy dose of conflict plays an important role in fostering innovation (Dyer and Song 1998). Creativity and adaptation are born of tension, passion and conflict (Pascale 1990). Pursuing teamwork and harmony can lead to suppression of the creative tension that brings vitality to development activities. Conflict, when managed appropriately, has been found to make teamwork within organizations effective (Tjosvold 2007). This paper hypothesized a positive relation between constructive conflict and ambidexterity (hypothesis 2).

As stated in the previous paragraph concerning willingness to cannibalize, transformational leadership and transactional leadership create very different contexts for organizational members to execute their jobs. In the context created by transformational leaders there is no ridicule or public criticism of individual members’ mistakes. This promotes taking the risk of failure when attempting innovation (Avolio and Bass 2004). Transformational leadership promotes the use of constructive conflict for innovative purposes because they are not afraid of change. It is therefore expected to positively moderate the relation between constructive conflict and ambidexterity.

Transactional leadership focuses the attention on irregularities, mistakes, exceptions, and deviations from standards. The transformational leader specifies the standards for compliance, as well as what constitutes ineffective performance, and may punish followers for being out of compliance with those standards (Avolio and Bass 2004). In the transformational leadership context, constructive conflict will be directed into maintaining a low level of deviations, complaints and failures. Organizational members are
discouraged to induce change or take risks of failure needed to pursue innovation. It is therefore hypothesized that transactional leadership will negatively moderate the relation between constructive conflict and ambidexterity.

_Hypothesis 7: Transformational leadership positively moderates the relationship between constructive conflict and ambidexterity._

_Hypothesis 8: Transactional leadership negatively moderates the relationship between constructive conflict and ambidexterity._

**Scanning**

With the growing flow of information facilitated by technological developments, the challenge for firms is not always producing new information rather it is to recognize and use relevant innovative information (De Bondt, 1996). Few innovative ideas actually make it to implementation, especially in the case of new product development (Borjesson, Dahlsten and Willander 2006). Scanning the environment can increase the amount of ideas that produce innovation. The relation between scanning and ambidexterity is hypothesized to be positive (hypothesis 3).

Secondly, the relationship between scanning and ambidexterity is viewed in the context of transformational and transactional leadership. Transformational leaders stimulate their followers' effort to be creative and question assumptions, reframe problems, and approach old situations in new ways. They get others to look at problems from many different angles and seek differing perspectives when solving problems (Avolio and Bass 2004). The context that transformational leadership creates is one that stimulates looking for new opportunities and using them for innovative purposes, since it is not afraid of changing current assets, processes or procedures. It is therefore expected that transformational leadership positively moderates the relation between organizational scanning for innovation purposes.

Transactional leadership focuses attention on exceptions and deviations and the technology a firm already owns. In the context of transactional leadership, risk will be avoided and attention will be directed towards keeping the status quo. Knowledge found through scanning the environment is not likely to be used for innovation purposes in the context created by transactional leaders. It is therefore expected that transactional leadership negatively moderates the relation between organizational scanning for innovation purposes.

_Hypothesis 9: Transformational leadership positively moderates the relationship between environmental scanning and ambidexterity._
Hypothesis 10: Transactional leadership negatively moderates the relationship between environmental scanning and ambidexterity.

**Slack**

Slack is defined as resources available to an organization that are in excess of the minimum necessary to produce a given level of organizational output. Having too little slack will inhibit innovation by discouraging any form of experimentation whose success is uncertain (Nohria and Gulati 1997). Based on previous research the relation between slack and ambidexterity has been hypothesized to be positive.

Different organizational activities compete for resources and require different organizational contexts for support (March 1991; Tushman, O'Reilly et al. 2002; Benner and Tushman 2003; Gibson and Birkinshaw 2004). This context is in part created by the style of leadership (Van Knippenberg and Hogg 2003). Transformational leaders create a context that stimulates innovation and creative thinking by questioning assumptions, reframing problems, and approaching old situations in new ways. There is no ridicule or public criticism of individual members' mistakes. Transformational leaders share the risk of failure with followers (Avolio and Bass 2004). This makes pursuing innovative ideas more attractive. It is therefore expected that having slack resources in the context of transformational leadership will encourage the use of slack for innovative activities. Transformational leadership is therefore expected to positively moderate the relation between slack and ambidexterity.

Transactional leaders clarify expectations and offers recognition when goals are achieved. It focuses on setting up agreements and specifying the compensation and rewards that can be expected upon successful completion of the tasks. The context created by transactional leadership encourages sticking to the status quo and discourages change (Avolio and Bass 2004). Objectives set be these type of leaders will deal with obtaining low levels of deviations and complains. This context does not stimulate the use of slack for innovative activities, on the contrary, it is expected to be detrimental. Transactional leadership is therefore expected to negatively moderate the relation between slack and ambidexterity.

Hypothesis 11: Transformational leadership positively moderates the relation between organizational slack and ambidexterity significantly.

Hypothesis 12: Transactional leadership negatively moderates the relation between organizational slack and ambidexterity significantly.
This research explores the moderating effect of leadership style by testing leadership style on a low hierarchical level on the relationship between organizational antecedents and ambidexterity. The proposed model and hypothesis are depicted in figure 3.

Figure 3. Conceptual model including the moderating effect of leadership style on the relation between organizational antecedents and ambidexterity.
Chapter 3 Analytical Method

This chapter focuses on the analytical method used to investigate the interrelationships between organizational antecedents, leadership style, exploratory and exploitative innovation and ambidexterity. It explains the choice in analytical method and gives information about the focal company of this research, data collection and how the variables have been tested.

Research field

The target respondent for this research was a low to medium level employee (no management team members) because these people have the best knowledge about the innovative activities pursued on the work floor. Higher level managers will, due to the span of activities they are responsible for, be less up to date on all innovative activities that take place.

Secondly, most innovative ideas come from the level of employees that are involved with product development and production processes. They have to most knowledge about the current way of doing things and should be able to see potential for improvement. Testing the organizational antecedents on a low hierarchical level will give information about the work environment of employees that contribute the largest number of innovative ideas. Also leadership style was tested on a low hierarchical level as recommended in literature (Jansen, George et al. 2008)

Another selection made was based on education level. Only employees with a higher education level were included. This choice was made because of the expected increased quality of the response due to better understanding of the survey questions. The combination of high level education on a low hierarchical level means that the target industry needs to compete on a basis of knowledge and technological complexity. One of the industries complying to these requirements is the pharmaceutical industry. This industry has produced innovations in the past that resulted in major contributions to public welfare. However, it is generally known that this industry today struggles with obtaining a level of innovation required for long term survival (Munos 2006). Finding support for drivers of innovation is therefore of particular importance to this industry.

We have limited our research to a Dutch division of a large global pharmaceutical organization Merck & Co, Inc, named MSD that has given us permission to perform ours research. Merck & Co, Inc, is currently the largest global research-driven pharmaceutical company (over 100,000 employees) that discovers, develops, manufactures and markets a range of products to improve human and animal health. For the selection of departments included in the research a selection has been made on the basis of closeness to
production processes, supply chain and product development. So only departments directly involved in the development, production and distribution were included in the sample.

The departments included in this research are;
- manufacturing department of active pharmaceutical ingredients containing seven plants and a supply chain group
- product development department of active pharmaceutical ingredients
- oral and polymeric products development department
- biopharmaceutics department

The first two departments are located in the manufacturing division of Merck & Co, Inc, and are responsible for developing and manufacturing active pharmaceutical ingredients. The latter two departments are located in the Merck research department and are responsible for research and development of drug products. All departments used in this research are located at a research and production site in Oss, The Netherlands.

The intended low hierarchical level to test our hypothesis meant that the research was performed on department level. For the manufacturing department the research was performed on plant level (this is viewed as department level by employees). The moderator variable, leadership style, was tested on the level of direct managers of employees. For every department three or four levels of employees were included. The lists of employees taking part in this research were set up with the help of the departmental heads and plant managers. The survey was distributed to 322 of the 750 employees from these departments. The large difference between the sample size and population was due to the large number of operators not included because of their education level.

**Choice of method**

The hypnotized relationships postulated in this research have been tested by obtaining quantitative data via a questionnaire. Even though electronic surveys have advantages in that they are easy to use for the respondent, faster in processing data afterwards and less prone to mistakes, the choice for this research has been a paper questionnaire. Two important reasons for choosing a paper version are;

- The small number of people on the distribution list, only 330, which made a high response rate crucial. In order to achieve a high response rate the list was distributed personally.
- A number of potential respondents do not have ready access to internet to complete an electronic survey. Using an electronic version could therefore result in limited representativeness of the test sample.
**Data collection**

The survey procedure included a pilot study aimed at enhancing the reliability and the validity of the questionnaire. First, since almost all employees are native Dutch speaking, the survey questions were translated into Dutch for increased understanding. Questions that resulted in ambiguous translations or translations that we were not satisfied with or confident about were sent to a translator. The translations suggested by the translator were incorporated in the survey.

Secondly the adapted survey was sent to five professionals from the manufacturing and product development departments. These people were subsequently interviewed to obtain feedback on the survey. Several issues were brought up during these interviews, such as the clarity of the questionnaire items, applicability of the questions to department activities, the time needed to fill in the questionnaire and other issues for further improvement of the items. On account of this pilot study several adaptations have been made in the exact wording and layout of the questionnaire items and response options.

In order to obtain permission to distribute the survey, the departmental heads were explained the purpose of this research and the possible benefits for them. Only one of the eleven departments / plants did not want to participate due to work load within that department. The survey was distributed personally in paper to increase the response rate. Two days prior to distributing the survey it was announced via mail to all employees taking part in the survey. The survey was accompanied with an addressed envelope and a separate card used for selecting the winner of a €30 book token. This token was used as an extra incentive and was granted to one of the employees who returned the book token card. The survey and card could be sent separately to ensure anonymity. We offered a summary of our findings to the respondents, which they would receive after the findings had been analyzed. The survey was distributed in the second week of January. Two weeks later a mail was sent as a reminder and a week later the survey was closed.

A potential threat to validity is common method bias. As all variables in the study were measured with self-reports, correlations between constructs may be inflated as a result of using a mono method design (Podsakoff, MacKenzie, Lee, and Podsakoff, 2003). However, Spector (2006) argues and shows that the threat of common method bias is generally exaggerated. Still, we believe a discussion of this threat to validity is warranted. High levels of expertise and interest of respondents reduce the threat of respondent “guessing”, which is one possible source of common method variance, together with social desirability (Malhotra, Kim, and Patil, 2006).
In order to reduce the threat of social desirability bias in our study design, we have indicated in the questionnaire that there are no right or wrong answers. Furthermore, we have assured respondents that their answers would be anonymous with exception of the departmental name.

Questions belonging to both leadership styles were scrambled as is done in the original survey (Avolio and Bass 2004). For the questions belonging to the other variables it was chosen to keep the questions belonging to one variable together. According to Podsakoff scrambling reduces the intra-variable bias but at the same time increases the inter-variable bias (Podsakoff, MacKenzie et al. 2003). In order to reduce the threat of respondents “guessing” we have specifically targeted employees with a higher education in development and manufacturing departments who would understand the questions and feel that they apply to their departmental activities. Taken together, the threat of common method variance in the data is considered to be very low.

In total 202 surveys were send back which corresponds to a response rate of 62%. From these surveys a selection was made to ensure the quality of data. First all surveys containing double answers to one question were removed. Also all surveys missing more than one answer were removed. Finally all surveys with reasonable doubt about the answers of reversed questions were removed. When answers of reversed questions were located at the same side of the middle score it was considered likely that the reversed question was overlooked. This was viewed as an indication for insufficient attention when filling in the survey. After eliminating these surveys, the raw data set compiled 182 responses. See next chapter for Rasch analysis.

### Table 1. Overview distribution surveys and response

<table>
<thead>
<tr>
<th>Department</th>
<th>N surveys distributed</th>
<th>N surveys after first selection</th>
<th>N survey after Rasch analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>manufacturing department of active pharmaceutical ingredients (CA)</td>
<td>141</td>
<td>83</td>
<td>81</td>
</tr>
<tr>
<td>product development department of active pharmaceutical ingredients (API-PD)</td>
<td>88</td>
<td>60</td>
<td>57</td>
</tr>
<tr>
<td>oral and polymeric products development department (OPPD)</td>
<td>69</td>
<td>29</td>
<td>16</td>
</tr>
<tr>
<td>biopharmaceutics department (Bioph)</td>
<td>24</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>322</td>
<td>182</td>
<td>162</td>
</tr>
</tbody>
</table>

The measures used in this study have been used and published before. In the following sections the measurement of each variable will be explained aggregated into four groups; organizational antecedents
(independent variables), innovation (dependent variables), leadership style (moderating variables) and lastly control variables.

**Organizational antecedents (independent variables)**

The independent variables included in this study are willingness to cannibalize, constructive conflict, scanning and slack. The items used to test these variables were taken from Danneels who developed and validated them (Danneels 2008). Willingness to cannibalize was measured with four items. Two examples are; we support projects even if they could potentially take away sales from existing products and we easily replace one set of abilities with a different set of abilities to adopt a new technology. Constructive conflict was measured with six items. Two examples are; there is useful give-and-take and disagreements impair discussions of issues. Scanning was also measured using six items. Two examples are; many people participate in professional association activities and we attend many scientific or professional conferences. Finally, slack was measured using four items with the two examples being; all available resources are locked up in current products (reversed) and my firm has a reasonable amount of resources in reserve.

All questions were tested on a five point Likert scale with 1 = agree completely and 5 = disagree completely as anchors. This deviates from research performed by Danneels who used a seven point Likert scale. In this research a five point Likert scale (as is used in the leadership variables reference) was used for every question to create uniformity throughout the questionnaire. The beginning of every question was changed into “in our department”. For some questions this meant that the syntax had to be changed somewhat, without changing the content.

**Exploration, exploitation and ambidexterity (dependent variables)**

Following previous research (Gibson and Birkinshaw 2004; He and Wong 2004; Jansen, van den Bosch et al. 2006) a two-step approach was used to test the level of ambidexterity. First, exploration and exploitation were tested with items developed by Jansen (Jansen, van den Bosch et al. 2006). He only published the items in English but since Jansen has used a Dutch company for his research in explorative and exploitative innovation he also used a Dutch question set. After kind request the Dutch question set was made available by him. Exploration was measured with seven items. Two examples are; our unit accepts demands that go beyond existing products and services and we invent new products and services. Exploitation was also measured with seven items. Two examples are; we frequently refine the precision of existing products and services and we regularly implement small adaptations to existing products and services.
In previous research ambidexterity has been calculated from the level of exploration and exploitation by taking the sum of both (Jansen, Tempelaar et al. 2009) or by taking the multiplicative interaction of both (Jansen, George et al. 2008). In this research both sum-ambidexterity and product-ambidexterity were calculated. The results for both calculated ambidexterity constructs were very similar and the same conclusions are valid. In this report only the results for ambidexterity calculated from the sum of exploration and exploitation are shown.

For this research the items were adapted to test innovation on department level. This was mainly accomplished by adding the following statement above the questions concerning innovation; “departments that do not have a direct link to the external market or clients can interpret markets/clients as departments to which they deliver products or services directly”. Also the beginning of every question was changed into “our department”. For some questions this meant that the syntax had to be changed somewhat, without changing the content.

All questions were tested on a five point Likert scale where 1 = agree completely and 5 = disagree completely. This deviates from research performed by Jansen who used a seven point Likert scale. In this research a five point Likert scale (as is used in the leadership variables reference) was used for every question to create uniformity. The evidence of convergence and discriminant validity of firm-level exploratory and exploitative innovations, Jansen performed an exploratory factor analysis with varimax rotation and examined the factor structure of the two measures. He proved that exploratory innovation cleanly loaded on one factor and exploitative innovation cleanly loaded on a second factor.

**Leadership style (moderating variables)**

The moderating variables included in this study are transformational and transactional leadership. The items used to test these variables were developed by Bass (Avolio and Bass 2004) and published as his multifactor leadership questionnaire. The short version compiling 45 questions was used in this research but without the last nine questions concerning effectiveness, satisfaction and extra effort.

Transformational leadership includes five underlying constructs. They are;

- Idealized Influence Attributes measures the degree leaders are admired, respected, and trusted (4 items).
- Idealized Influence Behaviors measures the degree leaders share risks with followers and are consistent in conduct with underlying ethics, principles, and values (4 items).
- Inspirational Motivation measures the degree leaders motivate those around them by providing meaning and challenge to their employees work (4 items).
• Intellectual Stimulation measures the degree leaders stimulate their followers’ effort to be innovative and creative by questioning assumptions, reframing problems, and approaching old situations in new ways (4 items).
• Individual Consideration measures the degree leaders pay attention to each individual’s need for achievement and growth by acting as a coach or mentor (4 items).

Transactional leadership was tested with 16 items divided evenly amongst four transactional properties. They are;
• Contingent reward measures the degree leaders clarify expectations and offer recognition when goals are achieved (4 items).
• Management by Exception Active measures the degree leaders specify the standards for compliance, as well as what constitutes ineffective performance, and may punish followers for being out of compliance with those standards. This style of leadership implies closely monitoring for deviances, mistakes, and errors and then taking corrective action as quickly as possible when they occur (4 items).
• Management by Exception Passive measures the degree leaders avoid taking action when needed and wait until problems become chronic or serious before taking action (4 items).
• Laissez-Faire measures the degree leaders avoid getting involved and making decisions (4 items).

Analogous to Avolio and Bass (2004), all items concerning leadership style were tested on a five point Likert scale with 1 = not at all and 5 = frequently, if not always.

**Control variables**

In previously executed research concerning ambidexterity different variables have been used as control variable. Three of the most frequently used control variables when measuring ambidexterity are the firm’s size, firm’s age and environmental dynamism. From these variables, the most frequently used is firm size or the (natural) logarithm of firm size (Jansen, van den Bosch et al. 2005; Jansen, George et al. 2008; Li, Lin et al. 2008; Jansen, Tempelaar et al. 2009). The rational of using this control variable is that larger firms may lack the flexibility to achieve ambidexterity (Jansen, Tempelaar et al. 2009). This control variable has also been used in our research but since this research was performed on department level not the firm size but the department size was used as reference.

In research concerning ambidexterity also firm age was used as control variable (He and Wong 2004; Jansen, van den Bosch et al. 2005; Jansen, Tempelaar et al. 2009). It is probably much less clear to determine the age of a department than it is to determine the age of a firm since departments usually change in name, are combined or separated from other departments etc. The departments tested in this
research were erected more or less in the same period but have since underwent changes in name, direction, scope and structure. Since it is ambiguous to determine a clear departmental age this variable has not been included in this research. Several references also used environmental dynamism as a control variable (Jansen, George et al. 2008; Li, Lin et al. 2008; Jansen, Tempelaar et al. 2009). Since all departments are located within the same pharmaceutical industry it was presumed that they would experience the same dynamic properties. Therefore this variable has not been included in this research.

Several other control variables have been used like industry classification (Jansen, Tempelaar et al. 2009), unit performance (Jansen, van den Bosch et al. 2005), geographic location and R&D spending (He and Wong 2004). Since our research was performed within one company, in different departments located on one site, none of these were considered appropriate for this research. Therefore the only control variable used was departmental size. This comprised the total amount of employees located in a department without taking the percentage they work into account.
Chapter 4 Analysis and results

First, the results were tested for their off-variable noise using the Rasch model. Respondents with a MNSQ above 2 were deleted as their off-variable noise is greater than the useful information they deliver. In total 20 respondents were deleted due to a MNSQ value greater than 2 (see table 1 for results per department). After that the Cronbach alpha’s, mean values and standard deviation were calculated, see table 2. The Cronbach alpha’s were determined using the data from all departments included in this research.

Table 2. Mean values, Cronbach alpha’s and standard deviations of variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number of items</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Willingness to cannibalize</td>
<td>5</td>
<td>3.05</td>
<td>0.69</td>
<td>0.53</td>
</tr>
<tr>
<td>Constructive conflict</td>
<td>6</td>
<td>3.54</td>
<td>0.60</td>
<td>0.77</td>
</tr>
<tr>
<td>Tolerance for failure</td>
<td>4</td>
<td>3.28</td>
<td>0.75</td>
<td>0.75</td>
</tr>
<tr>
<td>Scanning</td>
<td>6</td>
<td>2.48</td>
<td>0.86</td>
<td>0.88</td>
</tr>
<tr>
<td>Slack$^1$</td>
<td>4</td>
<td>2.60</td>
<td>0.69</td>
<td>0.65</td>
</tr>
<tr>
<td>Exploitative innovation$^2$</td>
<td>6</td>
<td>3.49</td>
<td>0.54</td>
<td>0.69</td>
</tr>
<tr>
<td>Explorative innovation</td>
<td>7</td>
<td>2.93</td>
<td>0.70</td>
<td>0.86</td>
</tr>
<tr>
<td>Transformational leadership</td>
<td>24</td>
<td>3.42</td>
<td>0.68</td>
<td>0.92</td>
</tr>
<tr>
<td>Transactional leadership$^3$</td>
<td>11</td>
<td>2.53</td>
<td>0.82</td>
<td>0.72</td>
</tr>
</tbody>
</table>

1. the first question has been removed to increase the Cronbach alpha from 0.56 to 0.65.
2. the first question has been removed to increase the Cronbach alpha from 0.67 to 0.69.
3. the first question has been removed to increase the Cronbach alpha from 0.69 to 0.72.

With the exception of variable willingness to cannibalize all variables showed acceptable Cronbach alpha’s indicating sufficient internal consistency and reliability of the variables. In contrast to the notion that organizations tend to prefer exploitation over exploration (March 1991), the mean value of transformational leadership in this research is higher than that of transactional leadership.

Multicollinearity was examined by calculating the variance inflation factors (VIFs) for each of the regression equations. The maximum VIF values found was 1.495, well below the 10 rule of thumb used for maximum value (O'Brien 2007).

Table 3 presents the correlations for the variables used in this study. Ambidexterity is calculated from exploration and exploitation, hence the high correlations found between these variables.
Table 3. Inter item correlation matrix

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Conflict</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Failure</td>
<td>0.450***</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Cannibalize</td>
<td>0.295***</td>
<td>0.244**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Scanning</td>
<td>0.123</td>
<td>0.114</td>
<td>0.238**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Slack</td>
<td>0.164*</td>
<td>0.325***</td>
<td>0.397***</td>
<td>0.258***</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Exploit</td>
<td>0.152‡</td>
<td>0.106</td>
<td>0.209**</td>
<td>-0.061</td>
<td>0.142‡</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Explore</td>
<td>0.164*</td>
<td>0.134‡</td>
<td>0.263***</td>
<td>0.405***</td>
<td>0.276***</td>
<td>0.122</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Ambidexterity</td>
<td>0.210**</td>
<td>0.162*</td>
<td>0.317***</td>
<td>0.275***</td>
<td>0.290***</td>
<td>0.651***</td>
<td>0.833***</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Transform</td>
<td>0.343***</td>
<td>0.235**</td>
<td>0.167*</td>
<td>0.098</td>
<td>0.154</td>
<td>0.197*</td>
<td>0.183*</td>
<td>0.250***</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Transact</td>
<td>-0.381***</td>
<td>-0.237***</td>
<td>-0.055</td>
<td>-0.149‡</td>
<td>-0.092</td>
<td>0.076</td>
<td>-0.055</td>
<td>0.001</td>
<td>-0.480***</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Department size</td>
<td>-0.074</td>
<td>-0.197*</td>
<td>-0.011</td>
<td>-0.362***</td>
<td>-0.102</td>
<td>0.224**</td>
<td>-0.125</td>
<td>0.030</td>
<td>0.079</td>
<td>0.210**</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.1 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)

The first regression calculations showed very different results for departments API-PD and CA compared to the departments OPPD and Biopharmaceuticals. Likely this is due to the different nature of these departments. CA is a pure manufacturing department who receives support from the closely related department API-PD. Departments OPPD and Biopharmaceuticals are research and development departments with a much stronger research orientation that API-PD. The difference in results obtained from these two groups of departments meant that no acceptable regression results were obtained when using data from all departments. However calculating regression using the data from CA and API-PD together separately from OPPD and biopharmaceuticals did lead to significant results. The most elegant method to overcome this problem was to find a control variable that could explain the difference between departments. However, since the departments OPPD and Biopharmaceuticals only contributed 24 of the 162 responses it was decided to perform the calculations using the response of departments API-PD and CA only.

In total nine models were tested;

- Model 1: organizational antecedents and exploit (Table 4)
- Model 2: organizational antecedents and explore (Table 4)
- Model 3: organizational antecedents and ambidexterity (Table 4)
- Model 4: organizational antecedents and exploit with transformational leadership as moderator (Table 5)
- Model 5: organizational antecedents and explore with transformational leadership as moderator
- Model 6: organizational antecedents and ambidexterity with transformational leadership as moderator
- Model 7: organizational antecedents and exploit with transactional leadership as moderator
- Model 8: organizational antecedents and explore with transactional leadership as moderator
- Model 9: organizational antecedents and ambidexterity transactional leadership as moderator

The first models investigated, model 1, 2 and 3, concern organizational antecedents as independent variables and exploitation, exploration and ambidexterity as dependent variables, without the addition of moderating effects. This analysis concerns hypothesis 1 - 4. The results are shown in Table 4.

Table 4. Results of regression analysis: model 1, 2 and 3

<table>
<thead>
<tr>
<th>Control variable</th>
<th>Model 1, exploit</th>
<th>Model 2, explore</th>
<th>Model 3, ambidex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beta</td>
<td>p-value</td>
<td>Beta</td>
<td>p-value</td>
</tr>
<tr>
<td>Department size (log)</td>
<td>0.124</td>
<td>0.137</td>
<td>0.136</td>
</tr>
<tr>
<td>Independent variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Willingness to cannibalize</td>
<td>0.181*</td>
<td>0.044</td>
<td>0.113</td>
</tr>
<tr>
<td>Constructive conflict</td>
<td>0.197*</td>
<td>0.019</td>
<td>0.119</td>
</tr>
<tr>
<td>Scanning</td>
<td>0.049</td>
<td>0.575</td>
<td>0.230*</td>
</tr>
<tr>
<td>Slack</td>
<td>0.141</td>
<td>0.118</td>
<td>0.172*</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>12%</td>
<td>15%</td>
<td>21%</td>
</tr>
<tr>
<td>F-value (Anova)</td>
<td>4.816</td>
<td>5.768</td>
<td>8.341</td>
</tr>
<tr>
<td>N</td>
<td>138</td>
<td>138</td>
<td>138</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)

Willingness to cannibalize was hypothesized to be positively related to ambidexterity (hypothesis 1). The results show a significant positive relationship between willingness to cannibalize and ambidexterity and therefore support hypothesis 1 (Beta = 0.173, p = 0.042). Constructive conflict was hypothesized to be...
positively related to ambidexterity (hypothesis 2). The results are in support of this hypothesis (Beta = 0.186, p = 0.019). The results found for scanning support the hypothesized positive relationship to ambidexterity (hypothesis 3, Beta = 0.191, p = 0.024). The relationship between organizational slack and ambidexterity was found to be positive and significant (Beta = 0.195, p = 0.023) which agrees with hypothesis 4. All correlations can be considered as being low (see table 11, appendix).

Since the relations of these antecedents and ambidexterity are the result of underlying relationships to exploration and exploitation the results of these two types of innovation are also discussed. The second column of table 4 shows the results for exploitative innovation. These results show that the argued positive relationship between willingness to cannibalize and exploitative innovation is supported (Beta = 0.181, p = 0.044). It must be noted that the Cronbach alpha of the willingness to cannibalize construct (0.53) is too low for the construct to be reliable. The argued positive relationship between constructive conflict and exploitative innovation is also supported (Beta = 0.197, p = 0.019). The results did not support the argued positive relations between scanning and exploitation and between slack and exploitation.

Danneels (2008) has tested the relationships between the independent variables and second order competences. He views second-order competences as a competence of exploration, the creation of new first-order competences. The results obtained from our research are compared to the results of Danneels. Danneels distinguishes between second order marketing and R&D competences. Second order marketing and R&D competences reflect the firm's ability to add new customer and technological competences respectively. He found a strong positive significant relation between willingness to cannibalize for both types of exploration. This positive effect could not be confirmed in our research. Maybe the differences in results are due to the presence of different types of willingness to cannibalize. Nijssen et al. (2005) has argued that there are three dimensions to cannibalization; cannibalization of investments, capabilities and sales. The relation of these types of cannibalization and innovation differs. He found that willing to cannibalize sales and investments are positively related to exploratory innovation. However willing to cannibalize capabilities is not. Danneels also found a positive relationship between constructive conflict and both types of exploration. This positive effect could not be confirmed in our research. The a priori expected positive relation between scanning and exploration is confirmed in our research, although the significance of the relationship found in our research is somewhat less. Danneels found a strong linear effect of organizational slack and both types of innovation, a result that is also found in our research however not significantly. The adjusted R² found by Danneels seem to be higher (0.28 and 0.39 at T1 and 0.10 and 0.28 at T2) than found on the basis of our data (0.15) but the R² could still be viewed as comparable when taking into account the large fluctuation found in the results from Danneels.
In total, the results of our research are in line with the results of Danneels only for the independent variable scanning. The results of the other independent variables could not be reproduced. At first glance there is no significant difference between industries used for both studies in that all are firms manufacture physical goods. There is a geographic difference between the studies since Danneels conducted his research in the US and our research has been performed in the Netherlands. Also the scale on which the research was conducted was different. Danneels tested innovation on a firm level. Our research was conducted on department level. The third difference that could explain the difference in results is the use of different items to evaluate explorative innovation.

Next, the models with interaction effects were analyzed. In model 4, 5 and 6 transformational leadership is added as moderator. The results of this analysis are shown table 5 and relate to hypotheses 5, 7, 9 and 11. Note that the willingness to cannibalize construct has insufficient internal validity. In the theory section only hypotheses concerning ambidexterity have been stated. However since ambidexterity is calculated from the level of exploitation and exploration the results of these types of innovation can give a more in depth understanding of the relation found for ambidexterity.

When looking at the model with ambidexterity as independent variable, the addition of transformational leadership does not lead to any significant interaction effects. This is in contrast to hypotheses 5 (willingness to cannibalize), 7 (constructive conflict), 9 (scanning) and 11 (slack) since they all propose positive moderating effects of transformational leadership.

In order to evaluate why the results show no moderating effect for transformational leadership we look at underlying results found for exploration and exploitation. This analysis can discriminate between two explanations for the lack of moderating effect; either transformational leadership does not moderate the relationships between the organizational antecedents and both types of innovation or transformational leadership does moderate these relationships but not in a way expected. When transformational leadership moderates the relation between the antecedent and exploration in the opposite way to the relation between the antecedent and exploitation the overall effect could be that the moderating effect on the relation to ambidexterity is annulled.

The hypotheses concerning transformational leadership as moderator are based on assumed positive moderating effects for every relationship between the organizational antecedents and exploration as well as exploitation. None of these positive moderating effects were supported by the data. Therefore it can be concluded that the lack of moderating effect of transformational leadership style on ambidexterity is due to a lack in underlying moderating effects, not the result of reversed moderating effects. The addition of
transformational leadership as moderator does not lead to an improvement in the adjusted coefficient of determination (compare model 3 with model 6).

Table 5. Results of regression analysis: model 4, 5 and 6

<table>
<thead>
<tr>
<th></th>
<th>Model 4, exploit</th>
<th>Model 5, explore</th>
<th>Model 6, ambidex</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transformational leadership</strong></td>
<td>B</td>
<td>Sig.</td>
<td>B</td>
</tr>
<tr>
<td>Constant</td>
<td>3.545***</td>
<td>0.000</td>
<td>2.836***</td>
</tr>
<tr>
<td>Control variable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Department size (log)</td>
<td>0.055</td>
<td>0.151</td>
<td>0.075</td>
</tr>
<tr>
<td>Independent variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Willingness to cannibalize</td>
<td>0.078*</td>
<td>0.049</td>
<td>0.064</td>
</tr>
<tr>
<td>Constructive conflict</td>
<td>0.069‡</td>
<td>0.065</td>
<td>0.046</td>
</tr>
<tr>
<td>Scanning</td>
<td>0.020</td>
<td>0.607</td>
<td>0.123*</td>
</tr>
<tr>
<td>Slack</td>
<td>0.062</td>
<td>0.104</td>
<td>0.085</td>
</tr>
<tr>
<td>Moderator variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transformational leadership</td>
<td>0.017</td>
<td>0.635</td>
<td>0.038</td>
</tr>
<tr>
<td>Interaction effects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cannibalize*Transform</td>
<td>0.001</td>
<td>0.969</td>
<td>0.062</td>
</tr>
<tr>
<td>Conflict*Transform</td>
<td>-0.004</td>
<td>0.905</td>
<td>0.001</td>
</tr>
<tr>
<td>Scanning*Transform</td>
<td>0.011</td>
<td>0.770</td>
<td>-0.121*</td>
</tr>
<tr>
<td>Slack*Transform</td>
<td>-0.035</td>
<td>0.353</td>
<td>0.043</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>10%</td>
<td>17%</td>
<td>21%</td>
</tr>
<tr>
<td>F- value (Anova)</td>
<td>2.479</td>
<td>3.770</td>
<td>4.562</td>
</tr>
<tr>
<td>N</td>
<td>138</td>
<td>138</td>
<td>138</td>
</tr>
</tbody>
</table>

‡ Correlation is significant at the 0.1 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)

The only significant moderating effect found was for the relationship between scanning and exploration (B = -0.121, p = 0.020). The moderating effect found was negative which implies that at higher degrees of transformational leadership the relationship between scanning and exploration is less positive. This is opposite of what is expected since it is assumed that transformational leadership positively moderates the relationship between scanning and explorative innovation.

Subsequently, the models with transactional leadership style as moderators were analyzed, model 7, 8 and 9. The results are shown table 6 and relate to hypotheses 6, 8, 10 and 12. In the theory section only hypotheses concerning ambidexterity have been stated. The model with ambidexterity as independent variable shows that the addition of transactional leadership as moderator leads to a 2% improvement in the adjusted coefficient of determination when (compare model 3 with model 9). However, the addition
does not lead to any significant interaction effects. This means that hypotheses 10 (willingness to cannibalize), 12 (constructive conflict), 14 (scanning) and 16 (slack) are unsupported. As with transactional leadership the results for exploitative and explorative innovation were analyzed in order to be able to discriminate between the lack of underlying moderating effects or opposing moderating effects. With the exception of the relationship between willingness to cannibalize and transactional leadership the results in table 6 show that transactional leadership does not have moderating effects for any relationship. Therefore, the lack of moderating effect of transactional leadership style on ambidexterity is due to a lack in underlying relationships, not the result of reversed underlying relationships.

### Table 6. Results of regression analysis: model 7, 8 and 9

<table>
<thead>
<tr>
<th></th>
<th>Model 7, exploit</th>
<th>Model 8, explore</th>
<th>Model 9, ambidex</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Sig.</td>
<td>B</td>
</tr>
<tr>
<td>Constant</td>
<td>3.548***</td>
<td>0.000</td>
<td>2.849***</td>
</tr>
<tr>
<td>Control variable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Department size (log)</td>
<td>0.042</td>
<td>0.274</td>
<td>0.078</td>
</tr>
<tr>
<td>Independent variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Willingness to cannibalize</td>
<td>0.070‡</td>
<td>0.067</td>
<td>0.062</td>
</tr>
<tr>
<td>Constructive conflict</td>
<td>0.085*</td>
<td>0.040</td>
<td>0.085</td>
</tr>
<tr>
<td>Scanning</td>
<td>0.021</td>
<td>0.587</td>
<td>0.156**</td>
</tr>
<tr>
<td>Slack</td>
<td>0.049</td>
<td>0.206</td>
<td>0.074</td>
</tr>
<tr>
<td>Moderator variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transactional leadership</td>
<td>0.047*</td>
<td>0.225</td>
<td>0.058</td>
</tr>
<tr>
<td>Interaction effects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cannibalize*Transact</td>
<td>-0.018</td>
<td>0.688</td>
<td>-0.126*</td>
</tr>
<tr>
<td>Conflict*Transact</td>
<td>0.012</td>
<td>0.735</td>
<td>0.036</td>
</tr>
<tr>
<td>Scanning*Transact</td>
<td>0.068‡</td>
<td>0.125</td>
<td>-0.001</td>
</tr>
<tr>
<td>Slack*Transact</td>
<td>-0.031</td>
<td>0.396</td>
<td>-0.027</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>12%</td>
<td>18%</td>
<td>23%</td>
</tr>
<tr>
<td>F-value (Anova)</td>
<td>2.784</td>
<td>3.966</td>
<td>5.165</td>
</tr>
<tr>
<td>N</td>
<td>138</td>
<td>138</td>
<td>138</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.1 level (2-tailed)
* Correlation is significant at the 0.05 level (2-tailed)
** Correlation is significant at the 0.01 level (2-tailed)
*** Correlation is significant at the 0.001 level (2-tailed)

The only significant moderating effect was found for the relationship between willingness to cannibalize and exploration. Table 6 shows that transactional leadership negatively moderates this relationship which contrasts the expected positive moderating effect. Note that the Cronbach alpha of the willingness to cannibalize construct is insufficient.
Chapter 5 Conclusion, discussion and recommendations

The ability to pursue both exploitation as well as exploration is referred to as organizational ambidexterity. Ambidexterity can be achieved through separating explorative from exploitative activities between units and integrating activities at the level of top management but also by creating organizational values and practices that enable the management of conflicting demands within one unit (Bledow, Frese et al. 2009). This research focuses on how organizations can achieve independent ambidexterity meaning that it exists harmoniously within a single organizational unit (Simsek, Heavey et al. 2009). Ambidexterity is calculated from the level of explorative innovation and exploitative innovation. Therefore also the relations with exploration and exploitation were analyzed in addition to the relations with ambidexterity.

Organizational antecedents and ambidexterity

Even though previous research has found a positive relationship between ambidexterity and performance (Jansen, van den Bosch et al. 2005), few studies have examined its drivers. This study has focused on four informal organizational antecedents previously tested in relation to explorative innovation and found to be significantly related (Danneels 2008). These antecedents are willingness to cannibalize, constructive conflict, scanning and slack. The main findings of this research are summarized in table 8.

Table 8. Findings concerning ambidexterity without moderators

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Statement</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypothesis 1</td>
<td>Willingness to cannibalize is positively related to ambidexterity.</td>
<td>Supported but construct unreliable</td>
</tr>
<tr>
<td>Hypothesis 2</td>
<td>Constructive conflict is positively related to ambidexterity.</td>
<td>Supported</td>
</tr>
<tr>
<td>Hypothesis 3</td>
<td>Scanning is positively related to ambidexterity.</td>
<td>Supported</td>
</tr>
<tr>
<td>Hypothesis 4</td>
<td>Slack resources are positively correlated to ambidexterity.</td>
<td>Supported</td>
</tr>
</tbody>
</table>

Our analysis shows support for significant positive relations between all antecedents tested and ambidexterity. On the basis of the classification shown in the appendix these relationships can be classified as having a low correlation. The Cronbach alpha of the willingness to cannibalize construct is too low to be considered reliable. Danneels’s (2008) research also indicated low Cronbach alpha’s for this construct (0.69 at T1 and T2). Future research could develop this construct further.
The most interesting findings relate to the results of explorative innovation and exploitative innovation. The results for exploration and exploitation suggest that the four organizational antecedents affect ambidexterity via a different route. Willingness to cannibalize and constructive conflict are positively related to exploitative innovation but not to explorative innovation. In contrast, scanning and slack are related to explorative innovation but not to exploitative innovation. This proposes an interesting approach for managers. When strategy implies that exploitative innovation needs to be increased, the most effective way would be to increase the preparedness to reduce the actual or potential value of its investments and encourage the debate of ideas, beliefs and assumptions. When strategy implies that explorative innovation needs to increase, managers are better of encouraging scanning the environment for opportunities and maintaining a strategic slack of human capacity. The consideration of maintaining organizational slack can be viewed as opposite to the popular idea of lean manufacturing where the goal is to reduce waste as much as possible (Womack and Daniel 1996). Our results suggest that striving for lean organizations should not result in reducing the capacity to such a minimum that it would only cover the immediate activities. This could be detrimental to achieving explorative innovation which provides the capacity to be competitive on the long term.

Leadership style and ambidexterity

As a second step our research has focused on leadership style as a moderator for relation between the organizational antecedents and ambidexterity (see figure 1 for conceptual model). In this research the classification of leadership styles as developed by Bass has been used (Avolio and Bass 2004). He identified two main types of leadership, transformational leadership and transactional leadership, both comprising several underlying leadership properties. Transformational leadership has been characterized as one who articulates a vision of the future that can be shared with peers and subordinates, intellectually stimulates subordinates and pays high attention to individual differences among people. Transactional leadership exchanges rewards contingent upon a display of desired behaviors (Waldman, Bass et al. 1987). Of these two types of leadership style, transformational leadership has been tested for its moderating effect on the relationship between senior team attributes and organizational ambidexterity (Jansen, George et al. 2008). These hypotheses went unsupported and the explanation suggested for the lack of moderating effect was the level on which leadership style was tested. The suggestion of Jansen, to test the importance of transformational leaders on the effectiveness of organizational members on a lower hierarchical level, was incorporated in this research. In our research the moderating effect of transactional leadership as well as transformational leadership has been tested. The moderating effect of transactional leadership in the context of ambidexterity has not been tested before.
The data did not support the hypothesized positive moderating effects of transformational leadership on the relationships between all organizational antecedents and ambidexterity. Also the hypothesized negative moderating effects of transactional leadership went unsupported for all relationships between organizational antecedents and ambidexterity. In fact the data did not show any significant moderating effects of leadership style in the relation to ambidexterity.

The relationships between leadership, organizational antecedents and innovation are complex. So far different approaches have been used to test the relationship between leadership style and innovation. The moderating properties of leadership style have been researched in the relation to ambidexterity (Jansen, George et al. 2008). Our research has followed this approach, however other approaches have to be

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Transformational leadership positively moderates the relation between willingness to cannibalize and ambidexterity.</th>
<th>Not supported and construct willingness to cannibalize unreliable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypothesis 10</td>
<td>Transactional leadership negatively moderates the relation between willingness to cannibalize and ambidexterity.</td>
<td>Not supported and construct willingness to cannibalize unreliable</td>
</tr>
<tr>
<td>Hypothesis 11</td>
<td>Transformational leadership positively moderates the relationship between constructive conflict and ambidexterity.</td>
<td>Not supported</td>
</tr>
<tr>
<td>Hypothesis 12</td>
<td>Transactional leadership negatively moderates the relationship between constructive conflict and ambidexterity.</td>
<td>Not supported</td>
</tr>
<tr>
<td>Hypothesis 13</td>
<td>Transformational leadership positively moderates the relationship between environmental scanning and ambidexterity.</td>
<td>Not supported</td>
</tr>
<tr>
<td>Hypothesis 14</td>
<td>Transactional leadership negatively moderates the relationship between environmental scanning and ambidexterity.</td>
<td>Not supported</td>
</tr>
<tr>
<td>Hypothesis 15</td>
<td>Transformational leadership positively moderates the relation between organizational slack and ambidexterity significantly.</td>
<td>Not supported</td>
</tr>
<tr>
<td>Hypothesis 16</td>
<td>Transactional leadership negatively moderates the relation between organizational slack and ambidexterity significantly.</td>
<td>Not supported</td>
</tr>
</tbody>
</table>
considered as well. Leadership style has been argued to effect innovation directly (Jansen, Vera et al. 2009). Using our data, the addition of leadership style as a direct independent variable resulted in significant positive relations between both leadership styles and ambidexterity. Also the adjusted $R^2$ increases from 21% to 25% which indicates increased predictability of ambidexterity (see table 10).

Table 10. Results of regression analysis: alternative model, leadership style as independent variable

<table>
<thead>
<tr>
<th></th>
<th>Exploit</th>
<th></th>
<th>Exploit</th>
<th></th>
<th>Ambidexterity</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beta</td>
<td>Sig.</td>
<td>Beta</td>
<td>Sig.</td>
<td>Beta</td>
<td>Sig.</td>
</tr>
<tr>
<td>Control variable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Department size (log)</td>
<td>0.098</td>
<td>0.249</td>
<td>0.091</td>
<td>0.267</td>
<td>0.115</td>
<td>0.144</td>
</tr>
<tr>
<td>Independent variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Willingness to cannibalize</td>
<td>0.159$^+$</td>
<td>0.080</td>
<td>0.074</td>
<td>0.393</td>
<td>0.134</td>
<td>0.109</td>
</tr>
<tr>
<td>Constructive conflict</td>
<td>0.213$^*$</td>
<td>0.021</td>
<td>0.147$^+$</td>
<td>0.096</td>
<td>0.214$^*$</td>
<td>0.012</td>
</tr>
<tr>
<td>Scanning</td>
<td>0.040</td>
<td>0.649</td>
<td>0.214$^*$</td>
<td>0.013</td>
<td>0.175$^*$</td>
<td>0.034</td>
</tr>
<tr>
<td>Slack</td>
<td>0.136</td>
<td>0.130</td>
<td>0.164$^+$</td>
<td>0.059</td>
<td>0.187$^*$</td>
<td>0.025</td>
</tr>
<tr>
<td>Transformational leadership</td>
<td>0.119</td>
<td>0.229</td>
<td>0.203$^*$</td>
<td>0.034</td>
<td>0.207$^*$</td>
<td>0.025</td>
</tr>
<tr>
<td>Transactional leadership</td>
<td>0.148</td>
<td>0.130</td>
<td>0.252$^{**}$</td>
<td>0.008</td>
<td>0.256$^{**}$</td>
<td>0.005</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>13%</td>
<td></td>
<td>19%</td>
<td></td>
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$^+$ Correlation is significant at the 0.1 level (2-tailed)

$^*$ Correlation is significant at the 0.05 level (2-tailed)

$^{**}$ Correlation is significant at the 0.01 level (2-tailed)

$^{***}$ Correlation is significant at the 0.001 level (2-tailed)

Even though the explanatory level of the model increases when leadership style is added, the results deviate from previously published results. For example transactional leadership is found to have a direct positive relationship with exploration whereas previous research argues and finds support for a negative relationship (Jansen, Vera et al. 2009). The results could have been influenced by potential moderating effects of antecedents. For example the relationship between leadership and innovation was found to be more pronounced in dynamic markets (Jansen, Vera et al. 2009). The pharmaceutical industry, the test environment of our research, is a highly regulated and compliance enforcing industry and is characterized by long development and product life cycles and can be described as having low dynamic properties (Renjing 2008).

Another possibility is that leadership directly effects the organizational antecedents of ambidexterity. This leads to the question which potential relations should be considered when researching leadership in the context of innovation?

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2 This table shows standardized coefficients
Another complicating factor that must be considered is that leadership is present on many levels within an organization and the antecedents tested differ in their perceived strategic importance. Which levels of leadership should be considered when researching leadership in the context of innovation? Willingness to cannibalize and slack have direct financial implications making it a more strategic concept, perceived as important on a higher level of leadership. Constructive conflict and scanning do not have the same obvious financial implications and might not be a direct concern for higher level leaders. Following this thought it can be argued that leadership style on high level will directly influence more strategic antecedents of innovation and leadership style. It is possible that the relationship between these antecedents and innovation are moderated by the leadership style on a lower hierarchical level. Viewing these antecedents as not directly amendable low level leaders can direct the potential in the direction they perceive most valuable. In contrast, organizational antecedents that are not shaped by high level leaders can be shaped directly on a lower level.

In conclusion it can be stated that leaders play a central role in organizational learning. The body of knowledge currently available supports this statement (Berson, Nemanich et al. 2006). However, looking at the amount of possibilities in the way leadership can effect innovation, future research into organizational antecedents of innovation should take the perceived strategic level of an organizational antecedent into account and the hierarchical levels of leadership affecting this antecedent either directly or as a moderator for the relation to ambidexterity.
Chapter 6 References


Chapter 7 Appendix

Questionnaire

The constructs tested with the questionnaire include four organizational antecedents; willingness to cannibalize, constructive conflict, scanning and slack. The items used to test these constructs were obtained from Danneels (Danneels 2008).

Willingness to cannibalize

- We support projects even if they could potentially take away sales from existing products.
- We easily replace one set of abilities with a different set of abilities to adopt a new technology.
- We tend to oppose new technologies that cause our manufacturing facilities to become obsolete (reversed).
- We are very willing to sacrifice sales of existing products in order to improve sales of our new products (reversed).

Constructive conflict

- There is useful give-and-take
- Disagreements impair discussions of issues.
- There is constructive challenge of ideas, beliefs and assumptions.
- People are comfortable about raising dissenting viewpoints.
- Different opinions of views focus on issues rather than on individuals.
- Even people who disagree respect each other’s viewpoints.

Scanning

- Many people participate in professional association activities.
- We attend many scientific of professional conferences.
- We participate frequently in trade shows.
- We have extensive contacts with researches at universities.
- We have an active network of contacts with the scientific and research community.
- We read specialized journals and magazines to keep abreast of market and technical trends.

Slack

- All available resources are locked up in current products (reversed).
- My firm has a reasonable amount of resources in reserve,
• We have ample discretionary financial resources.
• We can always find the ‘manpower’ to work on special projects.

To test the constructs for explorative and exploitative innovation, the items were used as developed by Jansen (Jansen 2005).

Exploratory innovations:
• Our unit accepts demands that go beyond existing products and services
• We invent new products and services
• We experiment with new products and services in our local market
• We commercialize products and services that are completely new to our unit
• We frequently utilize new opportunities in new markets
• Our unit regularly uses new distribution channels
• We regularly search for and approach new clients in new markets

Exploitative innovations:
• We frequently refine the precision of existing products and services
• We regularly implement small adaptations to existing products and services
• We introduce improved, but existing products and services for our local market
• We improve our provision’s efficiency of products and services
• We increase economies of scales in existing markets
• Our unit expands services for existing clients
• Lowering costs of internal processes is an important objective

The constructs used to test leadership style were tested using the Multifactor Leadership Questionnaire (MLQ) developed by Bass to test the level of transformational and transactional leadership (Avolio and Bass 2004).
**Correlation classification**

The below stated classification was used to evaluate the correlation effects found in this study.

Table 7. Correlation classification

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<th>Medium</th>
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