PEPIJN VAN NEERIJNEN

The adaptive organization

The Socio-Cognitive Antecedents of Ambidexterity and Individual Exploration

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The socio-cognitive antecedents of ambidexterity and individual exploration

De adaptieve organisatie

De sociaal-cognitieve antecedenten van ambidexteriteit en individuele exploratie

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"Life is like a box of chocolates.
You never know what you are going to get"
(Forrest Gump, 1994)

Preface

Life is full of surprises. Of this I am certain. In a way I feel akin to Forrest. Getting here certainly wasn't easy. Life has thrown many curve balls into my direction. Like in Forrest' life story though, every time a window closed a new one opened. Life then, like the topic of this dissertation, is about adaptation. It is about making the best of what you have and reacting the best way you can to what it throws at you.

Don't be alarmed however, unlike Forrest I won't give you a rundown of my whole life. Partly because I'm not quite the storyteller he is, and partly also because I want to dedicate this dissertation to those people who helped me get here: my teachers.

What I've learned is that teachers come in many shapes and sizes. Sometimes as a friend, a colleague, a student, a parent or a brother. And sometimes they just come as, well just as a teacher really.

Let me start off with thanking the most important teachers in my life, my parents, Pieter and Mieke. Both had a fundamental impact on who I am and how I relate to the world. Because they were so different in many respects, though similar in others, for me they were the best teachers one could have. My father taught me the value of reflection and the importance of weighing interest, while my mother learned me how to push on against all odds, to never give up and to stand up for myself. Both of them however fueled my interest regarding the world. I think I can honestly say that between them, they literally have taken me to every museum in the country and as my dad likes to call it "all the other beautiful and remarkable places in the Netherlands". Preferably those that nobody has heard of before and have a strange sounding name like Moddergat. My mother pitched in by allowing me to call in "school ziek" every once in a while so I could read history books or just browse through the encyclopedia and escape the sometimes somewhat monotone pace at primary school. Thank you both for doing your utmost best to help me and guide me through life. I could not have done this without you.

Important teachers are also your peers. Those people with which you embark on a journey. In that respect without a doubt the most important person for me has been my brother. Together we have been through some tough times, but perhaps more importantly, we could always rely on each other (and have a lot of fun in the process). Thank you bro: you are the best! Which brings me to my (former) colleagues…you have been amazing. Not only did my colleagues at RSM and ABS form me as researcher, lecturer, and as a manager, I regard many as my closest friends as well as shining examples of what I should strive for as an academic. In no way can I do justice to the help, inspiration, and camaraderie you have given me. But Michiel, Vares, Bernardo, Shik, Michaéla, Michal, Pieter-Jan, Jurriaan, Woody, Koen, Alex, Hans, Patrick Reinmoeller & Patrick Figge, Ernst, Ingrid, Mark, Bernadette, Ans, Nathan, Push, Annelies, Marten, Henri, Shahz, Niels, Flore, Jan-Willlem…you guys are simply awesome. You pushed me along and helped me back on my feet when needed. Thank you. I can only hope to repay the favor you have given me.

Speaking of colleagues and teachers, there are three gentlemen to which I owe a great deal: my promoters and co-promoter Justin, Pursey, and Tom. Writing a PhD dissertation next to a full teaching load is not easy. Especially when the box of chocolates for some reason keeps dishing out very bitter bonbons. You guys however really stepped up to the plate and helped me see this through. I really don't think many other promoters and co-promoters would have gone through the lengths that you guys have. Moreover, you have taught me what it takes to be an academic. Both practically as well as morally. Justin, Tom, and Pursey, thank you for your patience, your wisdom, and most of all, your friendship.

But let's not forget my actual teachers. Those people whose job it is to educate you but, as I have experienced, often go way beyond their call of duty to help you. Throughout my life several teachers have had a profound influence on me, something I never really had the opportunity to thank them for. As I certainly would not have gotten so far without their help, it seems only fair to pay tribute to them here. First of all, I would like to thank John van Seumeren. Not only because he is a great teacher, but also because he helped me by taking me back in when there was no need to do that. Thank you John. You really don't know how important that was to me back then and how much I

appreciated that. Also from the Minister Calsschool: Hans Dorrestijn. Thank you for just being there in a difficult time as well as your unforgettable lessons on history, biology… well just about everything I guess. After thirty years I can still remember them belief it or not. Another great story teller was my history teacher and class mentor at the Sint Vitus College: Hans Mouse. Thank you for the confidence you expressed in me as a student. The same thing goes for Mr. Luyben my mentor at the Alberdingk Thijm College. Although I must have been quite a handful that year, you saw my potential and stimulated me to do something with that. Likewise, Mr. Spaan from the Alberdingk Thijm College and Irma Koper from the Sint Vitus College, both statistics lecturers by the way, were excellent teachers. I will never forget the example of "mevrouw Pien" that always popped up during Mr. Spaan's classes. And it is only now that I realize the enormous dedication of Irma Koper, a teacher that you could just call during the weekend to ask questions related to the forthcoming exam. All of you are examples I try to live up to.

My friends have been a source of inspiration for me along the way as well; they have often shown me the possibilities in life and pushed me to take that extra step. In my view, this is one of the most important things a good teacher can do. Without my good friend Joost I probably would not have attended a university in the first place. I certainly would not have ended up at RSM. Joost, we had many crazy adventures together, and I am sure that there are many more to come. Thank you for being such a good friend. Without Eggherick the idea that I could write a PhD would not have entered my mind as a serious option. Something I could actually accomplish. Egg, thank you for this as well all the talks about life and the future that lay ahead of us. Without Berry, Laurens, Bob, Coen, Ellen, and Andre my first strides into academia wouldn't have been as much fun. A special word of gratitude goes out to Mariska. Without the support of Mariska I certainly would have given the whole thing up a long time ago. Your support however was relentless and unconditional. You were always there for me when I needed you, even when our relationship had met a temporarily low. You truly are a great friend. Neal, my life-long friend, thank you for your unique insights, your terrific stories, and your friendship. Jaap, thank you for all the laughs that we shared and the example you set for me both as a father as well as in your dedication to the good cause. Claus, my former neighbor and fitness-buddy, thank you for the weekly distractions and exotic meals that we had (and the ones

that are to come). Finally, I would like to thank someone I truly admire: Lizanne. Lizanne, you really are a source of inspiration. Your kindness, patience, empathy towards others, curiosity, and your drive to do good is a shining light to others. Our story began when I was at my lowest. But you looked beyond all that and just focused on who I was as a person. This last year with you has been wonderful. You keep me balanced while pushing me to develop myself both intellectually and physically. I am ever so grateful to have you in my life. Last, but certainly not least, I would like to thank two special ladies that have been at my side almost every step of the way during the writing process: Buffel and Poema. Without a doubt you are the cutest cats in the world.

So, can we draw any preliminary conclusions regarding how all those many teachers, in all their shapes and sizes, stimulated me how to get here? Well, if you haven't read the dissertation yet it perhaps is a bit of a spoiler, but the role they played in increasing my learning capacity was crucial. Not only to master the skills necessary to write a PhD, but perhaps even more importantly, to adapt to the ever changing environment we call life.

Pepijn van Neerijnen

Amsterdam, April 2016

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Chapter 1. General Introduction

"It is not the strongest of the species that survive, nor the most intelligent, but the one that is most responsive to change." Charles Darwin

1.2. The importance of exploration, exploitation, and organizational ambidexterity for competitive advantage.

Ashby's Law of Requisite Variety indicates that only variety can absorb variety. Applied to an organizational context, this means that an organizational system must be able to generate the adaptive responses necessary to maintain an overall level of fitness with the environment (McGrath, 2001; Van de Ven, 1986). The concept of 'fitness' lies at the heart of current notions of competitive advantage (Helfat, Finkelstein, Mitchell, Peteraf, Singh, Teece & Winter, 2007; O'Reilly & Tushman, 2008; Teece, 2007). Maintaining a sufficient level of fitness is by nature a dynamic process that requires firms to generate the appropriate organizational responses to environmental changes (e.g., Eisenhardt & Martin, 2000; O'Reilly & Tushman, 2000; Zajac, Kraatz & Besser, 2000). The simultaneous pursuit of both the exploitation of 'old certainties' and the exploration of 'new possibilities' is what enables organizations to adapt to their environment (March, 1991; Jansen, Tempelaar, Van den Bosch & Volberda, 2009; O'Reilly & Tushman, 2008). In order to avoid possible failure or success traps (Levinthal & March, 1993; Levitt & March, 1988; Ahuja & Lampert, 2001), it is vital for organizations in fast-moving environments to be able to exploit previous exploration as well to explore new domains using their existing knowledge base as a stepping stone (Cao, Gedajlovic & Zhang, 2009; Tushman & O'Reilly, 1996).

Organizations therefore have to become ambidextrous, i.e., they have to explore and exploit simultaneously (Cao et al., 2009; Jansen et al., 2009; O'Reilly & Tushman, 2008). One way that they can do this is by creating sub-units with an explorative or exploitative focus that are separated structurally, each characterized by a specific identity, expertise, structure, and processes (O'Reilly & Tushman,

2008; O'Reilly & Tushman, 2013). At the same time, these differentiated activities also need to be integrated through formal and informal integration mechanisms (Jansen et al., 2009). This should enable explorative and exploitative knowledge resources to be reconfigured dynamically (O'Reilly & Tushman, 2008). There is a large body of research which demonstrates that ambidexterity is positively associated with performance outcomes, reinforcing the idea that ambidexterity leads a firm to be capable of maintaining a dynamic fit with its environment (e.g., Burgers, Jansen, Van den Bosch, & Volberda, 2009; Cao et al., 2009; He & Wong, 2004; Hill & Birkinshaw, 2014; Lubatkin, Simsek, Ling, & Veiga, 2006; Tempelaar & Van de Vrande, 2012; Uotila, Maula, Keil, & Zahra, 2009).

1.2 Previous research, research gaps, and problem definition

However, despite these clear benefits, mastering ambidexterity is no easy feat; it requires the organization to continuously differentiate and integrate explorative and exploitative resources that are seemingly incommensurable (Lewis, 2000; O'Reilly & Tushman, 2008; Smith & Lewis, 2011). This creates a paradoxical situation as exploration and exploitation activities are contradictory, persistent, and self-referential in nature (Levitt & March, 1988; Smith, 2014). Managing these tensions is extremely challenging as exploration and exploitation activities seem to be logical separate from each other, but suggested ways of bringing together and integrating the two often appear irrational or even absurd (Birkinshaw & Gupta, 2013; Lewis, 2000; Smith & Tushman, 2005). Although these strategic contradictions are typically most apparent to those at the senior management level, these tensions are felt to some extent throughout the organization, especially by those who are involved in the integration (Andriopoulos & Lewis, 2008; Birkinshaw & Gupta, 2013; Smith & Tushman, 2005).

These paradoxical tensions are both material *and* perceptual in nature (Lewis, 2000; Smith and Lewis, 2011; Smith and Tushman, 2005). By focusing on the material side one highlights the tensions as if they are inherent to a particular system (Smith & Lewis, 2011). Within this logic, these tensions are taken for granted and as such have a universal truth to them. In contrast, by taking a

perceptual line of reasoning, tensions are more fluid as they are created within a specific time and space (Smith & Lewis, 2011). Seen from a longitudinal perspective, the ambidexterity paradox is structurational in nature (Giddens, 1984; Smith & Lewis, 2011). That is, the material tensions are outcomes of previous enactments which in turn form the environment for subsequent enactments by those confronted with the paradox (Weick, 1979). As such, organizational participants make sense of these paradoxical tensions within the structures, systems, and processes that result from previous enactments (Smith & Lewis, 2011).

This creates significant challenges for those trying to achieve ambidexterity. When faced with contradictions, organizational members are more likely to ignore rather than to engage with inconsistencies because they are subject to cognitive, behavioral, and institutional forces in their immediate environment that generates inertia (Smith & Lewis, 2011). In general, organizational participants will seek to maintain their existing beliefs, as this avoids cognitive and emotional strain (Smith & Lewis, 2011; Smith & Tushman, 2005). They tend to be myopic in nature, as they are inclined to privilege the "short term over long term, close rather than far, and certainty of success over risk of failure" (Smith & Tushman, 2005: 525). This means they will favor exploitation rather than exploration, but also – and perhaps just as crucially – will shy away from trying to realize integration of differentiated explorative and exploitative activities as the process is emotionally charged and cognitively demanding (Lewis, 2000; Smith & Lewis, 2011; Smith & Tushman, 2005). Well-known cases such as Polaroid (Tripsas & Gavetti, 2000) and Intel (Burgelman, 1991) demonstrate how existing belief structures regarding the 'razor blade model' (Polaroid) or 'we are the memory company' (Intel) can severely hamper or even bring a halt to adaptive efforts. At Polaroid top management had strong beliefs concerning the importance of a 'consumable component' (Tripsas & Gavetti, 2000: 1157). This prevented the company to launch cutting edge technology in the field of digital imagery that was developed in-house and which would have enabled the company to maintain its leading position in photography. At Intel management not only believed the production of DRAM's (Dynamic Random Access Memory) to be an essential driver for the company's learning curve, but they

also identified strongly with this product. Intel had been the first company that had been able to produce and market DRAM's. It was the business that started it all back in 1968, or as one of the interviewees put it: 'In a way DRAM's created Intel' (Burgelman, 1991: 245). As such the intended strategy was aimed at the production of memory chips even despite revenues in this market segment had been dropping rapidly for over a decade and the profits from logic chips had been rising. Had it not been for the autonomous action of lower level management as well as the resource allocation decision rule that shifted resources automatically to the most profitable products, Intel might had not survived.

But besides being a testament to the influence of belief structures on adaptation, these cases also show how the tension between exploration and exploitation is emotionally and socially charged. For those involved, taking a step into the unknown also involves letting go of the tried and true, and – at least partially – letting go of existing identities.

In addition, at the organizational level there is also significant inertia (Smith & Lewis, 2011). A constant pressure for consistency emanates from the organization's structure (Henderson & Clark, 1990), its routines and capabilities (Cyert & March, 1963; Eisenhardt & Martin, 2000; Leonard-Barton, 1992), and from the firm and inter-firm institutional context (Oliver, 1997).

These forces thus combine to make organizational members deny, ignore or avoid the exploration–exploitation paradox rather than embrace it (Bartunek, 1988; Smith & Lewis, 2011; Smith & Tushman, 2005). Cumulatively, this hampers the ability of the organization to become ambidextrous.

In relation to these challenges previous scholars have commented on the significance of so-called 'virtuous cycles' that allow firms to engage with and transcend the ambidexterity paradox and ultimately realize organizational ambidexterity (Andriopoulos & Lewis, 2008; Lewis, 2000; Smith & Lewis, 2011). These cycles, in which organizational participants accept and embrace the tensions between exploration and exploitation, regarding them as a source of opportunity rather than a threat, enable the creation of a dynamic adjustment through short term peak performance that ultimately results in long-term success (Smith & Lewis,

2011). These virtuous cycles go hand in hand with sensemaking processes (Andriopoulos & Lewis, 2009). In regard to creating these virtuous cycles, factors at both the individual and organizational level determine how the organization manages the ambidexterity paradox. At the individual level, cognitive and behavioral complexity as well as emotional calmness largely determine how organizational participants – and, through their actions, the organization – respond to these tensions (Smith & Lewis, 2011). At the organizational level, dynamic capabilities play a major role as they allow managers to respond to an ever-changing environment by combining and recombining information (Jansen et al., 2009; Smith & Lewis, 2011; Teece, 2007).

However, regarding ambidexterity most empirical and conceptual work has focused on factors relating to organizational design (e.g., Burgers & Jansen, 2008; Jansen et al., 2009; Jansen, Van den Bosch & Volberda, 2006; Greve, 2007; Lavie & Rosenkopf, 2006; Lavie, Stettner & Tushman, 2010; Sidhu, Volberda & Commandeur, 2004). More recently, considerable attention has also been paid to the characteristics of the top management team (TMT) (e.g., Alexiev, Jansen, Van den Bosch & Volberda, 2010; Cao, Simsek & Zhang, 2010; Heavey & Simsek, 2014; Heavey, Simsek & Fox, 2015; Jansen, George, Van den Bosch & Volberda, 2008; Lubatkin, Simsek, Ling, & Veiga, 2006) as antecedents to organizational ambidexterity. However, factors that influence the motivation and ability of organizational participants to engage with the paradox and the emotional, social-cultural, and cognitive attachments that surround it have been given far less attention. As such, the literature offers a great deal of insight concerning the nature of ambidexterity (e.g., Birkinshaw & Gupta, 2013; Cao et al. 2009; O'Reilly & Tushman, 2008, 2013; Smith & Lewis, 2011; Smith & Tushman, 2005) as well as ways to resolving some of the attendant issues (e.g., Cao, Simsek & Zhang, 2010; Jansen et al., 2006; Jansen et al., 2009; Jansen, Simsek, & Cao, 2012; Lubatkin, Simsek, Ling, & Veiga, 2006; Tushman, Smith, Wood, Westerman, & O'Reilly, 2010). However, it provides far less insight into why managers and other organizational participants faced with the ambidexterity paradox would seek to engage with it, when there are all these barriers to doing so.

Answering this question requires a shift in focus that brings socio-cognitive factors to the fore. It are precisely these factors that lie at the heart of both virtuous and vicious cycles, whose outcomes will greatly affect the organization's ability to transcend the ambidexterity paradox (Smith and Lewis, 2011). While recent case study research has indicated that these virtuous cycles do indeed play an important role in achieving ambidexterity (e.g., Andriopoulos & Lewis, 2009; Lüscher & Lewis, 2008; Smith, 2014), we are actually only beginning to understand the critical role played by these virtuous cycles and the socio-cognitive factors that drive them (Andriopoulos & Lewis, 2009; Smith & Lewis, 2011). Given the socio-constructionist nature of the ambidexterity paradox, it is important to undertake further conceptual extension and empirical validation of socio-cognitive antecedents that affect the motivation and ability of organizational participants to engage with the ambidexterity paradox. Unless we take these vital first steps, our understanding of ambidexterity will remain incomplete, as will our ability to manage it.

To address this gap in the literature, this dissertation focuses on different socio-cognitive antecedents of organizational ambidexterity and individual exploration activities. As these factors (that are situated at the organizational and individual levels of analysis) shape the information processing and learning behaviors of organizational participants, they directly influence those individuals' motivation and ability to deal with the risks, uncertainties, complexities, and anxieties attached to both the ambidexterity paradox and exploration activities. To express this more formally:

This PhD dissertation aims to advance scholarly and practical understanding regarding information processing and learning behaviors of organizational participants that influence their motivation to engage with, as well as their ability to, manage the ambidexterity paradox and individual exploration activities.

1.3 Dissertation overview

This dissertation consists of three separate studies (chapters 2–4), each of which contributes in its own unique way to answering the research aim outlined above. Each study addresses a different research question which is nevertheless embedded in the overall research aim of this dissertation. Each therefore focuses on different gaps, uses different theoretical constructs, and different units and levels of analysis.

In the subsequent paragraphs I provide an overview of the theoretical and methodological underpinnings of each of these studies (see tables 1.1 – 1.3). In table 1.4, I outline the main theoretical contributions of this dissertation.

1.3.1 Study 1: Organizational socio-cognitive antecedents of ambidexterity

In the first study, "Addressing the socio-cognitive aspects of the differentiation and integration challenge: The role of an organizational transactive memory system and reflexive climate", we draw attention to two issues in regard to ambidexterity that have received relatively little attention. The first issue is the distributed nature of the organization's resources. Within a differentiated organization, resources become too scattered to be overseen as whole, limiting the potential for reconfiguration, and thus the organization's capacity to become ambidextrous (Tsoukas, 1996; Becker, 2001). The second issue revolves around the need to persuade those who have to deal with the tensions inherent in integrating explorative and exploitative resources to face up to the challenges involved and to see the integration process through. The success of targeted integration efforts is likely to be hampered without such support.

We address these gaps in the ambidexterity literature by drawing attention to the significance of a reflexive climate (de Jong & Elfring, 2010; de Dreu, 2007; Patterson, West, Shackleton, Dawson, Lawthom, Maitlis, Robinson & Wallace, 2005; Schippers, 2003; Schippers et al., 2015) and an organizational transactive memory system (Argote & Ren, 2012; Jackson & Klobas, 2008; Moreland & Argote, 2003; Peltokorpi, 2012) as antecedents to ambidexterity. Our findings, based on 109 organizations in the six most innovation-intensive industries in the

Netherlands, indicate that a reflexive climate and an organizational transactive memory system (TMS) do indeed both have strong direct effects on ambidexterity. Moreover, organizational size interacts negatively with reflexive climate but does not interact with organizational TMS.

Table 1.1 Theoretical and methodological underpinnings of study one

Topic:	Socio-cognitive antecedents of ambidexterity
Outcome:	Organizational ambidexterity
Predictors:	Reflexive Climate, Organizational TMS
Moderators:	Organizational Size
Method:	• Survey • Hierarchical regression analysis
Level of analysis:	Firm-level
Sample:	Cross-sectional survey of 109 firms operating within the most innovation-intensive industries in the Netherlands

1.3.2 Study two: TMT cognitive antecedents to ambidexterity

In the second study, "Embracing Paradox: The Mediating Role of TMT Paradoxical Cognition on the Relationship between TMT Reflexivity and Ambidexterity", I examine how the capacity of the TMT to realize ambidexterity depends on the team's ability to engage in reflective behavior (TMT reflexivity) as well as its capacity for cognitive differentiation and integration (TMT paradoxical cognition). Within the ambidexterity literature, top management teams play a critical role: they are at the juncture of internal forces for stability and external forces for change (Smith and Tushman, 2005).

Despite the vital role the TMT plays as an orchestrator of this dynamic recombinative process, the literature provides little guidance in terms of what factors enable and motivate top-management to transcend this paradoxical tension (O'Reilly & Tushman, 2013; Smith, 2014). To shine more light on this matter I extend the work by Smith & Tushman (2005) and Smith and Lewis (2011), and argue that top

management's capacity to realize ambidexterity depends on TMT reflexivity as well as TMT paradoxical cognition.

Table 1.2 Theoretical and methodological underpinnings of study two

Topic:	TMT cognitive antecedents of ambidexterity
Outcome:	Organizational ambidexterity
Predictors:	TMT Reflexivity, TMT Paradoxical Cognition
Method:	• Survey • Hierarchical regression analysis
Level of analysis:	Firm-level
Sample:	Cross-sectional survey of 455 Dutch and German firms

To test the simple-mediation model, data was gathered by means of a survey in the Netherlands and in Germany. In total 455 usable questionnaires were gathered from CEOs and other members of the management board. I find confirmation that TMT reflexivity influences organizational ambidexterity. Moreover, I show that paradoxical cognition fully mediates the relationship between TMT reflexivity and organizational ambidexterity. This provides evidence for my argument that, although learning behaviors associated with TMT reflexivity are instrumental in helping teams to manage the paradox, the way in which they do so depends on how TMT shared mental models are organized (i.e. TMT paradoxical cognition).

1.3.3 Study three: The influence of relational capital on individual exploration

In the third and final study, "Relational Capital and Individual Exploration: Unraveling the Influence of Goal Alignment and Knowledge Acquisition", we investigate how the relational capital of a person within an organization affects the extent to which he or she conducts exploration activities. Our theory separates out a negative effect that comes from aligning goals with those of other organizational members from a positive effect that stems from acquiring knowledge from them.

Our data from 150 members of the R&D teams of three leading R&D-intensive firms support the theoretical model. By developing and testing this theory, we contribute to the literature on exploration, where there is insufficient understanding of the antecedents of individual exploration in organizations. We also contribute to the relational capital literature, which has focused on organizational and group-level exploration, but has shown inconsistent findings regarding the relationship between relational capital and exploration. One reason for this may be that this body of research has emphasized only the positive effects of relational capital on exploration, and has not accounted for the different mechanisms that mediate the effects of relational capital on individual exploration activities. Our theory offers a more comprehensive view by explaining how relational capital may provide both advantages and disadvantages to individual exploration activities.

Table 1.3 Theoretical and methodological underpinnings of study three

Topic:	The influence of relational capital on individual exploration
Outcome:	Individual Exploration
Predictors:	Relational Capital, Knowledge Acquisition, Goal Alignment
Method:	• Survey • Structural equation modeling
Unit of analysis:	Individual-level
Sample:	Cross-sectional survey of 150 organizational members

Table 1.4 Overview of gaps and main contributions of the dissertation

Studies	Gap(s)	Main contributions
Study 1. Addressing the socio-cognitive aspects of the differentiation and integration challenge: The role of an organizational transactive memory system and reflexive climate	The literature on the antecedents of structural ambidexterity has tended to focus on either formal and informal integration mechanisms (emphasizing the material aspect of the ambidexterity paradox) or – to a lesser extent – on the emotional and cognitive tensions surrounding the differentiation and integration of explorative and exploitative resources (i.e. the perceptual aspect of the ambidexterity paradox). Despite considerable progress in both areas. Several issues remain that span this ontological divide. First, as ambidexterity scholars increasingly recognize, willingness to engage with these tensions and support from other organizational members outside the TMT is crucial for the smooth integration of explorative and exploitative resources. Second, from a knowledge-based perspective, the differentiated nature of	We elaborate on and demonstrate the important role of organizational learning in relation to organizational ambidexterity. We introduce a reflexive climate and a transactive memory system as antecedents to ambidexterity, and show that they are instrumental in stimulating and enabling organizational participants to engage with and overcome the tensions inherent in the ambidexterity paradox. They also help participants to deal with the distributed nature of the ambidextrous firm as both facilitate learning activities. By focusing on the organizational systems that enable and motivate organizational participants to engage with the ambidexterity paradox, we enlarge our understanding of how organizations can manage both the material and

ambidextrous firms results in a distributed landscape in which organizational participants have only a partial awareness of the knowledge resources available to them, limiting their ability to sense, seize, and reconfigure resources. Third, recent inductive research has pointed to organizational size as an important contingent factor in regard to the effectiveness of differentiation and integration tactics. Yet, despite these issues, there is only limited research on the organizational systems that enable and stimulate organizational participants to cope with these challenges, and on how these systems are conditional on organizational size.

perceptual aspects of the ambidexterity paradox. Finally, our study shows that organizational size has a significant interacting effect with reflexive climate but not with organizational TMS.

	Gap(s)	Main contributions
Study 2. Embracing Paradox: The Mediating Role of TMT Paradoxical Cognition on the Relationship between TMT Reflexivity and Ambidexterity	The current ambidexterity literature shows that top managers play a vital role in managing the exploration–exploitation paradox as they are responsible for sensing, seizing, and reconfiguring these differentiated resources. The literature indicates that, in order to do this, top managers must transcend the ambidexterity paradox, overcoming their own cognitive biases. Despite recognizing this, the current body of literature offers few insights regarding the factors that enable and motivate top managers to engage with – and ultimately – transcend the ambidexterity paradox.	This study refines the conceptualization and argumentation concerning the positive influence of TMT reflexivity on paradoxical cognition and ambidexterity. In particular, it draws attention to the associated single and double-loop TMT learning behaviors associated with TMT reflexivity and the interrelated role they play in enabling ambidexterity. This study extends the ambidexterity literature by arguing that paradoxical cognition determines how managers will make sense of, and select among, ideas generated through TMT reflexivity. Although other literature streams have shown that learning behaviors are crucial in resolving paradoxes, learning behaviors have been given a much less prominent role within the ambidexterity

literature; in contrast, these studies have focused on TMT antecedents such as team design, leadership style, or task interdependence. This study therefore contributes to the ambidexterity literature by providing more detail on how TMT reflexivity and its associated learning behaviors relate to TMT paradoxical cognition and organizational ambidexterity.

This study is first to confirm the positive influence of paradoxical cognition on ambidexterity.

Study 3. Relational Capital and Individual Exploration: Unraveling the Influence of Goal Alignment and Knowledge Acquisition	**Gap(s)** Although the literature on organizational adaptation recognizes that a firm's capacity to explore is to a large extent rooted in the exploratory behavior of its members, there is a limited understanding of what enables and motivates individuals to explore or why they show differing degrees of explorative behavior despite similar surroundings. Recent research has indicated that relational capital may play a particularly valuable role in explaining new, innovation-orientated activities and learning in organizations. However, research on the relationship between relational capital and exploration has generated mixed findings, possibly because at lower levels (individual) relational capital has both benefits and drawbacks which may surface differently in different contexts.	**Main contributions** We advance the literature by developing and testing a comprehensive multi-mediational model in which relational capital is hypothesized to influence individual exploration through a positive effect which stems from knowledge acquisition and a negative effect emanating from goal alignment from other members in the organization. We thereby address the current lack of clarity within the literature regarding the influence of relational capital on exploration activities. We demonstrate that relational capital has both benefits and drawbacks, and by so doing, we increase both scholarly and managerial understanding regarding the drivers of individual exploration in organizations.

Chapter 2. Addressing the socio-cognitive aspects of the differentiation and integration challenge: The role of an organizational transactive memory system and reflexive climate.

2.1 Abstract

We still have relatively little understanding of the organizational systems that enable and stimulate organizational participants to overcome the considerable emotional and cognitive tensions inherent in the ambidexterity paradox; we also do not know enough about how they cope with only limited awareness of and access to the various explorative and exploitative resources. Moreover, fairly little is known about the effectiveness of different integration mechanisms for organizations of differing sizes. In response we draw attention to two important socio-cognitive antecedents of ambidexterity (organizational transactive memory systems and reflexive climate) and explain how they are moderated by organizational size. We find that both a reflexive climate and an organizational transactive memory system are strongly related to ambidexterity. In addition, we find that organizational size interacts negatively with reflexive climate, but does not interact with organizational transactive memory. By extending theory in this area and providing some empirical findings, we provide a more comprehensive understanding of how organizations can deal with the differentiation and integration challenge and thus increase ambidexterity.

Keywords: Ambidexterity, Organizational Transactive Memory, Reflexive Climate, Organizational Size, Organizational Learning

An earlier version of this paper was selected for the best paper proceedings of the Academy of Management Conference 2012, Business Policy & Strategy track, in Boston as van Neerijnen, P., Schippers, M., Tempelaar, M., & Figge, P., 2012, 'Creating performance through ambidexterity: The role of an organizational transactive memory system and organizational reflexive climate'. A final version of this co-athored paper is in the process of submission to an international journal in the field.

2.2 Introduction

To prosper in competitive settings, organizations need to be ambidextrous (Cao et al., 2009, He & Wong, 2004). Ambidexterity enables long-term adaptation as it allows firms to reap the benefits of current competencies while preparing the ground for the profits of tomorrow (Taylor & Helfat, 2009; Teece, 2014). The structural view on ambidexterity argues that, to achieve this, there must be differentiation between explorative and exploitative activities throughout the organization in order to prevent either one of these very distinct activities becoming too dominant, and at the same time ensure that there is continuous integration of these two activities (Jansen et al., 2009; O'Reilly & Tushman, 2008; Raisch & Birkinshaw, 2008; Smith, 2014; Tushman & O'Reilly, 1996).

This situation creates a paradox as exploration and exploitation activities are contradictory in nature, self-referential, and persistent over time (Levitt & March, 1988; Smith, 2014). So far the ambidexterity literature has predominantly addressed the tensions surrounding the differentiation and integration challenge from a structural perspective (e.g., Burgers et al., 2009; Jansen et al., 2009; O'Reilly & Tushman, 2008, 2011, 2013; Smith & Tushman, 2005). Here research has focused on formal and informal integration mechanisms as antecedents to ambidexterity. Although these contributions have deepened our understanding of the antecedents of ambidexterity, several issues remain with regard to the differentiation and integration challenge.

First of all, coping successfully with differentiation and integration requires enormous dedication from all the parties involved. Although it is indisputable that those in senior management face the brunt of the integration and differentiation challenge as they seek to sense, seize, and realize new combinations of explorative and exploitative resources (Jansen et al., 2009; O'Reilly & Tushman, 2008, 2011, 2013; Teece, 2014), in the end "even the most ordinary production worker or call center worker faces some version of the ambidexterity dilemma" (Birkinshaw & Gupta, 2013: 294). Therefore, the cognitive, behavioral, and institutional tensions perceived by all those involved in the integration (e.g., members of a cross-functional team) must be reconciled in order to achieve a smooth integration of explorative and exploitative resources (Kang & Snell,

2009; Lewis, 2000). In other words, for targeted integrations (O'Reilly & Tushman, 2008) to be successful, one must win the hearts and minds of the people.

Secondly, the differentiated nature of the ambidextrous firm creates a distributed landscape, in which knowledge, competencies, and individual skills are scattered throughout the organization and are too diverse and numerous for anyone to oversee as a whole (Tsoukas, 1996; Becker, 2001). This distributed nature makes it challenging for those who are dealing with the tensions between differentiation and integration to spot and make use of potential ways of reconfiguring the explorative and exploitatative resources available to them (Argote & Ren, 2012; Heavey & Simsek, 2014; van Neerijnen et al., 2012). Although most prevalent at the top management level, this challenge is also faced by other organizational participants. An ambidextrous organization needs to have a system in place to help those involved become more aware of the expertise available, because unless they do so, the variety of knowledge resources they can access will be limited, as will the number of potential synergies they can realise (van Neerijnen et al., 2012).

Thirdly, the way organizations of various sizes deal with the ambidexterity challenge are very dissimilar (e.g., Andriopoulos & Lewis, 2010; Csaszar, 2013; Ebben & Johnson, 2005; Lubatkin et al. 2006; Voss & Voss, 2013). Because smaller firms have different structural arrangements to larger ones, the challenges of differentiation and integration are more difficult for them (Blau, 1970; Cullen, Anderson & Baker, 1986; Donaldson, 2001; Levinthal & March, 1993; Mintzberg, 1980). While the literature has explored in some detail the contingent effect of organizational size on the relationship between ambidexterity and performance (Cao et al., 2009; Lee et al., 2013; Moss et al., 2013; Voss & Voss, 2013), the moderating influence of firm size on the antecedent-ambidexterity relationship remains unclear and warrants further investigation (Andriopoulos & Lewis, 2010; Csaszar, 2013).

Currently the ambidexterity literature offers limited insights into the *organizational systems that enable and stimulate employees* to cope with these issues related to the differentiation and integration challenge. We contribute to the ambidexterity literature by introducing two organizational-level socio-cognitive antecedents of ambidexterity and by arguing that the impact of each of these antecedents is contingent on organizational size.

First, by building on the paradox literature (Lewis, 2000; Smith & Lewis, 2011), we draw attention to the effect of a reflexive climate on ambidexterity, and we argue that it has the capacity to inspire organizational participants to engage in single- and double-loop learning, essential for managing the ambidexterity paradox (Argyris, 1991; Schippers, 2003; Senge, 1990; Smith & Tushman, 2005; Smith, 2014). A reflexive climate refers to "a concern with reviewing and reflecting upon objectives, strategies, and work processes, in order to adapt to the wider environment" (Patterson et al., 2005: 386). We develop an argument that, when operating within a reflexive climate, employees are more likely to transcend the cognitive and social tensions surrounding the integration of explorative and exploitative activities.

Second, we argue that an organizational transactive memory system (TMS) (Argote & Ren, 2012; Moreland, 1999; Peltokorpi, 2012) drives the ability of organizational members to access richer and more diverse expertise efficiently and effectively, and in a self-organizing manner (Argote & Ren, 2012). An organizational TMS can be defined as "a network of interdependent work groups that use each other as external cognitive aids to accomplish shared tasks" (Peltokorpi 2012: 17). It leads to a greater awareness of where different resources are located, and facilitates their subsequent integration, thus increasing ambidexterity.

Thirdly, we show that these two antecedents affect ambidexterity differently, depending on the size of the organization. Organizational size has been shown to be a key contingent factor in relation to organizational adaptation as it increases the complexity of organizational decision-making, communication, and control (Blau, 1970; Baker & Cullen, 1993). Larger organizations have been shown to become more formalized and structurally differentiated (Blau, 1970; Baker & Cullen, 1993; Cullen et al., 1986; Greiner, 1972; Levinthal & March, 1993; Mintzberg, 1980). Consequently, organizational participants in larger organizations are less focused on system-wide opportunities for integration, are more prone to engage in routine behavior, and will have less developed cross-unit relationships, both in number and in quality. It is therefore much harder for large organizations to benefit from a reflexive climate. Likewise, the more departmentalized structure of larger firms means that there is less awareness of explorative and exploitative resources. This lowers the cohesiveness within the organization, increases the costs of

tracking and tracing knowledge and information, and reduces the accuracy and reliability of expertise awareness (Peltokorpi, 2012). We develop a theoretical argument that an organizational TMS is likely to have more influence in smaller organizations than in larger ones.

In the next section we present our literature review and develop our theoretical model and hypotheses. We then provide a detailed account of our methods and empirical findings. We conclude by drawing out the implications of our findings for the ambidexterity literature and suggesting avenues for further research.

2.3 Theory and hypotheses

2.3.1.1 Organizational ambidexterity

Central to organizational adaptation is the ability of the organization to manage the relationship between what James March has called "the exploration of new possibilities and the exploitation of old certainties" (March, 1991: 71). Here exploration refers to organizational behaviors characterized by search, experimentation, play, flexibility, discovery, innovation, and risk-taking, while exploitation, by contrast, includes activities such as refinement, implementation, efficiency, execution, selection, and production (Cao et al., 2009; Jansen et al., 2009; March, 1991). For long-term survival organizations need to be able to balance exploration and exploitation activities (Levitt & March, 1988). An over-emphasis on exploitation might lead to a 'success trap' (Levinthal & March, 1993; Levitt & March, 1988) or a 'competence trap' (Leonard-Barton, 1992), while too great a stress on exploration might lead to a 'failure trap' (Levinthal & March, 1993). Both these scenario's result in maladaptive behavior (Levinthal & March, 1993; Levitt & March, 1988). Although balancing exploration and exploitation activities is crucial for the firm's long-term survival, achieving this kind of balancing act is notoriously difficult, due to the self-reinforcing learning dynamics related to each of these activities (Levitt & March, 1988). While both types of learning trap can occur, in general organizations are far more inclined to favor exploitation, because of the greater certainty involved, the faster return on investment, and the easier process in terms of adapting their existing knowledge base (March, 1991).

2.3.1.2 The differentiation and integration challenge

To help them pursue both exploration and exploitation, organizations can create parallel structures in which a common vision provides the overarching goals that give legitimacy to the collective action required for the targeted integrations initiated and coordinated by management (Burgers et al., 2009; Jansen et al., 2009; O'Reilly & Tushman, 2008, 2013; Raisch et al., 2009). However, merely adopting certain configurations is unlikely to facilitate the dynamic alignment needed to ensure organizational survival (Zajac et al., 2000; Raisch et al., 2009). For dual structures to provide a dynamic capability, management must be able to continuously sense, seize, and reconfigure resources (Birkinshaw & Gupta, 2013; Jansen et al., 2009; O'Reilly & Tushman, 2008, 2013; Raisch et al., 2009; Schreyögg & Sydow, 2010; Smith & Tushman, 2005). One of the major obstacles that managers face in undertaking this type of dynamic adaptation is the differentiation and integration challenge (Smith, 2014). This challenge is both material and perceptual in nature (Heavey & Simsek, 2014; Raisch et al., 2009; Schreyögg & Sydow, 2010; Smith, 2014; Smith & Tushman, 2005). In terms of the material issues related to the differentiation and integration challenge, the search for integration across structurally differentiated units is always accompanied by a risk of losing the identity of the unique "thought worlds" of the respective units. There can also be ambiguity over which sub-unit goals should take priority, leading potentially to mounting coordination costs (Carlile, 2004; Dougherty, 1992; Raisch et al., 2009; Schreyögg & Sydow, 2010). However, the emotional and cognitive pressures (i.e., the perceptual issues) involved in the differentiation and integration challenge are also substantial (Birkinshaw & Gupta, 2013; Lüscher & Lewis, 2008; Smith, 2014; Smith & Lewis, 2011). Achieving integration is likely to be perceived as a strenuous or even fruitless exercise as these exploration and exploitation activities are logical in isolation, but tend to be perceived as "absurd and irrational when appearing simultaneously" (Lewis, 2000: 760). This situation is likely to be exacerbated by the behavioral and cognitive defences that people are likely to put up to new configurations that might seem, in the first instance, rather strange and pointless (Lewis & Smith, 2014).

While scholars working in the field of structural ambidexterity has commented on and explored the role of top management in dealing with these paradoxical tensions – in particular its role in regard to sensing, seizing, and reconfiguring explorative and exploitative resources (O'Reilly & Tushman, 2008; Smith & Tushman, 2005) – the success of these targeted integrations will also depend partly on the ability and motivation of other organizational participants to engage with the ambidexterity paradox and to see these integrations through (Birkinshaw & Gupta, 2013; Raisch et al., 2009; Schreyögg & Sydow, 2010). Just like top management, other organizational participants are also inclined to shy away from the ambidexterity paradox, given the perceived emotional and cognitive pressures involved (Birkinshaw & Gupta, 2013; Lüscher & Lewis, 2008; Smith, 2014; Smith & Lewis, 2011). Moreover, given top management's cognitive and emotional limitations (March & Simon, 1958; March, 1978; Simon, 1987; Simon, 1991), it is unlikely that top management will be able to supervise the dynamic adaptation required on their own (Raisch et al., 2009; Schreyögg & Sydow, 2010). To be effective and efficient, the overall organizational system will need some degree of lower-level adaptation as well. Recent work by Martin and Eisenhardt (2010) convincingly demonstrated the importance of lower-level adaptive efforts in regard to resource reconfigurations in multi-business organizations. Their comparative case study revealed that an integration process driven purely from the top down led to poor performance outcomes as top management often lacked the information necessary to judge the merits of a reconfiguration, and formal incentives across the firm did not persuade lower-level employees to buy into the proposed integration. It would seem then that to create an ambidextrous organization, management must put in place an organizational system which stimulates and enables employees to face up to the differentiation and integration challenge that is inherent in structural ambidextrous organizational designs (Schreyögg & Sydow, 2010).

2.3.1.3 The role of organizational learning in regard to the ambidexterity paradox

A major tension in integrating explorative and exploitative resources is that individuals have to let go of the certainty provided by their existing cognitive and behavioral frames before they can construct a new frame (Lewis, 2000). Organizational participants can cope with these paradoxical tensions by relying on different yet related

tactics of acceptance, confrontation, and transcendence that will respectively enable them to develop a: heightened awareness of these tensions and their causes; construct a more accommodating understanding; and/or reframe their existing schemata, attributing a new meaning to the situation through a greater capacity for paradoxical thinking (Lewis, 2000). What these tactics have in common is that they depend on the ability of organizational actors to learn and develop new knowledge, i.e., to extend, draw and redraw distinctions in their existing conceptual models (Lewis, 2000; Quinn, 1988; Tsoukas, 2009). Such learning is necessary to escape the self-referential loops that can often exist within explorative or exploitative units (Lewis, 2000; Lewis & Smith, 2014; Smith, 2014). As organizational actors draw and redraw divides within their existing schemata, new meanings emerge (Lewis, 2000; Tsoukas, 2009). These new meanings act as triggers or stimuli for the activation of associative networks which, in turn, generate new insights and perspectives (Schilling, 2005). This provides actors with additional knowledge that can broaden their current understanding, and gives them opportunities for new ways of thinking by bringing different concepts together and by reshuffling the elements of specific knowledge domains (Mom et al., 2015). They can then 'discover' new interrelationships as they are confronted with possible relationships which they had previously been unaware of (Smith & Tushman, 2005). It is precisely this change in meaning, facilitated by learning, that marks the transformation from perceiving exploration and exploitation as incommensurable activities to regarding them as complementary and interwoven (Lewis, 2000).

Although the ambidexterity literature has explored the emotional and cognitive tensions involved with the differentiation and integration of explorative and exploitative resources (e.g., Birkinshaw & Gupta, 2013; Lüscher & Lewis, 2008; Smith, 2014; Smith & Lewis, 2011), and stressed the importance of learning in relation to resolving this paradox (e.g., Lewis, 2000; Lewis & Smith, 2014; Schreyögg & Sydow, 2010), it offers few insights into the organizational systems that might stimulate and enable organizational participants to engage in the learning activities needed to deal with the emotional and cognitive tensions involved in differentiating between and integrating of exploration and exploitation activities. In the subsequent sections we will explain how both an organizational reflective climate and an organizational transactive memory system

facilitate learning activities, and how these learning activities then enable and stimulate organizational participants to engage with these tensions, thereby increasing organizational ambidexterity.

2.3.2 A reflexive climate as antecedent to ambidexterity

An organizational climate refers to the practices, shared beliefs, and value system of the organization which together form an institutionalized normative system that guides the behavior of organizational members (Bock et al., 2005; Kuenzi & Schminke, 2009; Lindell & Brandt, 2000; Schneider, 1975). The climate within an organization can exert a strong influence on the daily activities of organizational participants. Prior studies on the antecedent role of organizational climate in relation to ambidexterity have found that the interplay between hard elements (discipline and stretch) and soft elements (support and trust) has a significant influence on ambidexterity (Birkinshaw & Gupta, 2013; Gibson & Birkinshaw, 2004). Building on the paradox literature (e.g., Andriopoulos & Lewis, 2009, 2010; Lewis, 2000; Lewis & Smith, 2014; Lüscher & Lewis, 2008; Smith, 2014; Smith and Lewis, 2011; Smith & Tushman, 2005), we draw attention to the behavioral and social *direct* effects of a reflexive climate. Reflexive thought and the related learning behaviors have recently been suggested as important enablers in relation to resolving paradoxical tensions (Lewis, 2000; Lüscher & Lewis, 2008; Schreyögg & Sydow, 2010). Rather than focussing on the interplay between hard and soft elements as suggested in the competing values model (Gibson & Birkinshaw, 2004; Patterson, West, Shackleton, Dawson, Lawthom, Maitlis, Robinson, & Wallace, 2005; Quinn & Rohrbaugh, 1981; Quinn & McGrath, 1985), we argue that a reflexive climate drives ambidexterity directly through its capacity to inspire sustained engagement in single- and double-loop learning behavior of organizational participants (Lewis, 2000; Schippers, 2004).

An organizational reflexive climate refers to "a concern with reviewing and reflecting upon objectives, strategies, and work processes, in order to adapt to the wider environment" (Patterson et al., 2005: 386). It stimulates organizational participants to explore different viewpoints, question the status quo, and give more careful thought to current or alternative strategies, processes, and objectives, as well as to threats and

opportunities in the internal and external environment (Schippers, 2003; West, 2000). It encourages them to develop a greater degree of cognitive adaptability, making them more open to other people's ideas (Schippers et al., 2008; Konradt, Schippers, Garbers, & Steenfalt, 2014), and it motivates them to engage in systematic information processing (de Dreu, 2007; Schippers, Edmondson & West, 2015). Crucially, it also facilitates the differentiation between, and the integration of, exploitation and exploration; its 'dual focus' involves reflecting on existing processes, capabilities, products, or strategies, but at the same time also drawing attention to adaptations that will be required in the future (de Jong & Elfring, 2010). A reflexive climate is associated with both single- and double-loop learning behaviors (Schippers, Den Hartog & Koopman, 2007; Vashdi, Bamberger, Erez & Weiss-Meilik, 2007). Here single-loop learning refers to learning that takes place within existing mental models (Argyris & Schön, 1978; Vashdi et al., 2007). Lessons learned are incorporated into the prevailing routines, norms, policies, strategies, or goals, leading to further refinement of existing mental models (Vashdi et al., 2007; Volberda, 1996). Single-loop learning is associated with shallow reflection (Schippers et al., 2007; Swift & West, 1998). In contrast, double-loop learning is associated with deeper reflection and involves discussion of the norms, values, strategies, and objectives of the organization (Argyris & Schön, 1978; Schippers et al., 2007; Swift & West, 1998; Vashdi et al., 2007; Volberda, 1996). It involves the generation of new mental models and is a prerequisite for the emergence of new configurations of resources and capabilities (Volberda, 1996).

To sustain exploration and exploitation, it is vital that the organization engages in differentiation and integration practices (Smith, 2014). The ability to engage simultaneously in both modes of learning prevents organizational participants from succumbing to defensive responses or vicious paradoxical cycles (Lewis & Smith, 2014; Smith, 2014). Single- and double-loop learning processes act respectively as centrifugal and centripetal forces that are both required to enable ambidexterity. As pointed out by Smith (2014), achieving both differentiation and integration is not only a challenge: the two are also mutually supportive as differentiation without integration increases conflict, while an overemphasis on integration might lead to myopia (Levinthal & March, 1993; Tripsas & Gavetti, 2000). As the capacity of the firm to become ambidextrous is ultimately determined by its employees' ability to transcend the ambidexterity paradox, the effect of a

reflexive climate on organizational participants is to increase organizational ambidexterity. Because of the associated single- and double-loop learning behaviors, a reflexive climate plays a pivotal role in stimulating organizational participants to engage with the emotional and cognitive challenges involved in differentiation and integration, as well as enabling them to recognize and realize opportunities, linkages and synergies between explorative and exploitative knowledge resources. The result is an increase in the firm's level of ambidexterity.

Here single-loop learning activities serve to make organizational members more able to differentiate between exploration and exploitation activities. When they reflect on tasks that are close at hand – for example, leading them to improve on an existing routine– they actively drive the extension and refinement of the explorative and exploitative knowledge domains. This increases the depth, accuracy, and reliability of the knowledge domains in question (Katila & Ahuja, 2002; van Neerijnen, 2015). The single-loop learning activities associated with shallower reflection help organizational members to focus their attention on explorative or exploitative activities, providing legitimacy for each of these activities and enabling them to differentiate between these activities both cognitively and emotionally (Schippers et al., 2007; Smith & Tushman, 2005; Swift & West, 1998). This greater capacity to draw distinctions between different categories of knowledge reduces the adherence to existing points of view (Smith & Tushman, 2005): i.e., it allows organizational participants to see the world in a rich palette of colours rather than just in black and white. Moreover, these processes of differentiation create more information, which may prove essential in order to respond to changing circumstances (Smith & Tushman, 2005). Finally, due to the greater propensity of organizational members to recognize different categorizations, it is more likely that new points of convergence will be enacted (Smith & Tushman, 2005; Weick, 1979). Because a reflexive climate stimulates single-loop learning and the associated cognitive differentiation, it provides the creation of a greater variance in material for future integrations, essential for organizational members to be able to deal effectively with the differentiation and integration challenge.

At the same time, double-loop learning behaviors free organizational participants from perspective-limiting assumptions (Gray, 2007), because they can actively question

these existing mental models and move beyond entrenched assumptions about explorative and exploitative knowledge resources and the norms, policies, and objectives that surround them (Argyris & Schön, 1978; Lewis, 2000; Lüscher & Lewis, 2008). Reflexivity triggers double-loop learning behaviors as it stimulates organizational members to step back, critically reflect upon and communicate about objectives, strategies and processes, and adapt them to current or anticipated circumstances (West, 2000). When organizational participants engage in reflective discussion, they shift their focal awareness to the subsidiary particulars (Nonaka, 1994; Polanyi, 1975; Tsoukas, 2002), opening up their ways of thinking to critique, and that then allows them to avoid the paralysis that often accompanies paradoxical tensions (Lewis, 2000). Because they are stepping back from the humdrum of daily life, they are more likely to recognize and enact linkages between activities that might have seen incommensurable before (van Neerijnen, 2015). Where there is a reflexive climate, organizational members are able to bring existing assumptions to the fore and review them, enabling them to reframe these assumptions, give more thought to the tensions involved and what might cause them, and to develop a more sophisticated understanding of the potential interdependencies and interrelationships between exploration and exploitation activities (Lewis, 2000). Novel integration of explorative and exploitative resources is more likely to be achieved when supported by a rich understanding of the respective knowledge domains. Because a reflexive climate is associated with both single- and double-loop learning behaviors, organizational participants are better able to deal with the tensions surrounding the differentiation and integration of explorative and exploitative resources. This increases the likelihood that they will try to transcend the ambidexterity paradox. We therefore argue that:

Hypothesis 1: A reflexive climate is positively related to ambidexterity.

2.3.3 An organizational TMS as an antecedent to ambidexterity

An organization that seeks to become more ambidextrous may benefit from an organizational transactive memory system (TMS). A TMS is a system that individuals in groups and organizations use to encode, store, and retrieve knowledge and expertise (Argote & Ren, 2012; Jackson & Klobas, 2008; Peltokorpi, 2012; Ren & Argote, 2011;

Wegner 1987). Following Peltokorpi (2012: 17), we define an organizational TMS as "a network of interdependent work groups that use each other as external cognitive aids to accomplish shared tasks". It allows individuals to use other organizational participants as external cognitive repositories (Wegner, 1995, Yuan et al., 2007). A TMS gives people access to a wider and richer range of knowledge and expertise, enabling them to access it in a more efficient and more organized way (Argote and Ren 2012). This is likely to be particularly important for ambidextrous organizations characterized by highly distributed knowledge resources, where there will be less awareness of the resources available and of the reconfigurative potential those resources might offer, thus constraining the organization's ability to generate Schumpeterian rents (Becker, 2001; Tsoukas, 1996; van Neerijnen et al., 2012).

Although TMSs are functionally equivalent across various levels of analysis, there are structural differences between team-level and organizational-level TMS (Moreland, 1999; Moreland & Argote, 2003; Peltokorpi, 2012). Most notably, rather than having a shared awareness of what expertise is available, complementary expertise awareness can exist (Ashworth, 2007; Peltokorpi 2012). This means that, besides the benefits associated with a direct awareness of 'who knows what', expertise awareness can also be indirect as members provide each other access to their individual cognitive repositories – for example, referring knowledge-seekers to an expert who would otherwise be unknown to them. An organizational TMS integrates different work groups with their respective group TMS through both direct and indirect connections between individual members. It is through this connection of the individual to the collective that an organizational capability emerges. This allows individuals to tap into a 'collective mind' (Wegner, 1987; Weick & Roberts, 1993), enabling them to locate and utilize explorative and exploitative knowledge resources. An organizational TMS matures as organizational participants engage in novel social interactions, creating a greater awareness of 'who knows what' and 'who knows whom'. Based on its unique characteristics, an organizational TMS has been conceptualized as a powerful capability that provides the basis for a dynamic reconfiguration of resources (Argote & Ren, 2012). Because it is based on interlocking social relationships that provide mutual access to specific resources, an organizational TMS has self-organizing properties (Davis, Eisenhardt, & Bingham, 2009;

Martin & Eisenhardt, 2010; van Neerijnen et al., 2012). It empowers organizational participants to seek out the expertise of local and distant others. As such, it enables a more dynamic, and emergent, reconfigurative process, providing an important complement to the more top-down efforts by the TMT to sense, seize, and reconfigure resources (Martin & Eisenhardt, 2010; Raisch et al., 2009; Schreyögg & Sydow, 2010).

An organizational TMS enables the efficient and effective integration of knowledge and expertise across exploratory and exploitative boundaries. Regarding a TMS's impact on efficiency, employees in organizations with a well-developed TMS are relatively close to each other in terms of path lengths (Gulati et al., 2012, Milgram, 1967). Longer search chains between knowledge-seekers and adequate experts lead to information disadvantages (Singh et al., 2010). With an organizational TMS, these search chains are shorter, and intermediate steps can be better coordinated by drawing on the greater awareness of 'who knows what' as well as 'who knows whom'. Another related benefit for coordination is the increased capacity to both "pull" and "push" knowledge and information rapidly across explorative and exploitative boundaries. Through a TMS, experts can be identified and contacted more easily, leading to a more informed interpretation and reaction to market signals, new technological developments, or new business ideas. In addition to this "knowledge pull", a TMS can also be used to "push" new information or insights to the employees with the most appropriate knowledge or skills to react. This ability to quickly span exploratory and exploitative knowledge boundaries eases the transition between and translation of exploratory and exploitative knowledge (Im & Rai, 2008; Kogut & Zander, 1992; Raisch et al., 2009). As such, the increased exposure to knowledge that spans the boundaries between exploration and exploitation highlights the potential of a firm-level TMS to foster an efficient integration of exploration and exploitation, i.e., facilitating organizational learning.

Furthermore, an organizational TMS is an invaluable capability to effectively organize the integration of explorative and exploitative knowledge resources and realize synergies between them, driving organizational learning (Argote & Ren, 2012). Important in this respect are the coordination advantages of an organizational TMS, as it facilitates interaction between both individuals and groups through direct and indirect expertise awareness (Argote & Ren, 2012; Faraj & Sproull, 2000; Peltokorpi, 2012). An

organizational TMS increases awareness of distributed knowledge and expertise (Becker, 2001; Tsoukas, 1996). Given the greater awareness of individual competences, organizational members can better coordinate who will do what (Argote & Ren, 2012; Brandon & Hollingshead, 2004; Faraj & Sproull, 2000; Kanawattanchai & Yoo, 2007; Liang et al., 1995; Rulke & Rau, 2000). As a result, experts are more accurately matched (Jackson & Klobas, 2008; Littlepage et al., 2008). This can help the organization to staff teams with the experts who are most likely to transcend the exploration and exploitation paradox. In addition, an organizational TMS provides access to a wider scope of more diverse knowledge resources as it greatly expands the search horizon of organizational participants (Argote & Ren, 2012; Rau 2005, 2006). An organizational TMS forges temporal connections between organizational members with non-overlapping knowledge domains (Miller et al., 2007). Combining previously unrelated knowledge within the firm in this way increases the likelihood of creating resource combinations that are novel to the firm and synergistic in nature. Here, the earlier mentioned push and pull properties of an organizational TMS increase the intra-organizational knowledge flow within the firm; in effect this drives the knowledge "pollination" process within the firm as new combinations are enacted, often involving the reactivation of old knowledge in new ways, opening up learning opportunities in the process (Dierickx & Cool, 1989; Garud & Nayyar, 1994; Hargadon & Sutton, 1997; Schulz, 2000). Given the intrinsically social relationships within a TMS, employees are likely to be more open to different viewpoints, and are more willing to provide each other with detailed feedback, to explain how different knowledge components relate to one another, and to listen to ideas, even when they might be complex or unproven (Akgün et al., 2005; Hansen, 1999; McEvily, Perrone, & Zaheer, 2003; Mom et al., 2015; Ren & Argote, 2011). Because different ideas and viewpoints are exchanged during this informal integration, employees are presented with different windows on reality, stimulating them to let go of certain beliefs that might stop them from transcending the exploration and exploitation paradox and realizing new forms of integration (Lewis, 2000). As employees engage in dialogues enabled by the organization's TMS, they will therefore not only start to develop a common understanding, but will also initiate a knowledge conversion process that triggers organizational learning and the creation of new knowledge or new resource configurations (Kogut & Zander, 1992; Nonaka, 1994).

Because an organizational TMS facilitates the efficient and effective integration of explorative and exploitative resources, we argue that:

Hypothesis 2: An organizational TMS is positively related to ambidexterity.

2.3.3 Organizational size as a conditional effect on the antecedent–ambidexterity relationship

Both small and large firms face competitive pressures to simultaneously explore and exploit (Lubatkin et al., 2006). However, organizations of different sizes are having to deal with very different circumstances when tackling the challenges that ambidexterity involves. For example, compared to large firms, SMEs have fewer slack resources (Bourgeois, 1981; Cao et al., 2009; Chen & Hambrick, 1995; Lubatkin et al., 2006; Voss, Sirdeshmukh & Voss, 2008), are less structurally differentiated, and less bureaucratic (Ebben & Johnson, 2005; Forbes & Milliken, 1999; Voss & Voss, 2013); their hierarchical administrative systems which might help in managing contradictory knowledge processes tend to be less developed (Lubatkin et al., 2006), and they are more limited in their information-sharing resources and ability to manage the complexities associated with activities that are physically, cognitively, behaviorally, or culturally separated (Voss & Voss, 2013). This makes the pursuit of ambidexterity more challenging for them than for larger firms (Ebben & Johnson, 2005; Lubatkin et al., 2006; Voss & Voss, 2013). Despite some indications that organizational size has a contingent effect on the antecedent–ambidexterity relationship, empirical research on this is scarce. Research on the contingent role of firm size has predominantly zoomed in on the relationship between ambidexterity and performance (Cao et al., 2009; Lee et al., 2013; Moss et al., 2013; Voss & Voss, 2013). However, a recent comparative case study by Andriopoulos and Lewis (2010) indicated that there are substantial differences in how organizations of differential size transcend the exploitation–exploration paradox. In this study, organizations of differing sizes turned to different "integration and splitting practices" (i.e. different means for integration and differentiation) to achieve ambidextrous outcomes (Andriopoulos & Lewis, 2010: 118). By the same logic one can expect that the effectiveness of different integration practices will depend on organizational size. As such, the moderating influence of firm

size on the antecedent–ambidexterity relationship warrants further investigation (Andriopoulos & Lewis, 2010; Csaszar, 2013).

2.3.3.1 The interaction between reflexive climate and firm size

Although small firms face greater challenges in resolving the ambidexterity paradox, it is much harder for larger organizations to reap the benefits that a reflexive climate can bring for ambidexterity. As they grow in size and complexity, organizations tend to develop more elaborate structures with more specialized tasks in differentiated units (Blau, 1970; Cullen, Anderson & Baker, 1986; Donaldson, 2001; Levinthal & March, 1993; Mintzberg, 1980). Because of the differences in structural arrangements, the influence a reflexive climate will have on ambidexterity will vary for organizations of different sizes. First of all, the different structural arrangements will affect the quality and amount of social capital the organization develops. Here, a key point of difference is the frequency of social interactions. In larger organizations the degree of social interaction between differentiated units tends to be much lower, because task-interdependent activities tend to be clustered within specialized departments (Lorsch & Lawrence, 1972; Thompson, 1967). This means that, in general, large organizations are characterized by a series of local social networks that are very dense in themselves, but have relatively few connections to one another (Krackhardt, 1994). Moreover, given the lower levels of social interaction across explorative and exploitative domains, relationships across these units tend to be weaker in nature, as these relationships are generally more formal and transactional in nature, being based in a more mechanistic structure (Burns & Stalker, 1961; Donaldson, 2001; Mintzberg, 1980).

In contrast, smaller organizations are much less departmentalized, and communication and decision-making is far more informal, involving people throughout the organization (Child, 1972a; Donaldson, 2001; Mintzberg, 1980). This makes it more likely that those in smaller organizations will know one another personally and will develop close relationships with one another, leading to a network with greater overall density. As a result, comparatively speaking, employees in smaller organizations have greater trust in one another, are more willing to share information, and are keener to listen to each other's ideas or reservations (Mom et al., 2015; Phelps, Heidl, & Wadhwa, 2012). These

conditions are conducive to double-loop learning, as they support the identification of the problem as well as the realisation of a consensus regarding the way it should be addressed (Schippers, 2003). The relative scarcity of inter-unit relationships in larger firms have a dampening affect on a reflexive climate as there is then less likelihood that organizational participants will have either the ability or opportunity to engage in reflective discussions. Secondly, as a consequence of departmentalization, learning processes tend to become more focused on a narrowly defined problem space. Although this allows the organization as a whole to cope with an increase in complexity (Levinthal & March, 1993), a side effect is that within large firms organizational participants tend to be more focused on the specific problem space of their own specific unit (Ocasio, 1997). As organizational size increases, it therefore becomes increasingly unlikely that organizational participants will be stimulated to reflect on opportunities for system-wide integration. Finally, as larger firms tend to be more formalized (Busenitz & Barney, 1997), behavior becomes more routine, representing 'a truce' that allows organizational participants to economize on cognitive effort (Cyert & March, 1963). This makes it less likely that a reflexive climate will take hold (Schippers, 2003). It follows that the effects of reflexive climate on ambidexterity are moderated by organizational size. To put this more formally:

> *Hypothesis 3a: Firm size moderates the relationship between reflexive climate and ambidexterity such that this relationship is stronger for smaller firms but weaker for larger firms.*

As organizations grow in size, it becomes increasingly difficult for them to develop an awareness of the available knowledge resources (Davenport & Prusak, 1998; Moreland & Argote, 2003), weakening the effect that an organizational TMS has on ambidexterity. First of all, as larger organizations tend to be more departmentalized (Donaldson, 2001; Levinthal & March, 1993), the overall level of cohesiveness tends to be lower than for smaller, less departmentalized, organizations (Peltokorpi, 2012). This can result in a lower degree of integration and less commitment by employees to the organization (Mathieu et al., 2015; Zacarro, Rittman, & Marks, 2001). In these circumstances, individuals might be more tempted to engage in social loafing (Harkins,

1987; Karau & Williams, 1993, 1997; Latané, Williams, & Harkins, 1979) or free-riding behavior (Holmstrom, 1982; Wasko & Faraj, 2005) when it comes to cooperating with parties outside their own unit. This is harmful for the functioning of an organizational TMS that requires individuals to specialize in certain knowledge domains as well as to be willing to share their knowledge with others (Peltokorpi, 2012). Secondly, as the organization grows in size, the expertise awareness of any given employee will tend to become less accurate and less reliable (Peltokorpi, 2012). Although the expertise awareness in larger organisations is likely to be far more extensive, it is simultaneously more likely that there will be a greater discrepancy between the actual expertise base of the individual and his or her *perceived* expertise base, making a TMS less efficient (Palazollo, Serb, She, Su, & Contractor, 2006; Peltokorpi, 2012). Lastly, the costs involved in tracking and tracing information tend to increase with organizational size. This is particularly problematic for tacit knowledge that is deeply personal in nature and often rooted in action (Brown & Duguid, 2001; Nevo & Wand, 2005; Polanyi, 1966; Tsoukas & Vladimirou, 2001). This severely hampers knowledge transfer across inter-unit boundaries (Carlile, 2004). As tacit knowledge – due to its personal nature – is more likely to offer unique insights than codified knowledge, the capacity of an organizational TMS to create new knowledge combinations that transcend the exploration–exploitation paradox diminishes as the organization grows in size. When combined, these arguments lead us to hypothesize that:

> *Hypothesis 3b: Firm size moderates the relationship between organizational TMS and ambidexterity such that this relationship is stronger for smaller firms but weaker for larger firms.*

2.4 Method

2.4.1 Data collection and sample

We developed and administered a survey to companies active in the Netherlands in six industries identified as innovation-intense. Invitations to participate were sent to the individual email addresses of managers with specified job profiles.

First, we used the Orbis database[1] to generate a list of target companies. We chose to restrict our sample to six industries with high innovation intensity, as the hypothesized relationships can be observed best in such a setting (e.g., He & Wong, 2004). Innovation intensity was measured by the total costs of innovation divided by sales.[2] We focused on the largest companies (measured by number of employees) from each of the six industries.

Second, we collected the individual email addresses of appropriate respondents. Besides increasing the response rate, we aimed to improve the quality of the answers by targeting specific job profiles that indicated the respondents would have the knowledge and motivation to provide reflective and accurate answers. Further, we assured participants of confidentiality and offered them a summary of the results. To identify adequate respondents, we generated a list of job profiles at the executive level (e.g., CEO, CTO), senior (e.g., R&D Manager, Business Development Manager) and middle management level (e.g., Innovation Manager, Senior Operations Manager). Different hierarchical levels and functional backgrounds were included to limit potential local biases. We identified individual email addresses for the specified functions in the targeted companies from publicly available sources. In this way, we were able to trace and contact a total of 1,363 individuals operating within 121 companies. Individuals who had not responded to the initial invitation received a reminder after 14 days. We received responses from 254 individuals, a response rate of 18.6%. After outliers and incomplete surveys had been removed, the final sample contained responses from 192 individuals, working within 101 different organizations. This translates into an average of 1.9 responses per organization.

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[1] The Orbis database is published by the Bureau van Dijk and was called 'Reach' at the time the data was gathered. It contains all companies registered with the Chamber of Commerce in the Netherlands.

[2] Total innovation costs comprised investment in plant, machinery and equipment, license and patent acquisitions, product design, trial production, marketing, and R&D expenditures (Evangelista et al., 1998; Pavitt, 1984; von Hippel, 1988).

The size of the companies varies from 52 to 167,841 employees, with an average of 10,945 (s.d. = 25,091) and a median of 987. The companies covered the six target industries as follows: chemicals and allied products manufacturing (26.6%), communications (6.4%), industrial and commercial machinery and computer equipment (15.6%), electronic and other electric equipment, and components (11%), transportation equipment manufacturing (22.9%), and measuring, analyzing, and controlling instruments (17.4%). The respondents held executive positions (29%), senior management positions (33%), and middle management positions (38%).

2.4.2 Measures

A full overview of the measures and corresponding items can be found in the appendix.

Ambidexterity. We adapted the scales from Jansen et al. (2006) to measure *ambidexterity*, i.e., the ability to simultaneously pursue explorative and exploitative innovation (Cao et al., 2009, Jansen et al., 2006; Lavie & Rosenkopf, 2006; Lubatkin et al., 2006). We used a three-item scale to measure exploration (α = 0.67); this was designed to measure both the degree to which the innovations are designed to meet the needs of emerging customers or markets and the degree to which they represent a departure from the existing knowledge base of the firm (Jansen et al., 2006). The three items relating to exploitative innovation (α= 0.68) reflect the extent to which innovations are incremental, build upon and refine the existing knowledge base, and are targeted to meet the demands of existing customers and markets (Jansen et al., 2006).

Within the literature several ways of operationalizing ambidexterity have been proposed. Ambidexterity has been operationalized as the absolute difference between exploration and exploitation (Cao et al., 2009; He & Wong, 2004), the multiplication of exploration and exploitation (Cao et al., 2009; Gibson & Birkinshaw, 2004; He & Wong, 2004), and the sum of exploration and exploitation (Jansen et al., 2009; Lubatkin et al., 2006). In line with Lubatkin et al. (2006) and Jansen et al. (2009), we followed the procedures recommended by Edwards (1994) to choose the most interpretable approach for our operationalization of ambidexterity. As a first step, we ran an unconstrained regression with firm performance as a dependent variable, and exploration and exploitation as separate independent variables. Then, we ran three constrained regression analyses: one

in which exploration and exploitation were multiplied together, one in which exploitation was subtracted from exploration, and one in which they were added together. We mean-centered the exploitation and exploration scales before obtaining their product to mitigate possible multicollinearity issues (Cao et al., 2009; He & Wong, 2004). The additive model (R_2=.25) turned out to be superior to either the unconstrained (R_2=.25), the subtractive model (R_2=.021) or the multiplicative model (R_2=.013). The F-test for the additive model did not show a significant loss in information compared to the unconstrained model. Following the procedure of Lubatkin et al. (2006), we then compared three different additive models using CFA (AMOS 23) after having established the preferred way to operationalise ambidexterity. The first model specifies all items to load on the same underlying latent factor. As expected, the model had a very poor fit to the data (χ^2= 39.63, DF =9, CFI= 0.77, RMSEA= 0.18). The second model regards the exploitation and exploration as two independent constructs. Again, model fit was poor (χ^2= 30.69, DF= 9, CFI= 0.83, RMSEA= 0.15). However, the third model, which treats exploitation and exploration as part of a second-order factor structure, returned a close fit with the data, (χ^2= 11.58, DF= 8, CFI= 0.97, RMSEA= 0.06). Subsequently, and in line with ambidexterity theory, we operationalized ambidexterity as a second-order construct.

Organizational reflexive climate (α= 0.70). The moderating variable *organizational reflexive climate* consists of a three-item scale, and is based on the reflexivity scales developed by Schippers et al. (2007) and Patterson et al. (2005). It captures the degree to which organizational members consciously reflect on and communicate about objectives, behavior, processes, assumptions, and performance in order to adapt to the wider environment (Patterson et al., 2005; Schippers et al., 2012; West, 2000).

Organizational transactive memory systems (α= *0.79)* measures the degree to which organizational members are able to make efficient and effective use of the shared awareness among individuals concerning 'who knows what' (Argote & Ren, 2012; Lewis, 2003; Ren & Argote, 2011; Wegner, 1987; Wegner et al., 1985). A transactive memory system is a system that individuals in groups and organizations use to encode, store, and retrieve expertise (Argote & Ren, 2012; Jackson & Klobas, 2008; Wegner, 1987). A TMS allows individuals to use other organizational participants as external cognitive

repositories (Wegner, 1995; Yuan et al., 2007). Given that an organizational TMS is structurally distinct from a group-level TMS, we revised the sub-dimensions accordingly (Moreland, 1999; Moreland & Argote, 2003; Peltokorpi, 2012). Our nine-item measurement for organizational TMS captures the extent to which organizational members demonstrate an ability to *locate* knowledge resources, and *coordinate* these resources in an effective and efficient way, and the extent to which they perceive the knowledge provided by others as *credible*. Rather than directly driving the cognitive co-specialization that is characteristic of group TMS (Lewis, 2003; Liang et al., 1995), an organizational TMS creates an (indirect) awareness of the location of expertise within the organization. Similar to a group TMS, however, an organizational TMS leads to coordinated integration of that knowledge, and causes organizational members to perceive each others' knowledge as credible (Faraj & Sproull, 2000; Lewis, 2003). For an organizational TMS to exist, all three reflective behaviors (localization, coordination, and credibility) must be present. For example, individuals who are able to locate distributed expertise are not likely to retrieve and utilize this expertise if they do not trust the quality of the information that is brought to the table. Similarly, the ability to localize knowledge is of limited value when exchange partners face coordination difficulties. Likewise, high degrees of trustworthiness and coordinative ability will not lead to an organizational TMS unless knowledge resources can be located. Exploratory factor analyses revealed the expected three-factor structure in which all factor loadings were well above the 0.6, and cross-loadings were below the 0.3 threshold levels (DeVellis, 1991). The individual reliability scores of the three different sub-dimensions of organizational TMS were α=0.78 for credibility, α=0.75 for coordination, and α=0.68 for localization.

Organizational size was measured by taking the natural logarithm of the number of full-time employees.

Control variables. We controlled for possible alternative explanations by including four control variables: ambiguity related to the environment, ICT maturity, cross-functional collaboration, and industry type. First, we controlled for environmental *ambiguity* as it slows down decision-making, increases risk-averse behavior, and therefore has a negative effect on firm performance (Daft & Lengel, 1986; Milliken, 1987). Similarly, when organizations perceive their environment as being ambiguous, they will

departmentalize in order to buffer organizational activities from this uncertainty (Burns & Stalker, 1961; Lawrence & Lorsch, 1967; Levinthal & March, 1993), and this again results in higher structural differentiation. Second, since there are two ways that knowledge can be exchanged within a firm – the interpersonal or the technological approach (Moreland, 1999; Ren & Argote, 2011) – we controlled for the influence of the technological approach by measuring *ICT maturity* using a three-item scale (α= 0.84) which captures the sophistication of the systems and tools used by the firm to encode, store, retrieve and communicate information (Alavi &Leidner, 2001; Anand et al., 1998; Ren & Argote, 2011). Third, we controlled for the extent of *cross-functional collaboration* within the organization by means of a two-item scale (α= 0.66). Formal integration mechanisms such as cross-functional teams are known to be powerful antecedents to organizational ambidexterity (Jansen et al., 2009). Lastly, we controlled for *industry effects* by including a dummy for each industry, with the *chemicals and allied products manufacturing* industry as the reference group.

Aggregation and measurement analysis

As our theory and measurements are aimed at the organizational level of analysis, we calculated the inter-rater agreement scores ($r_{wg(j)}$) (James et al., 1984) before aggregating individual responses to the organizational level. The average inter-rater agreements were 0.93 for organizational TMS, 0.83 for exploitation, 0.74 for exploration, and 0.92 for organizational reflexive climate respectively. Values above 0.7 indicate a 'good' fit (James et al., 1993).

We performed several tests to provide evidence of convergent and discriminant validity. First, we conducted a factor analysis using principal component analysis and varimax (exploration, exploitation, and organizational reflexivity) or promax rotation (organizational TMS). We applied the following criteria to each item: (1) commonality higher than 0.3, (2) dominant loading greater than 0.5, (3) cross-loading lower than 0.3, and (4) satisfactory scree plot criterion (DeVellis 1991). All items satisfied these criteria. Second, we performed an integrated confirmatory factor analysis using AMOS 23 with all items related to organizational TMS, ambidexterity, reflexive climate, and organizational size. The model in which the items loaded on their corresponding latent constructs

demonstrated an 'excellent' fit (χ^2= 178.3, DF= 160, CFI= 0.97, TLI= 0.96, RMSEA= 0.033; 90% CI-RMSEA: 0.000–0.056.) for models of this complexity and observation numbers (Hair et al., 2006; Mathieu & Taylor, 2006). All item loadings factor loadings were above 0.5 and significant at ($p < 0.001$).

To further assess the discriminant validity of our scales we compared the constrained and unconstrained model fit for each possible pair of constructs in our model (Anderson & Gerbing, 1988; Hair et al., 2006). We constrained the covariance between the latent constructs and limited the variance of the latent constructs themselves to 1. In every case the χ^2 difference test returned a superior fit for the freely estimated model ($p<0.01$), providing evidence of the discriminant validity of the variables in our model (Hair et al., 2006).

Non-response bias

Although response rates were comparatively high and gave no reason for concern, we tested the data for potential non-response bias. A standard test often used in survey studies compares the answers of early and late respondents, assuming that the latter are more similar to non-respondents (Armstrong and Overton, 1977). We compared the first 10% of respondents to the last 10% of respondents, and then repeated the process for the first and last 20%. In the first specification, the mean score of TMS was significantly ($p < 0.05$) higher for the first 10% of respondents. No statistically significant differences ($p < 0.01$) were revealed for any of the other variables in our research model. This suggests that the data is sufficiently free from non-response bias.

Common method variance

We took several steps to avoid common method variance and assessed the likelihood that common method variance (CMV) presents a problem.

First, following the recommendations of Podsakoff et al. (2003), we took various precautions to mitigate the risk of CMV. We pretested the survey, we ensured anonymity, we included an introduction to the survey which stipulated its purpose, and finally we promised and delivered a summary of the study's findings to respondents in order to encourage more reflective answers.

Second, we verified statistically whether common method variance was present in the data using the Harmon one-factor test (Podsakoff & Organ, 1986). The exploratory factor model including all items in our model extracted six factors in total, cumulatively explaining 63% of the variance. Here the factor "coordination" (one of the factors of TMS) exhibited the largest single variance (26.8%). As the dependent and independent items loaded on different factors, we conclude that common method variance is unlikely to be a problem.

2.5 Results

	Mean	SD	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. Organizational ambidexterity	7.38	0.95	-											
2. Reflexive climate	3.93	0.49	0.38***	-										
3. Organizational TMS	3.65	0.40	0.47***	0.41***	-									
4. Firm size	7.20	2.15	0.01	-0.06	0.04	-								
5. CFT	3.28	0.67	0.09	0.09	-0.03	0.07	-							
6. ICT maturity	3.04	0.77	0.23*	-0.21**	0.47***	0.11	-0.08	-						
7. Ambiguity	2.88	0.64	-0.13	-0.06	-0.35***	-0.02	0.24	-0.32**	-					
8. Chemical's and allied products manufacturing	0.26	0.44	-0.09	-0.08	-0.04	0.07	-0.05	-0.06	-0.04	-				
9. Transportation equipment manufacturing	0.22	0.41	0.09	-0.10	-0.13	-0.14	0.01	0.07	0.03	-0.31**	-			
10. Electrical equipment	0.11	0.33	0.21*	0.07	0.16	0.04	-0.12	0.24*	-0.05	-0.22*	-0.19*	-		
11. Industrial and commercial machinery	0.12	0.38	0.06	0.04	0.11	-0.003	0.07	-0.05	0.13	-0.27*	-0.24*	-0.17*	-	
12. Measuring, analyzing, and controlling instruments	0.17	0.38	-0.12	0.09	0.003	-0.02	0.05	-0.09	0.006	0.27*	-0.24*	-0.17*	-0.20*	-
13. Communications	0.07	0.26	-0.16	0.02	-0.09	0.10	0.04	-0.11	-0.10	-0.16	-0.14	-0.10	-0.12	-0.12

Table 2.1: Descriptives and correlations

Table 2.1 presents the descriptive statistics and correlations between the variables. We calculated the variance inflation factors (VIFs) to examine for potential multicollinearity. As the maximum VIF score of 1.75 is well below the rule of thumb cut-off value of 10 (Hair et al., 2006), we did not find any cause for concern.

Table 2.2 presents the results of the regression analyses. Here model 1 represents the baseline model with the control variables. In model 2 the direct effect of a reflexive climate on ambidexterity is added. The effect is strong and highly significant (B=0.37, p<0.001). In model 3 we test the direct effect of an organizational TMS on ambidexterity. Again, we find a strong and highly significant effect (B=0.47, p<0.001). In model 4 we incorporate both the direct effect for reflexive climate and organizational TMS to test for potential suppressing effects. As can be seen in table 2.2, for both relationships the effects remain strong and significant. As such we find confirmation of Hypotheses 1 and 2.

In model 5 we add the interactive effect between organizational size and reflexive climate. In line with Hypothesis 3a, this effect is negative and significant (B=-0.25, p<0.05). Unfortunately, as can be seen in model 6, the interactive effect between organizational size and organizational TMS is insignificant (B=-0.09, p=n.s.), indicating that the direct effect of organizational TMS on ambidexterity is – surprisingly – unaffected by organizational size (Hypothesis 3b). Model 7 represents our full model, in which both direct and both moderating effects are included. The effects remain unchanged. We therefore find confirmation of Hypothesis 3a but not of Hypothesis 3b.

To facilitate the interpretation of the result regarding Hypothesis 3a, we incorporated a simple plot (figure 2.1). From the interaction plot between reflexive climate and organizational size (in which we controlled for TMS) it becomes clear that both small and large organizations tend to benefit from a more reflexive climate, but that this increase in ambidexterity is greatest for smaller organizations. Here larger organizations already demonstrate higher degrees of ambidexterity, even at low levels of reflexivity, probably because they have other means to facilitate ambidexterity. However, comparatively speaking, large organizations are somewhat insensitive to an increase in reflexive climate.

Predictor	Organizational ambidexterity						
	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*	*Model 7*
Control variables							
Firm size (nlog)	0.01	0.05	0.02	0.04	0.04	0.03	0.05
Ambiguity	-0.14	-0.15	-0.02	-0.05	-0.02	-0.03	-0.02
ICT maturity	0.12	0.034	-0.06	-0.08	-0.04	-0.09	-0.03
Cross-functional collaboration	0.16	0.15	0.13	0.13	0.11	0.12	0.11
Measuring, analyzing and controlling instruments	-0.04	0.08	-0.07	-0.09	-0.6	-0.09	-0.06
Electrical equipment	0.21	0.19	0.18	0.17	0.21*	0.18	0.21*
Transportation equipment manufacturing	0.12	0.14	0.17	0.17	0.19	0.17	0.19
Industrial machinery and commercial machinery	0.11	0.08	0.04	0.04	0.07	0.04	0.07
Communications	-0.12	-0.15	-0.10	-0.12	-0.9	-0.13	-0.09
Independent variable							
Reflexive climate		0.37***		0.26*	0.22*	0.24*	0.22*
Organizational TMS			0.47***	0.37**	0.34*	0.38**	0.33*
Moderating variable							
Reflexive climate*Organizational size (nlog)					-0.25*		-0.25*
Organizational TMS* Organizational size (nlog)						-0.09	0.13
R^2	0.15	0.27	0.30	0.35	0.41	0.36	0.41
Δ *adjusted* R^2	0.06	0.19***	0.22***	0.27*	0.33*	0.27	0.32

Table 2.2: Hierarchical regression analysis

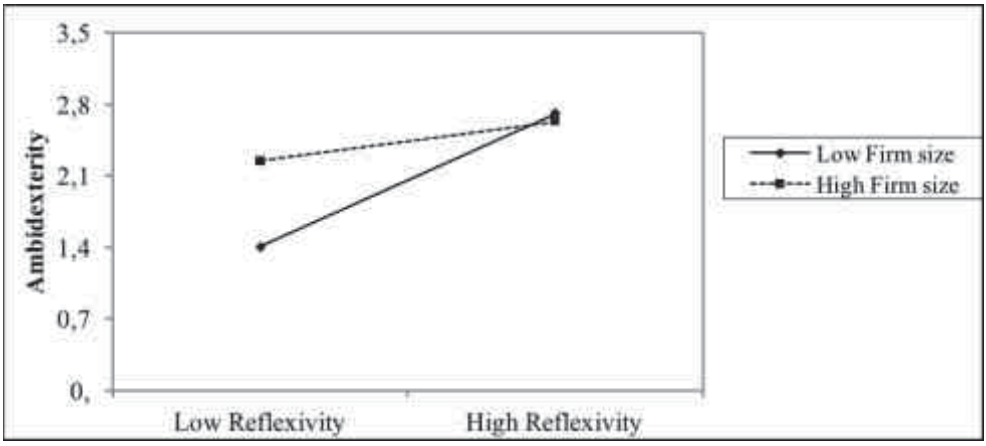

Figure 2.1: Interaction plot Reflexive climate * Organizational size

Further probing of the interactive effect using the Johnson-Neyman technique provided in PROCESS (Hayes, 2013) reveals a more fine-grained picture (Table 2.3). A more detailed analysis of this kind is desirable for interaction effects, as the simple plots can lead to interpretation difficulties (Hayes, 2013). Here one can see the interplay between reflexive climate and ambidexterity at different values of organizational size. The table shows that the negative interactive effect between reflexive climate and ambidexterity remains positive for small and medium-sized organizations (light grey area), but becomes insignificant for larger firms (dark grey area). As can be seen from the table, the effect size between reflexive climate and ambidexterity gradually decreases as the size of the organization increases. In fact, it even turns negative for the larger organizations, although these outcomes are no longer significant. As such, devoting attention to developing a more reflexive climate could be a viable alternative for smaller organizations that often lack the slack resources, structures, systems, and processes that larger organizations can draw on to increase their level of ambidexterity.

Firm size	Effect	se	t	p	LLCI	ULCI
-6,10	1,76	0,48	3,70	0,00	0,82	2,70
-5,56	1,64	0,44	3,75	0,00	0,77	2,51
-5,01	1,52	0,40	3,81	0,00	0,73	2,31
-4,46	1,40	0,36	3,87	0,00	0,68	2,12
-3,92	1,28	0,33	3,92	0,00	0,63	1,93
-3,37	1,16	0,29	3,96	0,00	0,58	1,74
-2,82	1,04	0,26	3,99	0,00	0,52	1,56
-2,28	0,92	0,23	3,96	0,00	0,46	1,38
-1,73	0,80	0,21	3,84	0,00	0,39	1,22
-1,18	0,68	0,19	3,56	0,00	0,30	1,06
-0,64	0,56	0,18	3,09	0,00	0,20	0,92
-0,09	0,44	0,18	2,43	0,02	0,08	0,81
0,24	0,37	0,19	1,99	0,05	0,00	0,74
0,46	0,32	0,19	1,69	0,09	-0,06	0,70
1,00	0,20	0,21	0,97	0,33	-0,21	0,62
1,55	0,08	0,23	0,36	0,72	-0,38	0,55
2,10	-0,04	0,26	-0,14	0,89	-0,55	0,48
2,64	-0,16	0,29	-0,53	0,60	-0,74	0,43
3,19	-0,28	0,33	-0,84	0,40	-0,92	0,37
3,74	-0,40	0,36	-1,09	0,28	-1,11	0,32
4,28	-0,51	0,40	-1,29	0,20	-1,31	0,28
4,83	-0,63	0,44	-1,45	0,15	-1,50	0,23

Table 2.3: Johnson Neyman technique, showing the conditional effect of reflexive climate on ambidexterity at different values of organizational size

2.6 Discussion

While the ambidexterity literature has focused predominantly on the role of formal and informal integration mechanisms (e.g. Jansen et al., 2009), and on the role played by top management as initiators and coordinators of integration activities in relation to the differentiation and integration challenge, the problem is much more encompassing. As recently stressed by various authors (e.g., Birkinshaw & Gupta, 2013; Smith, 2014), this challenge is not restricted to the boardroom, nor can it be resolved by investing in the development of informal and formal integration mechanisms alone. Rather, it is something that is felt throughout the organization. Like those of their corporate bosses, the integration efforts of organizational participants are hindered by significant emotional and cognitive obstacles that must be overcome as well as by widely dispersed knowledge that reduces individuals' awareness of explorative and exploitative resources and their ability to access them. Nevertheless, even though the willingness of organizational members to cooperate is likely to be a key factor in determining the organization's ability to deal with the differentiation and integration challenge, and these individuals have only a limited awareness of the resources available, the literature on ambidexterity has paid relatively little attention to the organizational systems that may stimulate and enable organizational participants to deal with these obstacles. A recent case study suggests that the effectiveness of different "integration and splitting practices" depends on the size of the organization (Andriopolous and Lewis, 2010), but large-scale empirical testing has yet to be undertaken.

By drawing attention to a reflexive climate (de Jong & Elfring, 2010; de Dreu, 2007; Patterson et al., 2005; Schippers, 2003; Schippers et al., 2015) and an organizational transactive memory system (Argote & Ren, 2012; Jackson & Klobas, 2008; Moreland & Argote, 2003; Peltokorpi, 2012) as antecedents to ambidexterity, and investigating how these systems are contingent on the size of the organization, we address these gaps in the ambidexterity literature. We find that both a reflexive climate and an organizational TMS are strongly related to ambidexterity. Moreover, organizational size interacts negatively with reflexive climate but does not interact with organizational TMS. We elaborate on the theoretical and practical implications of our findings in the subsequent section.

2.6.1 The differentiation and integration challenge: key issues

People throughout the organization face two important challenges in their efforts to come up with ambidextrous solutions: a material challenge (e.g., Jansen et al., 2009; O'Reilly & Tushman, 2008) and a perceptual challenge (e.g, Heavey & Simsek, 2014; Lewis, 2000; Smith & Lewis, 2011; Smith & Tushman, 2005). Both have attracted considerable attention from ambidexterity scholars, but they have typically been looked at singly, and always from the perspective of top management -either implicitly or explicitly (Heavey & Simsek, 2014; Jansen et al., 2009; O'Reilly & Tushman, 2008; Smith & Tushman, 2005; Smith, 2014). In the literature on structural ambidexterity it is senior management that senses, seizes, and reconfigures (O'Reilly & Tushman, 2008; O'Reilly & Tushman, 2013; Smith & Tushman, 2005). The common separation in streams of research of the structural and cognitive-emotional sides of the differentiation and integration challenge has arguably led to a somewhat fragmented understanding as these two sides are inherently inseparable (Smith & Tushman, 2005). As is increasingly recognized by ambidexterity researchers, the ambidexterity paradox is a problem faced throughout the organization (Birkinshaw and Gupta, 2013), not just by top managers. To create a truly ambidextrous organization, one must create an organizational system that is dynamic enough to facilitate the short- and long-term adaptation that is required (O'Reilly & Tushman, 2008). We argue that, to do so the organization must be able to overcome two distinct important issues that have not been adequately addresses within the ambidexterity literature.

First of all, the organization is likely to benefit from organizational systems that stimulate and enable people throughout the organization to deal with the differentiation and integration challenge by accepting, confronting, and transcending the ambidexterity paradox. To achieve this, we argue that top management's integration attempts are likely to succeed when supported by all the organizational participants involved. Although most of the work on structural ambidexterity seems to assume cooperation by organizational participants, this kind of obedient attitude is not a given. For example, in a recent comparative case study, Martin and Eisenhardt (2010) found that all top-down attempts to integrate cross-business units failed to meet their objectives. Time and time again within

these organizations a key factor in determining the success or failure of integration attempts was the amount of motivational support they received from the organization.

In addition, lower-level adaptation initiatives are likely to be necessary as well in order to align the organization with its environment, given the cognitive and emotional constraints of management (March & Simon, 1958; March, 1978; Simon, 1987; Simon, 1991). At a very basic level, this is due to the sheer complexity and uncertainty that top managers are confronted with. They simply cannot initiate and coordinate by themselves all the dynamic integration needed for the firm to become ambidextrous. But these limitations also work in more nuanced ways. Cases like Polaroid (Tripsas & Gavetti, 2000) and Intel (Burgelman, 1991) are testimony to the importance of adaptation initiatives being undertaken by other organizational participants. In both organizations cognitive beliefs and emotional attachments caused management to dismiss what was actually happening and take a negative stance towards lower-level initiatives that might have realigned the organization with its environment. Quite simply: the commitment and ability of employees throughout the organization matters for any organization that seeks to become ambidextrous.

Second, if employees can increase their awareness of, as well as access to, the explorative and exploitative resources that are available within the organization, the likelihood that synergies will be realized greatly increases. Informed by the knowledge-based-view, we know that ambidexterity leads to a highly distributed knowledge landscape, as exploratory and exploitative knowledge differ significantly and need to be supported by different organizational means (Kogut & Zander, 1992; Grant, 1996; Argote & Ingram, 2000; Raisch et al., 2009). As a result, knowledge, competencies, and individual skills become scattered: too diverse, numerous and difficult for anyone to oversee as a whole (Tsoukas, 1996; Becker, 2001). Because this limits the variety of knowledge resources that can be accessed and reduces the likelihood of realizing synergies, it is imperative that an organization seeking ambidexterity stimulates a more complete awareness of its areas of expertise by interrelating and connecting the knowledge that each individuals has (Nonaka, 1990; Tsoukas, 1996; Becker, 2001). In this way, an organization may be better able to overcome the physical, social, and cognitive boundaries between its explorative and exploitative knowledge and to foster important synergies

between exploration and exploitation (Brown & Duguid, 1991; Carlile, 2004; Majchrzak et al., 2011). Surprisingly, although this knowledge-based perspective has fundamental implications for the ability to generate ambidexterity, it has not received explicit conceptual or empirical attention within the literature.

By focusing on a reflexive climate and an organizational TMS as antecedents to ambidexterity, and addressing the structural and cognitive-emotional aspects of the differentiation and integration challenge, we seek to increase our understanding of the organizational systems that stimulate and enable organizational participants to deal with the particularities of this challenge.

2.6.2. The value of learning in relation to ambidexterity

What an organizational reflexive climate and an organizational TMS have in common is that they bring to the fore the importance of learning in regard to ambidexterity. Such learning is essential to change the meaning of specific schemata: i.e., the way organizational participants perceive and interpret explorative and exploitative resources and the relationships between them (Lewis, 2000; Smith & Tushman, 2005). Doing so requires employees to be able to change their conceptual and emotional viewpoint in regard to these specific resources (Watzlawick, Weakland, & Fisch, 1974). This subsequently enables the firm to set in motion a virtuous cycle, resulting in greater ambidexterity (Andriopoulos & Lewis, 2009). Although, conceptual accounts have elaborated on the role of learning in regard to transcending paradoxical tensions (Lewis, 2000; Smith & Lewis, 2011), empirical accounts have not followed suit. While several authors have noted that integration mechanisms can be conduits for learning about new ways to achieve ambidexterity (Jansen et al., 2009), they do not detail how and why organizational participants are stimulated to do so, nor how such learning activities aid them in transcending the ambidexterity paradox. We provide an explanation of the causal mechanisms behind organizational systems that drive the capacity of organizational participants for fluid, more emergent, adaptation as a result of constant learning (Schreyögg & Sydow, 2010).

Here we extend existing work that has commented on the importance of reflexivity in relation to the transcendence of paradoxes, particularly ones related to

ambidexterity (Lewis, 2000; Lüscher & Lewis, 2008). Previous work has already pointed to the value of reflexivity with regard to creating a better understanding of the paradox itself as well as ways of dealing with it (Lewis, 2000; Lüscher & Lewis, 2008). However, in this work reflexivity is regarded as a managerial practice ("reflective questioning") which helps managers to make sense of the paradox (Lüscher & Lewis, 2008). We build on this notion by drawing attention to reflexive climate and arguing that reflexivity has a more systemic influence on ambidexterity than hitherto been acknowledged.

Using the paradox literature as a point of departure (Lewis, 2000; Smith and Tushman, 2005), we argue that single- and double-loop learning each play a distinct role in terms of the capacity of organizational participants for differentiation and integration. While the paradox literature has commented on the role of cognitive processes of differentiating and integrating in relation to managing strategic contradictions such as those related to ambidexterity (Smith & Tushman, 2005), it has not explicitly linked both these process to learning activities by organizational members.

Although some researchers have stressed the importance of double-loop learning in relation to ambidexterity (Lüscher & Lewis, 2008; Schreyögg & Sydow, 2010), we argue that the single-loop learning behaviors associated with a reflexive climate also play a role of particular interest. Here single-loop learning drives organizational participants' capacity for differentiation as it gives them a more refined and rich understanding of certain explorative or exploitative activities and helps them to draw categorical distinctions, providing greater legitimacy to each of these distinct activities in the process. Previous literature has neglected these beneficial aspects of single-loop learning and has only identified the need "to break out of single-loop learning into double-loop reframing" (Lüscher & Lewis, 2008: 235).

In regard to double-loop learning, Lüscher & Lewis (2008) were first to find that it was due to reflexive questioning that managers were stimulated to engage in double-loop learning. This caused them to question their understanding and way of thinking, which enabled them to become aware of and transcend their "either/or" mindset that had previously dominated their thinking and behavior (Lüscher & Lewis, 2008). By combining this insight with the seminal work of Smith and Tushman (2005) on cognitive differentiation and integration and the literature on reflexivity (de Jong & Elfring, 2010; de

Dreu, 2007; Patterson et al., 2005; Schippers, 2003; Schippers et al., 2015), we make the argument that double-loop learning enables organizational participants to free themselves from perspective-limiting assumptions. This opens the door for them to examine the tensions and their perceived causes, and to develop a more sophisticated understanding of the potential interdependencies and interrelationships between exploration and exploitation activities (Lewis, 2000). This in turn makes novel forms of integration more likely.

But the role of a reflexive climate is not beneficial just for increasing the number of integrations across structurally differentiated units; as a point of discussion we would like to raise the potential for the role of a reflexive climate as a part of the organization's overall "reflexive monitoring" capacity (Schreyögg & Sydow, 2010: 1258). The learning dynamics triggered by a reflexive climate also bring the systems through which the organization seeks to differentiate and integrate its exploration and exploitation activities under scrutiny (Schreyögg & Sydow, 2010). A reflexive climate can therefore potentially play a bigger role than simply that of an integration mechanism; it could enable the firm to extend its repertoire of differentiation and integration solutions.

Overall, reflexive behaviors – especially when they can be institutionalized in a reflexive climate, for example – seem to play a wider role than previously assumed within the paradox and ambidexterity literature. A reflexive climate provides a constant stimulus for first- and second-order learning behaviors, and can therefore be vital in generating the energy needed to initiate and maintain a virtuous cycle in regard to the paradoxical tensions surrounding the differentiation and integration challenge (Lüscher & Lewis, 2008; Smith & Lewis, 2011; Smith, 2014).

An organizational TMS is also importnant in supporting organizational participants' ability to learn about new ways of dealing with the differentiation and integration challenge, as it makes them more aware of and able to access a greater variety of resources. Existing work that has focused on the structural aspect of the differentiation and integration challenge has focused mainly on realizing integration across structurally separated units (e.g., He & Wong, 2004; Jansen et al., 2009; O'Reilly & Tushman, 2008). However, besides these issues we point out that organizational participants also suffer from a limited situational awareness: they simply do not have a complete overview of the resources at their disposal. This limits their ability to devise novel forms of integration

(van Neerijnen et al., 2012). We contribute to both the ambidexterity and TMS literature by arguing that it is the organisational TMS that enables employees to learn of the opportunities for integration. An organizational TMS allows organizational participants to 'push' or 'pull' specific expertise across explorative and exploitative boundaries by forging temporal connections. These knowledge flows represent opportunities for organizational members to learn: i.e., they help them to refine and hone existing mental models, and may at the same time trigger them to fundamentally reframe their existing schemata (Dunbar et al., 1996; Tsoukas, 2009; Watzlawick et al., 1974). Because of these potential learning effects that are enabled by an organizational TMS, linkages between knowledge resources that in first instance seemed fundamentally at odds with each other might become recognized and acted upon.

2.6.3 Improving the dynamics within the ambidextrous organization: self-organization and complexity theory

Both a reflexive climate and an organizational TMS increase the potential for autonomous action as both systems stimulate and enable organizational participants to be proactive to take on the differentiation and integration challenge. We contribute to the ambidexterity literature by drawing attention to organizational systems that enable employees throughout the firm to deal with the paradoxical tension within the differentiation and integration challenge. To create the dynamic adjustment necessary for ambidextrous organizational designs, we argue that an organization can benefit from organizational systems that support self-organizing behavior.

In regard to self-organization a reflexive climate can be an important component in creating a more fluid and flexible organizational system that is able to support the constant dynamic integration required by firms that seek to become ambidextrous. In a reflexive climate organizational participants are triggered to see beyond the obvious, to not to take things for granted, and to carefully consider goals, strategies and ways of doing things. It gives them a heightened sense of awareness of possible opportunities and threats, improves the quality of decision-making, and reduces the likelihood that their decisions will be biased (Schippers et al., 2014). This means that they are not simply carrying out orders, and confined to either an explorative or exploitative role, but instead have

considerable agency to transcend ambidextrous tensions on their own (Giddens, 1984; Orlikowski, 2002). As they become more mindful of these paradoxes, and think of new ways to address them, it becomes increasingly likely that they themselves will initiate action to deal with these tensions.

Likewise, the value of self-organization is indicated by an organizational TMS that empowers employees to locate and access distributed knowledge, making them more able to integrate explorative and exploitative knowledge resources without managerial intervention or supervision. Prior research has argued that organizational adaptation in dynamic environments is complicated by two factors: rigidities of organizational structure and limitations to the speed at which knowledge can be acquired and processed (Posen & Levinthal, 2012). An organizational TMS can be viewed as a flexible alternative to more rigid knowledge management systems, and one that also increases the speed of knowledge processing. Cumulatively, because of the self-organizing properties of an organizational TMS, at the organizational level the firm is better able to maintain a higher degree of evolutionary fitness (Helfat et al., 2007).

2.6.4 The importance of organizational size as contingency factor

Pursuing ambidexterity is especially challenging for small and medium-sized organizations. In particular, SMEs that seek to simultaneously achieve high levels of exploration and exploitation have been argued to face great difficulties, given their limited resources and underdeveloped or pluriformity in structures, processes, systems, cultures, and values (Cao et al., 2009). Although previous work has investigated the conditional effect of organizational size on the ambidexterity–performance relationship (e.g., Cao et al. 2009; Voss & Voss, 2013), it is somewhat surprising perhaps that we know so little about the differences in effectiveness of certain integration mechanisms for organizations of different sizes.

Our work builds on and further refines the findings of the explorative case studies undertaken by Andriopoulos and Lewis (2010). Our conclusions are similar to theirs in that we find that the effectiveness of certain antecedents of ambidexterity is contingent on organizational size. However, while their overall conclusion is that small organizations seek to manage the paradox between exploration and exploitation by fostering external

networks (i.e., by becoming 'big' in a virtual sense) – and large organization try to do reach the same goal by trying "make their organization feel smaller" (Andriopoulos & Lewis, 2010: 118) – the antecedents that we looked at seemed to show a quite different effect with organizational size, and hence follow a very different logic to that proposed by Andriopoulos and Lewis.

Our findings indicate that small organizations in particular seem to benefit from the single- and double-loop learning behaviors that are stimulated by a reflexive climate. In this sense it has a more direct effect on the organization's ability to become ambidextrous than antecedents previously described in the literature. While earlier investigated antecedents such as the use of external networks (Andriopoulos & Lewis, 2010), cross-functional interfaces, connectedness, senior-team social integration (Jansen et al., 2009), or shared vision (Jansen et al., 2008; O'Reilly & Tushman, 2008) derive their effect on ambidexterity from their ability to combine and recombine different resources (in terms of exploration and exploitation) with others, a reflexive climate will not only stimulate organizational participants to engage in reflective discussions with others (as a social activity), but will also encourage them to think and act reflectively under their own steam. In a reflexive climate organizational participants are stimulated to reflect critically on whether or not they should continue with the same course of action or perhaps venture out and explore alternative strategies, solutions, or ways of working. Although the value of reflective thinking is arguably greater when undertaken with dissimilar others, it goes without saying that it can also be valuable when practiced in isolation. This suggests that a reflexive climate is a highly powerful antecedent to ambidexterity for organizations such as SMEs whose resource base is relatively limited and not very varied.

Surprisingly, the influence of TMS on ambidexterity is unaffected by organizational size. This seems to indicate that, in contrast to our Hypothesis 3b that builds on the conceptual work of Peltokorpi (2012), a TMS is a powerful and universal integration mechanism. Nevertheless, it might be the case that different contingent factors offset each other for firms of different organizational sizes. For example, although our argument is that the positive effect of a TMS is dampened as the organization grows in size (due to lower levels of cohesiveness, reliability, and accuracy, and increased information tracking and tracing costs), at the same time this effect might be off-set with

the benefits that are associated with such a growth in size such as a larger and more diverse resources base. Also, potentially, the sheer growth in the number of indirect connections in large organizations could compensate for the lower level of accuracy that is likely in smaller organizations. More work is needed to identify and empirically test these potential negating effects.

2.6.5 Limitations and suggestions for future research

There are several limitations and indications for future research that warrant attention. First, while our emphasis on organizational systems as antecedents to ambidexterity that stimulate learning and reframing has yielded promising results, future research may describe the mechanisms in greater detail and provide further nuance. For instance, it would be interesting for future research to investigate in which circumstances it is better to have access to a broad range of knowledge resources (i.e. through the usage of a TMS), and when it is preferable to use more targeted and directive mechanisms, such as cross-functional teams. Matters of organizational design spring to mind. For instance, when organizations are highly formalized, the roles of different actors, and the knowledge they should possess, are well-delineated and articulated. In such circumstances, it may be clearer which actors should be involved, and a more targeted and directive approach may be preferable. On the other hand, formalized organizations may run the risk of developing integration routines that stifle experimental and novel ways of thinking among actors, and they may therefore benefit from a more permanent and self-organizing integration mechanism (such as a TMS) as well as a strong reflexive climate.

Second, both reflexive climate and organizational TMS provide a clear conceptual explanation of how the influence of these systems is generated by individual action. In particular, organisational TMS looks to be a very promising area to investigate further in future work on the micro-foundations of knowledge reconfiguration (Argote & Ren, 2012). As there have already been calls for more research on the multi-level intricacies of organizational ambidexterity (Birkinshaw & Gupta, 2013; Simsek, 2009), it could be very valuable to consider the multi-level implications of an organizational TMS and a reflexive climate. For instance, does the nature of their TMS make certain individuals or teams be able to provide support for integration efforts? How are different individuals and groups

interrelated? How do current and past ties facilitate the functioning of an organizational TMS? On a related theme, we have conceptualized reflexive climate as being fairly consistent across the organization. Although we have multiple respondents from each organization with different functional backgrounds and from different hierarchical levels, it could be that a more refined analysis of the reflexive climate of each organization would reveal that individuals are not just nested within the organization, but are also nested in groups which differ in terms of reflexive climate. To answer these questions, future research needs to sample multiple respondents from each group and conduct detailed analyses of individual knowledge networks.

Finally, although there is justification within the literature for the relationships in our model, our cross-sectional data does not allow us to make any definitive claims regarding causality (Pitariu & Ployhart, 2010). Future research should gather longitudinal data to address this concern.

APPENDIX: MEASURES AND ITEMS

Overall model fit: χ^2= 178.3, DF= 160, CFI= 0.97, TLI= 0.96, RMSEA= 0.033; 90% CI-RMSEA: 0.000–0.056.

Exploration (Adopted from Jansen et al., 2006), Cronbach's alpha= 0.67

In our organization:

We experiment with new products and services in our local market.

We commercialize products and services that are completely new to our organization.

We frequently utilize new opportunities in new markets.

Exploitation (Adopted from Jansen et al., 2006), Cronbach's alpha=0.68

In our organization:

We frequently make small adjustments to our existing products and services.

We increase economies of scales in existing markets.

Our organization expands services for existing clients.

Organizational transactive memory system (Adopted from Faraj & Sproull, 2000; Lewis, 2003), Chronbach's alpha=0.79

Localization (α= 0.68)

Employees in our organization tend to know which employees have expertise in specific areas.

We know where specific expertise can be found within our organization even when this expertise has not been used for some time.

When recognizing a business opportunity, we can quickly rely on our existing knowledge.

Credibility (α= 0.78)

Employees in our organization are confident that they can rely on the information other employees bring to the discussion.

Employees in our organization trust that the knowledge from other employees is credible.

Employees in our organization have a lot of faith in other employees' expertise.

Coordination (α=0.75)

While working on product development projects with other organizational units in general it is clear early on who is responsible for a specific task.

While working on product development projects with other organizational units in general it is clear early on how we will accomplish the task.

In our organization, product development teams rarely have misunderstandings about what to do.

Organizational reflexive climate (Adopted from Patterson et al., 2005; Schippers et al., 2007), Cronbach's alpha= 0.70

In our organization[b]:

The results of actions are evaluated.

We talk about different ways in which we can reach our objectives.

We work out what we can learn from past activities.

'Strongly disagree' (1)-------(5) 'Strongly agree'

Chapter 3. Embracing Paradox: The Mediating Role of TMT Paradoxical Cognition on the Relationship between MT Reflexivity and Ambidexterity

3.1 Abstract

Within the ambidexterity literature the TMT plays a critical role in managing the tensions between exploration and exploitation. Doing so requires them to transcend the ambidexterity paradox. Despite this recognition, the current body of literature offers few insights regarding the factors that enable and motivate management to engage with – and ultimately transcend – the ambidexterity paradox. This paper highlights the importance of the information-processing capacity of the TMT in relation to the realization of ambidexterity. More concretely, I contribute to the ambidexterity literature by proposing a model in which TMT paradoxical cognition mediates the relationship between TMT reflexivity and organizational ambidexterity. In so doing I extend the current conceptualizations of TMT reflexivity and TMT paradoxical cognition in relation to ambidexterity and empirically assess the relationship between them, increasing our understanding concerning how learning behaviors and shared mental models affect the TMT's willingness and capacity to transcend the ambidexterity paradox. The dataset, which was composed of 455 Dutch and German SMEs, provides confirmation of my hypotheses.

Keywords: Organizational Ambidexterity, TMT Reflexivity, TMT Paradoxical Cognition, SMEs

3.2 Introduction

Organizational life is rife with paradoxes (Poole & Van de Ven, 1989). One of the more salient ones is the paradoxical tension between exploration and exploitation (Holmqvist, 2003; Lewis, 2000; Smith & Lewis, 2011). Researchers have pointed to the importance of firms not only refining their existing products and procedures, but also investing in the discovery and development of new opportunities (March, 1991). However, explorative and exploitative activities are contradictory in nature as they are associated with different structures and processes, have very different identities, follow different logics, and often compete for organizational resources (Gilbert, 2006; Gupta, Smith, & Shalley, 2006; March, 1991; Smith & Tushman, 2005). As such, exploration and exploitation need to be structurally differentiated and protected from each other's potentially negative influences. Yet, at the same time, for a firm to truly benefit from the value-enhancing effects of exploration and exploitation resources, these resources also need to be combined (Jansen et al., 2009; O'Reilly & Tushman, 2008). Organizations that seek to become ambidextrous must therefore transcend the exploration–exploitation paradox (Lewis, 2000; Smith & Tushman, 2005). This creates significant pressures within the organization.

Ambidexterity research has highlighted the importance of top management teams (TMTs) in relation to these pressures (Heavey & Simsek, 2014; O'Reilly & Tushman, 2008; Smith, 2014; Smith & Tushman, 2005). In particular, the key role that TMTs play in sensing, seizing, and reconfiguring explorative and exploitative resources has led many to argue that creating an ambidextrous organization is more of a challenge for leadership than it is for organizational design (e.g., Mirron-Spektor & Argote, 2008; O'Reilly & Tushman, 2008, 2011, 2013; Smith, 2014; Smith, Binns & Tushman, 2010; Smith & Tushman, 2005). Despite the TMT's vital role as orchestrator of this dynamic recombinative process, the literature provides little help in respect to the sources that enable and motivate top management to transcend this paradoxical tension (O'Reilly & Tushman, 2013; Smith, 2014). To address this gap, I argue that two TMT characteristics are important antecedents to organizational ambidexterity: TMT reflexivity and TMT paradoxical cognition.

Here TMT reflexivity refers to reflexive behavior that is associated with learning behaviors within the TMT (Schippers, Edmondson & West, 2014). Although the literature on organizational paradoxes has drawn attention to the value of self- and social reflection

(Lewis, 2000) as well as reflexive questioning (Lüscher & Lewis, 2008), our understanding of both the nature of these reflexive behaviors in relation to ambidexterity and their influence remains somewhat underdeveloped. This is surprising as we know from other theoretical fields that learning behaviors such as reflexivity have a strong influence on our ability to deal with paradoxes, conflicts, and dialectical situations (e.g., Barrett, 1998; Bledow et al., 2009; Hirst et al., 2009; Lüscher & Lewis, 2008; Poole & Van de Ven, 1989; Rothenberg, 1979). This makes TMT reflexivity potentially a particular powerful antecedent of ambidexterity. Drawing on the organizational behavior literature, I adopt West' definition of reflexivity which states that reflexivity is "the extent to which group members overtly reflect upon, and communicate about the group's objectives, strategies (e.g., decision-making) and processes (e.g., communication), and adapt them to current or anticipated circumstances" (2000: 3). In so doing I refine the theoretical understanding of the importance of TMT reflexivity for realizing ambidexterity by developing the reflexivity construct further than it has previously been operationalized within the ambidexterity literature. Drawing on the team literature (e.g., Schippers et al., 2007; West, 2000), I argue that the degree to which TMTs reflect can be regarded as a particular trait of the team; reflection is not simply something that occurs on an ad hoc basis, in response to interventions by third parties, as others have suggested (Lüscher & Lewis, 2008). Some TMTs can therefore have a natural inclination to reflexive behaviors. Moreover, by introducing TMT reflexivity and its associated single- and double-loop learning processes as antecedent to organizational ambidexterity, I also examine the importance of TMT reflexivity, and the associated single- and double-loop learning processes, as antecedents to ambidexterity. While previous studies have given attention to double-loop learning in relation to resolving paradoxes and realizing ambidexterity (Lewis, 2000; Lüscher & Lewis, 2008; Smith & Tushman, 2005), I add to the literature by drawing attention to the critical role played by single-loop learning in laying the foundations for double-loop learning to take hold, leading to new combinations.

The other antecedent in my model, TMT paradoxical cognition, refers to a shared mental model that enables the effective handling of the contradictions that exist between exploration and exploitation by providing a base for cognitive differentiation and integration processes (Mirron-Spektor & Argote, 2008; Smith & Lewis, 2011; Smith &

Tushman, 2005). Here the cognitive differentiation and integration processes provide the TMT with the means to escape cognitive biases and conceive ambidextrous solutions. I argue that TMT paradoxical cognition mediates the relationship between TMT reflexivity and organizational ambidexterity as it determines the extent to which top managers "embrace the tensions and benefit from them or are halted by the inconsistencies" (Smith & Tushman, 2005: 526). Or, in other words, while TMT reflexivity provides management with variance in 'material', paradoxical cognition will determine how they will select and make sense of these inputs. While the crucial role played by paradoxical cognition is clear, the construct itself still awaits large-scale empirical testing. Moreover, although conceptual work has pointed to antecedents such as team design, leadership style, and task interdependence (Smith & Tushman, 2005), we know very little about how TMT learning behaviors relate to paradoxical cognition and ambidexterity. Given the importance of learning behaviors in regard to resolving paradoxes (e.g., Barrett, 1998; Bledow et al., 2009; Hirst et al., 2009; Lüscher & Lewis, 2008; Poole & Van de Ven, 1989; Rothenberg, 1979), a big piece of the puzzle still seems to be missing from the ambidexterity literature. I extend current thinking on the antecedents of paradoxical cognition by arguing that the single- and double-loop learning behaviors associated with TMT reflexivity relate positively to paradoxical cognition. Finally, the study reveals more details on the role of paradoxical cognition in relation to structural differentiation and formal integration mechanisms (e.g., Jansen et al., 2009). The results seem to indicate that paradoxical cognition is particularly important for realizing integration within structurally differentiated organizations, but is neutral in its relation to formal integration mechanisms such as cross-functional interfaces. This seems to suggest that paradoxical cognition is particularly valuable for solving the differentiation and integration challenge, but may play a more limited role in the functioning of specific integration mechanisms.

The model is tested within the setting of SMEs. SMEs face the same paradoxical tensions as larger organizations, but do not have slack resources or sophisticated administrative and/or information-processing systems to draw upon. They are more reliant on their TMT's ability to become ambidextrous and the capacity of those top managers to deal with the exploration-exploitation paradox (Lubatkin et al., 2006).

In this paper I therefore build on the ambidexterity and reflexivity literature and clarify the conceptual role played by both reflexivity and paradoxical cognition, and I provide a detailed explanation how they enable TMTs within SMEs to realize organizational ambidexterity.

3.3 Theory and hypotheses

Recent work on ambidexterity has noted the importance of the TMT's capacity to deal with the cognitive challenges surrounding the exploration–exploitation paradox (Eisenhardt et al., 2010; Gilbert, 2006; Heavey & Simsek, 2014; Smith &Tushman, 2005). This makes the TMT's learning capacity as well as the team's shared mental models of prime interest for developing a greater understanding of generating ambidexterity.

The continuous differentiation and integration of exploration and exploitation activities requires top management to be constantly involved in a sensemaking process (Lewis, 2000; Smith & Lewis, 2011). Top managers make sense of how to separate exploration from exploitation activities and facilitate each of these processes, as well as how to combine these activities in novel ways, by engaging in social processes with one another (Balogun & Johnson, 2004). As paradoxical tensions are perceptual in nature – being the product of socially constructed processes – top managers must cognitively reframe this sometimes irrational or even absurd coexistence of opposites in order to transcend their apparent contradictions and realize ambidextrous solutions (Lewis, 2000; Smith & Lewis, 2011).

In SMEs in particular, top managers face a unique set of cognitive challenges for which the literature currently offers few solutions. SME top managers are often involved in the firm's daily operations, so they have to shift constantly between strategic and operational mindsets (Cao et al., 2010). This provides TMT members with a thorough understanding of the firm's competencies and greater awareness of market developments. However, they may also be more likely to fall prey to inertia as they are an integral part of the operations themselves, and can get caught up in the micro-management process, which makes developing abstract thought and developing a more unified understanding potentially more difficult (Eisenhardt et al., 2010). To overcome this, SME top managers must somehow seek to respect both exploration and exploitation activities and see beyond

their apparent contradictions (Cao et al., 2010; Lewis, 2000; Smith & Lewis, 2011; Smith & Tushman, 2005).

I will argue that the effectiveness of top management's attempts to make sense of how to manage and benefit from the exploration–exploitation paradox depends on the reflexive capacity of the TMT, as well as on the extent to which team members employ a paradoxical cognitive mindset.

3.3.1 The effect of TMT reflexivity on ambidexterity

Within the ambidexterity literature, attention has been given to self- and social reflection (Lewis, 2000), and reflective questioning (Lüscher & Lewis, 2008), have been highlighted as behavioral antecedents to ambidexterity. I draw from the organizational behavior literature and regard reflexive behaviors as "a discussion-based process in which teams assess current information and past or planned actions, decisions or conclusions, with respect to goals, processes or outcomes" (Schippers, Edmondson & West, 2014: 735). Because reflexive team members engage deliberately and collectively in discussion, it can be seen as a relational activity (Schippers et al., 2008). Given that this activity is social and collective in nature, it has a great influence on the way top managers enact their environment (Weick, 1979). Reflexivity stimulates them to learn from the past as well as to anticipate on future changes. In that sense reflexivity has been argued to have a dual focus (De Jong & Elfring, 2010; LePine et al., 2008; Schippers et al., 2014). As reflexive teams are more likely to be attentive to deviations from the norm than non-reflexive teams, these teams are likely to demonstrate greater single-loop learning – i.e., are more likely to refine their existing mental models (Argyris & Schön, 1978; Volberda, 1996). However, as they are also far more prone to pick up on imperfections in the norms themselves, they are also more inclined to show higher levels of double-loop learning (Schippers, 2003). Here reflection stimulates top managers to externalize their reasoning and motivates others within the top management team to challenge and exchange these ideas (Vashdi et al., 2007; Senge, 1990). As a consequence, reflexive TMTs are more likely to construct new mental models as they call into question the norms, values, strategies, and objectives of the organization (Argyris & Schön, 1978; Schippers et al., 2007; Swift & West, 1998; Vashdi et al., 2007; Volberda, 1996). Although the current ambidexterity literature recognizes the

value of reflexive behaviors in regard to ambidexterity, these behaviors are of an ad-hoc nature and have tended to overlook the vital role of single-loop learning (Lewis, 2000; Lüscher & Lewis, 2008). I posit that the reflexivity is not a haphazard occurrence, as some have suggested, but that a propensity to reflect can in fact be seen as a team characteristic that has profound and lasting effects on the learning behavior of the TMT and hence on its ability to achieve ambidexterity.

First of all, managers within a reflective TMT continuously make sense of situations by communicating and questioning views and ideas within the team as well as learning from past and planned actions (Schippers et al., 2008). It are these single- and double-loop learning behaviors associated with TMT reflexivity that greatly increase management's chances of realizing organizational ambidexterity. Because of the single-loop learning behaviors, reflexive TMTs will tend to be more knowledgeable as they are more likely to develop deeper, more refined, and accurate knowledge structures (Katila & Ahuja, 2002). As the TMT engages in single-loop learning, it may choose to refine its ways of working and its understanding of markets, clients, products, or competitors, but without discarding (or even doubting) the validity of the underlying assumptions (i.e., the governing values and norms) themselves (Argyris & Schön, 1978; Volberda, 1996). The knowledge domain in question, and thus the specific mental model it entails, will therefore grow in sophistication as it becomes more elaborate and accurate over time. Crucially, the knowledge in both explorative and exploitative domains will become not only more sophisticated but also more extensive, increasing the chances that the TMT is able to transcend the exploration–exploitation paradox. Importantly, within a reflexive TMT, these single-loop learning activities can be expected to be commonplace (Volberda, 1996). This makes it more likely that the mental models they relate to are more accurate, which in turn increases the chances that, when the TMT tries to forge novel combinations between explorative and exploitative activities, these will be more successful.

Simultaneously, double-loop learning is likely to free TMT members from existing belief structures as it interrupts the normal way of doing things and therefore creates room for more deliberate and thoughtful deviation from the norm (Lewis, 2000; Lüscher & Lewis, 2008; Smith & Lewis, 2011). Because it frees top managers from perspective limiting assumptions, this process of 'stepping back' increases the chances that

they will recognize and make links between explorative and exploitative activities that might have seemed incommensurable before (van Neerijnen et al., 2015). Although managers need to break free from their existing mindset in order to discover novel combinations, their attempts to do this are likely to be more successful when supported by a rich understanding of the specific knowledge domains (Day & Lord, 1992). In this respect, the single-loop learning activities provide an important stepping stone to double-loop learning activities. Overall then, TMT reflexivity creates a situation in which TMT members will engage in more systematic information-processing to answer questions that may have been raised (De Dreu, 2007). Some of them will be simple, requiring a modest adjustment in activities, but some of them will be more fundamental, requiring managers to rethink the basic assumptions of their schemata (an thus their way of doing things). Due to their greater information-processing and learning capacity, reflective teams are therefore more likely to develop a greater understanding of the particularities of the exploration–exploitation paradox. This makes it more probable that they will try to reframe the apparent paradox and enact a new resolution. Moreover, as reflexive TMTs understand more about the tensions between explorative and exploitative activities – including their causes and constraints, as well as their potential – it is likely that they will be more successful in achieving their envisioned outcomes. Because reflexive TMTs are stimulated to engage in single- and double-loop learning activities, they are more likely to successfully transcend the exploration–exploitation paradox. From this, I argue that:

Hypothesis 1: TMT reflexivity is positively related to organizational ambidexterity

3.3.2 The role of paradoxical cognition in mediating between TMT reflexivity and organizational ambidexterity

Although TMT reflexivity increases the *likelihood* that top managers are able to overcome the exploration–exploitation paradox, conceive new synergies, and realize organizational ambidexterity, it does not explicate the cognitive mechanism through which such transcendence is made possible. In a very real sense, the way the shared mental models of the TMT are organized will determine top management's ability to effectively deal with this paradox. After all, what top managers will see, predict and understand

depends on their cognitive structures (Nystrom & Starbuck, 1984). Their belief structures are an important interpretative filter on their learning activities (Daft & Weick, 1984; Tripsas & Gavetti, 2000). These cognitive structures will determine which lessons are retained, what is dismissed, or what is ignored. In particular, the cognitive processes of differentiation and integration that are an integral part of paradoxical cognition have been argued to be instrumental in enabling top managers to deal effectively with the exploration–exploitation paradox (Smith & Tushman, 2005; Smith & Lewis, 2011). In the following section I will define and explain paradoxical cognition in more detail, and argue that it has a mediating effect in the relationship between TMT reflexivity and organizational ambidexterity.

3.3.2.1 The relationship between TMT paradoxical cognition and organizational ambidexterity

Paradoxical cognition is a shared mental model that consists of two interrelated cognitive elements – a paradoxical cognitive frame and the cognitive processes of differentiation and integration – that together stimulate TMTs to recognize and embrace contradiction, thus enabling balanced decision-making (Mirron-Spektor & Argote, 2008; Smith & Tushman, 2005). The basis of paradoxical cognition is formed by a paradoxical cognitive frame that acts as a mental template, filtering information and guiding TMT behavior such that it enables TMT members to recognize and accept exploration and exploitation activities. This leads them to embrace this cognitive juxtaposition, rather than avoid or deny it (Smith & Tushman, 2005). This paradoxical cognitive frame in turn provides the context for two cognitive processes that function as behavioral routines which guide the way they think about and respond to information, enabling them to deal with the tensions between exploration and exploitation (Smith & Tushman, 2005). Here cognitive differentiation processes allow TMT members to recognize and express a contrast between exploration and exploitation, while cognitive integration processes enable them to create connections at a meta-level between differentiated activities (Smith & Tushman, 2005). There are several reasons why paradoxical cognition relates to ambidexterity.

First of all, when they have a paradoxical mindset, TMT members will regard explorative and exploitative goals as being legitimate, stimulating them to try and achieve

those goals (Smith & Tushman, 2005). As paradoxical cognition primes them to pursue both explorative and exploitative activities, the problem space (i.e., the unknown territory between the current and the desired state) becomes larger than in a problem space in which the end state is defined by either an explorative or explorative goal (Mirron-Spektor & Argote, 2008; Simon & Newell, 1971). Because a paradoxical mindset leads them to probe more deeply into both explorative and exploitative activities, TMT members are able to deal with more complex tasks, such as those relating to the exploration and exploitation paradox. As a result, they will have more ideas in relation to each of these activities, both separately and in combination (Mirron-Spektor & Argote, 2008).

Second, a paradoxical mindset influences the way the exploration and exploitation paradox is perceived and subsequently how information is processed. A paradoxical mindset leads managers to believe that both explorative and exploitative activities can be achieved simultaneously, and that they are – or can be – related (Mirron-Spektor & Argote, 2008). This in effect reduces the feelings of threat and fear that arise from the perceived tension between these activities (Smith & Tushman, 2005). The belief in a positive outcome reduces the anxiety surrounding the paradox. Because of their paradoxical mindset TMT members will tend to confront this anxiety head-on, rather then seek to avoid it (Lewis & Dehler, 2000). This makes it more likely that they will try to deal with the exploration and exploitation paradox by seeking to combine both activities, even if this involves high levels of perceived risk and uncertainty. Moreover, compared to TMTs that do not experience the reduced levels of threat and fear, TMTs with a paradoxical mindset are more likely to search for information across a broad field of attention, using a greater number of information channels (Mirron-Spektor & Argote, 2008; Staw, Sandelands & Dutton, 1981). This increases TMT members' understanding of exploration and exploitation activities – providing the variance in material – and improves their understanding of what causes the tensions between exploration and exploitation activities, and how these might be overcome, giving them potential anchor points for subsequent integration.

Third, because of the cognitive processes of differentiation and integration associated with paradoxical cognition, TMT members are better able to deal with the tensions between exploration and exploitation activities. Balancing these two contradictory

forces is made possible by the cognitive processes of differentiation and integration (Smith & Tushman, 2005). In this regard, cognitive differentiation is vital for developing an innovation stream reflecting both exploration and exploitation efforts for the firm as well as for expanding its knowledge base for its explorative and exploitative activities; it is also important in ensuring that these two types of activity are protected from one another (Lynn, 2005; O'Reilly & Tushman, 2008; Smith & Tushman, 2005). The successful management of the ambidexterity paradox requires TMT members to maintain both these activities as both are desirable from an organizational fitness perspective (Cao et al., 2009; Lewis & Dehler, 2000). A paradoxical cognitive mindset ensures that the needs of both exploration and exploitation activities are attended to (Smith & Tushman, 2005). The ability to draw distinctions between them enables managers to strike a better balance between present and future needs because they are less prone to cognitive overcommitment, leading to more effective resource allocations (Langer, 1989; Smith & Tushman, 2005). Moreover, as cognitive differentiation can be regarded as a core process that enables learning, creativity, and effective decision-making, it not only ensures that both activities can be pursued simultaneously but also leads to more knowledge and an overall ability to cope with demanding circumstances (Smith & Tushman, 2005). The TMT's attempts to deal with the paradox are likely to be more successful when when TMT members have an intimate knowledge of both exploration and exploitation activities – again providing greater variance in material and increasing the potential connections between them. In addition, because of cognitive differentiation TMT members are less likely to fall prey to cognitive inertia (Smith & Tushman, 2005), making it easier for them to let go of the past and reframe the way they think about both exploration and exploitation and the relationships between them. This capacity to reframe is an essential first step in the TMT's attempts to become ambidextrous (Lewis, 2000; Lewis & Dehler, 2000; Smith & Lewis, 2011).

However, while cognitive differentiation allows TMT members to "identify more targeted and focused synergies between the distinct products" (Smith & Tushman, 2005: 529), it will not lead to synergistic outcomes unless there is also cognitive integration. Cognitive integration refers to a process of finding conceptual linkages between different perspectives (Suedfeld, Tetlock, & Streufert, 1992). For this to happen,

it is essential that managers are able to shift their thinking to the meta-level (Smith & Tushman, 2005). Cognitive integration processes enable connections to be forged; they give managers conviction that it is actually possible to pursue two seemingly contradictory sets of activities, and that then impels them to look for, and achieve, novel combinations of exploration and exploitation in a very focused way (O'Reilly & Tushman, 2008; Smith & Tushman, 2005). As such, the cognitive differentiation and integration processes reinforce one another; they are instrumental in TMTs' capacity to deal effectively with the tensions between exploration and exploitation activities and thereby increase organizational ambidexterity (Smith & Tushman, 2005).

3.3.2.2 The relationship between TMT reflexivity and TMT paradoxical cognition

While the literature on paradoxical cognition has noted the importance of team design, leadership style, and task interdependence as antecedents to paradoxical cognition (Smith & Tushman, 2005), I argue that TMT reflexivity and the associated learning behaviors are also key drivers for paradoxical cognition. The complex and sophisticated behavioral responses that result from cognitive differentiation and integration processes are driven by the single- and double-loop learning associated with TMT reflexivity.

First of all, TMT reflexivity improves top management's capacity for cognitive differentiation. Here both the single- and double-loop learning behaviors related to TMT reflexivity play a distinctive role. Single-loop learning refines categorizations within the team's existing schemata (Smith & Tushman, 2005; Volberda, 1996). The single-loop learning behaviors that accompany TMT reflexivity are therefore instrumental in the team's capacity to demarcate the boundaries between the cognitive frames associated with explorative and exploitative resources and refine the internal logic and coherence of these cognitive frames: i.e., the team's capacity for cognitive differentiation (Smith & Tushman, 2005). At the same time, double-loop learning releases the TMT from these distinctions that may limit its capacity to explore. This process of 'deep reflection' allows for a more fundamental restructuring of schemata. As the very assumptions implicit within the TMT's working model are called into question, new categories are drawn within the TMT's cognitive schemata, again further increasing the sophistication with which the TMT thinks about exploration and exploitation and responds to information.

Second, TMT reflexivity is positively related to the team's cognitive integration processes. As reflective TMTs continuously make sense of situations by communicating and questioning views and ideas within the team, they are likely to be more successful in constructing linkages across different knowledge domains. Reflexive questioning can bring current beliefs under scrutiny but can also increase the chances that subsequent integrative attempts of explorative and exploitative resources will bear fruit. Here double-loop learning assists TMT members in their efforts to 'break their lenses' (Dunbar et al., 1996), come to new realizations, recognize linkages that they did not see before, or dismiss past tensions. These processes go hand in hand with the unlearning of old schemata, a process that facilitates the construction of a new shared mental model (Tsang & Zahra, 2008; Nystrom & Starbuck, 1984). The chances that cognitive integration processes (i.e., the ability of the TMT to find conceptual linkages across different concepts) will be successful will be far greater when the TMT is able to free itself from the cognitive constraints of its old schemata.

3.3.2.3 *The mediating effect of paradoxical cognition*

When combined, these arguments suggest that TMT reflexivity indirectly influences organizational ambidexterity through its effect on paradoxical cognition. While TMT reflexivity is likely to increase the chances that TMT members will recognize linkages between exploration and exploitation activities, it is through top management's paradoxical cognition that such combinations are realized. Unless TMT members have a mental model that encourages them to pursue both explorative and exploitative goals, guides the way that they process information and deal with anxieties, and enables them to engage in cognitive differentiation and integration, reflexivity is likely to be of little value. Without the mediating effect of paradoxical cognition TMT members will be less inclined to make balanced resource allocations to these two separate activities. Moreover, they are far less likely to engage with the paradox at all, given the emotional anxiety surrounding it. And finally, without a capacity for cognitive differentiation and integration, the TMT will find it much harder to separate exploration from exploitation and construct linkages between them. As such, paradoxical cognition, with its focus on both exploitation and exploration, brings more balance to how TMT members react to the single- and double-

loop learning behaviors associated with TMT reflexivity (Smith & Tushman, 2005). Paradoxical cognition then directs TMT reflexivity towards organizational ambidexterity. I therefore argue that:

Hypothesis 2: TMT paradoxical cognition has a positive mediating effect on the relationship between TMT reflexivity and organizational ambidexterity.

3.4 Methods

3.4.1 Data and sample

To investigate the model, a survey was conducted among Dutch and German firms. From this database I selected firms between 25 and 250 employees. The 250 employee headcount is generally accepted to be the upper-level cut-off point for SME categorization (European Commission, 2003). I omitted firms with fewer than 25 employees, as very small firms are not very likely to have the capability to continously invest time and resources in simultaneously exploring and exploiting (Lubatkin et al., 2006; Voss & Voss, 2013). When asking CEOs to fill in the questionnaire, I assured them of confidentiality and offered them a report in which their firm was compared to others in their sector (with other firms treated anonymously). After omitting the companies that fell outside the 25 to 250 employee headcount and screening the data and accounting for missing data, I retained 455 usable questionnaires from the original 699.

The final sample covers a wide range of industries, covering metal and wood manufacturing (31.4%), retail and wholesale trade (19.6%), administrative support, management of companies, professional, scientific and technical services (25%), utilities and construction (5.1%), arts, entertainment, and food industries (2.6%), health care, social assistance and educational services (3.5%), and other services (2.2%). On average, the firms in the sample were 46.16 years old (s.d. = 8.45) and consisted of 87.71 full-time employees (s.d. = 54.52).

To test for nonresponse bias, I examined differences between respondents and non-respondents in the number of full-time employees, total assets, and prior performance. T-tests showed no significant differences. I also compared early and late respondents on

demographic characteristics and model variables. These comparisons did not reveal any significant differences ($p<.05$). This indicates that nonresponse bias was not a problem.

Alongside the primary survey, I asked each CEO to let a second survey be completed by another senior manager in order to assess validity and reliability of the CEO's response. This resulted in 41 responses, or 9% of the firms from the sample of 455.

3.4.2 Measurements

Unless otherwise noted, all measures used a response scale in which 1 indicated "strongly disagree" and 7 indicated "strongly agree". All main variable items are included in an appendix at the end of this study.

Ambidexterity. Following previous research (Gibson & Birkinshaw, 2004; He & Wong, 2004; Lubatkin et al., 2006), I developed a two-step measure for organizational ambidexterity, based on measures of exploration and exploitation by Jansen, Van den Bosch, and Volberda (2006). Exploratory factor analysis indicated I needed to drop one item from the exploration scale. The resulting six-item scale for exploration ($\alpha = 0.87$) captured the extent to which organizations depart from existing knowledge and pursue radical innovations for emerging customers or markets. For the firm-level exploitation scale, exploratory factor analysis indicated I should drop one item (see appendix). The resulting six-item scale ($\alpha = 0.79$) captured the extent to which organizations build upon existing knowledge and pursue incremental innovations that meet the needs of existing customers (Benner & Tushman, 2003; Smith & Tushman, 2005). A subsequent joint exploratory factor analysis showed the intended two-factor structure, with each item loading clearly on its intended factor (all factor loadings were above 0.61, with cross loadings under 0.35) and both factors having eigenvalues greater than one. Second, I operationalized ambidexterity as the sum of exploration and exploitation, following the Edwards test (1994) as suggested by Lubatkin et al. (2006). As a final check of the convergent validity of my operationalization of ambidexterity I compared the fit of three different additive models using confirmatory factor analysis (AMOS 20). Here the model of ambidexterity as a second-order factor structure generated the closest fit to the data ($\chi^2= 149.031$, DF= 51, CFI= 0.93, RMSEA= 0.08). The model in which all items were specified to load on the same underlying factor demonstrated a very poor fit ($\chi^2= 534.341$,

DF= 52, CFI= 0.66, RMSEA= 0.19). The last alternative model treats exploration and exploitation as independent variables (χ^2= 177.049, DF= 52, CFI= 0.91, RMSEA=0.09). The difference in fit between the independent variable model and the second-order factor structure model is significant ($\Delta\chi^2$= 28.02, Δdf= 1, p<0.00). Accordingly, I operationalized ambidexterity as a second-order construct.

Top management team reflexivity. I used the six-item scale from Schippers et al. (2008). These items are based on Carter and West (1998). The scale demonstrated high reliability (α= 0.93), and exploratory factor analysis showed high factor loadings (all factor loadings above .80). Confirmatory factor analysis provided further confirmation of the construct validity of reflexivity (χ^2= 32.226, DF= 8, CFI= 0.99, RMSEA= 0.09).

Top management team paradoxical cognition. As I am not aware of any published scales for *top management team paradoxical cognition* (α= 0.83), a new six-item scale was developed. I consulted five academic experts and two corporate members for further refinements. Based on Smith and Tushman (2005), the scale measures the extent to which the top management team exhibits differentiation and integration at a cognitive level. For differentiation I asked the TMT members the extent to which the top management team differentiates between existing and new products and devise appropriate strategies for each. For integration I asked the TMT members the extent to which they identify linkages and synergies between existing and new products and services. An additional CFA revealed a very close fitting model (χ^2= 8.93, DF= 5, CFI= 0.99, RMSEA= 0.04), providing further evidence of the construct validity of the scale.

Control variables. I controlled for several alternative explanations. Larger organizations may have more resources, yet lack the flexibility to pursue exploratory and exploitative activities simultaneously (Ahuja & Lampert, 2001). Therefore, I included the number of full-time employees within organizations to account for *firm size*. In addition, I controlled for *TMT size*. TMT size is a known covariate of other TMT variables such as TMT diversity and cognition (Cho & Hambrick, 2006). It is known that inertia increases with age as incumbent firms are naturally more inclined towards exploitative (Gilbert, 2005), so I added the number of years since the firm was founded to the controls to account for *age*. In uncertain environments, a careful balance may be more difficult to sustain, therefore I included a four-item measure for *uncertainty concerning the environmental state* (Ashill &

Jobber, 2010). *Team intuition* captures the unconscious processing of information leading to the perception of a coherent pattern (as such, it captures the TMT's hunch or gut feeling). I included a five-item scale (α= 0.78) from Dayan and Elbanna (2011) to control for unconscious processing of information versus the more conscious processing of information stimulated by TMT reflexivity. As TMTs that control organizations with excess resources will find it easier to balance the tension between exploration exploitation (Lubatkin et al., 2006), I used a three-item scale that is based on the scale from Atuahene-Gima (2005) to control for the presence of *slack resources* (α= 0.74). I included a dummy variable for c*ountry* since the data spans two countries, the Netherlands and Germany, which may influence the results. I also controlled for the structural differentiation of the organization. Organizations that are separated in different spatially dispersed units can more easily develop an structure that encompasses both explorative and exploitative activities (Jansen et al., 2009). Similarly, I controlled for cross-functional interfaces that enable knowledge exchange between explorative and exploitative units using a four-item scale (α= 0.65) (Li & Calontone 1998; Tsai & Ghoshal, 1998). An important control factor is the degree to which the top management team is organized to deal with tensions between exploration and exploitation that occur at the TMT level. These can either be addressed by the TMT as a whole (in which case the team as a whole makes trade-offs to resolve the tensions between the respective explorative and exploitative activities undertaken by the organization), or they can be managed by the CEO (in which case the CEO is informed by other members of the TMT concerning the matters of either explorative or exploitative nature but the final choice of how these tensions are dealt with lies with the CEO) (Smith & Tushman, 2005). The way the TMT is organized to address these questions affects the cognitive tensions that team members experience as well as their ability to create organizational ambidexterity (Smith & Tushman, 2005). I developed a new five-item scale for that purpose entitled *shared decision-making* (α= 0.90). Finally, results in terms of exploitation or exploration may be industry-specific (He & Wong, 2004), thus I recoded the NAICS industry codes for each responding organization into six different industry dummy variables: manufacturing, wholesale trade, professional, scientific and technical services, construction, financial services, and other industries.

Aggregation and measurement analysis

I calculated an inter-rater agreement score (rwg) for the data on the main variables before aggregating the data to the organizational level (James, Demaree, & Wolf, 1993). The average inter-rater agreements were 0.85 for exploration, 0.86 for exploitation, 0.76 for paradoxical cognition, and 0.83 for TMT reflexivity. Values above 0.7 indicate a 'good' fit (James et al., 1993).

In addition to the construct analysis of the individual constructs (EFA and CFA), an integrated confirmatory factor analysis was conducted. The model in which the items loaded on their corresponding latent constructs demonstrated a good fit (χ^2= 474.259, DF= 222, CFI= 0.94, RMSEA= 0.05) for models of this complexity and observation numbers (Hair et al., 2006). All item loadings were as anticipated and significant ($p < 0.000$).

	Unconstrained				Constrained				
	χ^2	DF	CFI	RMSEA	χ^2	DF	CFI	RMSEA	χ^2-difference test
Reflexivity Paradoxical cognition	139,58	42	0,95	0,093	145,37	43	0,95	0,094	5,796*
Reflexivity Ambidexterity	279,45	128	0,95	0,066	330,81	129	0,93	0,076	51,355**
Paradoxical cognition Ambidexterity	257,15	113	0,93	0,069	291,13	114	0,92	0,076	33,981**

Table 3.1: Constrained and unconstrained model fit for all construct pairs

To verify the discriminant validity of the scales I compared the constrained and unconstrained model fit for each possible pair of constructs in my conceptual model (Anderson & Gerbing, 1988). I constrained the covariance between the latent constructs and limited the variance of the latent constructs themselves to 1. In every case the χ^2 difference test returned a superior fit for the freely estimated model ($p<0.01$), providing evidence of the discriminant validity of the variables in my model (table 3.1).

Common method variance

I took several steps to mitigate against and assess the potential for common method variance (CMV). First, following the recommendations from Podsakoff et al. (2003) I took several precautions to mitigate the risk of CMV. I pre-tested the survey items, I ensured anonymity, and I included an introduction to the survey, stipulating its purpose. Second, I verified statistically whether common method variance was present in the data, using Harmon's one-factor test (Podsakoff & Organ, 1986). An exploratory factor analysis which included all items of my hypothesized model revealed four different factors (TMT reflexivity, Paradoxical cognition, Exploration, Exploitation) that together explained 64% of the variance. The largest of these four factors explained 22% of the variance (rotated loadings). The dependent and independent factors loaded on different factors. This suggests that common method variance is not a cause for concern.

Analyses

I tested the mediating effect of TMT paradoxical cognition on the relationship between the TMT reflexivity and organizational ambidexterity using the four-step Baron and Kenny procedure (1986) as well as the bootstrapped Sobel test with confidence intervals (Hayes, 2013).

3.5 Results

The descriptive statistics and correlations are represented in Table 3.2. To check for potential multicollinearity issues, I calculated the variance inflation factors (VIFs). The highest VIF score was 2.41, which is well below the cut-off value of 10 (Hair et al., 2006). Table 3.3 represents the outcomes of the hierarchical regression analyses which follow the four-step Baron and Kenny (1986) procedure. Here model 1 represents the baseline model containing only the control variables. Model 2 adds the direct effect of TMT reflexivity to the baseline model, representing the first step from the Baron and Kenny procedure. This effect is positive and significant (β= 0.27, p<0.05). Model 3 includes the mediating variable TMT paradoxical cognition to the factors already incorporated in model 2. As can be seen in Table 3.3, the relationship between paradoxical cognition and organizational ambidexterity is strongly significant (β= 0.46, p<0.001). Moreover, the introduction of the

mediating variable paradoxical cognition in the regression model should render the relationship between TMT reflexivity and ambidexterity insignificant. In model 3, the effect size and significance levels of the relationship between TMT reflexivity and organizational ambidexterity are clearly reduced (β= 0.12, p< n.s.).

Finally, model 4 consists of the baseline model and the effect of TMT reflexivity on paradoxical cognition. This final step again shows a strong and significant relationship (β= 0.36, p< 0.001). To provide further evidence of the mediating effect, and address some of the methodological limitations of the Baron and Kenny method (Hayes, 2009; Kenny et al., 1998, MacKinnon et al., 2000, Preacher & Hayes 2004, Shrout & Bolger 2002), I performed a bootstrapped Sobel test with confidence intervals (Hayes, 2013). The findings confirmed the findings of the Baron and Kenny four-step procedure as it returned a strong mediating effect of paradoxical cognition between TMT reflexivity and organizational ambidexterity (Sobel z = 3.28, p<0.001, CI-95 0.09-0.29).

To strengthen the validity of my empirical results I tested various competing models with multiple parallel mediators in PROCESS (Hayes, 2013). First, I specified three different models in which the mediating effect of TMT paradoxical cognition was contrasted to another potential mediator (cross-functional interfaces[3], shared leadership[4], and TMT intuition[5]). The results show that the mediating effect of TMT paradoxical cognition remains strong and constant for the different competing models. In addition, I ran a multiple mediation model in which these four mediators were specified to run in parallel (TMT paradoxical cognition, cross-functional interfaces, shared leadership, and TMT intuition). Again, the effect of TMT paradoxical cognition proves to be strong and stable (Sobel z = 3.80, p<0.001, CI-95 0.12-0.35). Interestingly, this is also the case for cross-functional interfaces (Sobel z = 2.76, p<0.01, CI-95 0.07-0.31).

[3] Paradoxical cognition, Sobel z = 3.46, p<0.001, CI-95 0.10-0.29; Cross-functional interfaces Sobel z = 2.48, p<0.01, CI-95 0.05-0.22.
[4] Paradoxical cognition, Sobel z = 3.48, p<0.001, CI-95 0.10-0.30; Shared leadership Sobel z = 0.71, p<n.s., CI-95 -0.03 – 0.13.
[5] Paradoxical cognition, Sobel z = 3.32, p<0.001, CI-95 0.10-0.29; Intuition Sobel z = 1.09, p<n.s., CI-95 -0.002 - 0.09.

	Mean	SD	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
1. Organizational ambidexterity	9.45	1.72	-																			
2. TMT reflexivity	5.09	1.15	0.39**	-																		
3. Paradoxical cognition	4.83	1.06	0.49**	0.59**	-																	
4. Shared decision making	5.18	1.16	0.41**	0.63**	0.47**	-																
5. Structural differentiation	4.03	1.33	0.24**	0.16**	0.20**	0.16**	-															
6. Cross-functional interfaces	4.66	1.23	0.44**	0.60**	0.45**	0.53**	0.19**	-														
7. State uncertainty	4.46	1.08	0.24**	0.50**	0.40**	0.44**	0.18**	0.40**	-													
8. Intuition	4.63	0.83	0.15*	0.07	0.12*	0.01	-0.06	-0.00	0,03	-												
9. Organizational slack	4.16	1.33	0.32**	0.37**	0.14*	0.34**	0.23**	0.34**	0.23**	0.02	-											
10. TMT size	8.32	16.48	0.03	0.11	0.08	0.06	-0.01	0.11*	0.10	-0.02	-0.05	-										
11. Firm size	87.71	54.52	-0.07	0.07	0.04	0.01	0.04	0.03	0.13*	-0.00	-0.06	0.11	-									
12. Firm age	46.16	8.45	0.00	0.16**	0.04	0.14*	-0.03	0.10	-0.01	0.01	0.03	-0.03	-0.03	-								
13. Country (NL=1, DE=0)	0.58	0.49	0.11	-0.12*	-0.13*	0.04	0.40**	-0.10	-0.11	-0.06	0.24**	-0.19**	-0.23**	0.01	-							
14. Metal and wood manufacturing	0.35	0.49	-0.07	-0.00	-0.05	-0.14*	-0.05	-0.03	-0.03	0.02	-0.04	0.00	0.21**-	0.08	-0.12*	-						
15. Retail and wholesale trade	0.22	0.41	0.09	0.08	0.10	0.09	0.11*	0.05	0.02	-0.14*	0.08	-0.06	0.12*	-0.00	0.13**	-.39**	-					
16. Administrative support, management of companies, professional, scientific and technical services	0.28	0.45	0.08	-0.07	-0.02	0.04	0.07	0.02	-0.00	0.07	0.02	-0.02	-0,11*	-0.09	0.04	-0.46**	-0.33**	-				
17. Utilities and construction	0.06	0.23	-0.06	-0.01	-0.03	0.03	-0.01	0.07	0.07	0.06	0.06	-0.04	0.02	0.05	0.08	-0.18**	-0.13**	-0.15**	-			
18. Arts, entertainment, and food industries	0.03	0.17	-0.02	0.09	0.06	0.10	0.02	-0.01	-0.02	0.01	-0.08	0.24**	-0.8	0.01	0.03	-0.13**	-0.09	-0.11*	-0.04	-		
19. Health care, social assistance and educational services	0.04	0.20	-0.06	-0.01	-0.02	-0.00	-0.14**	-0.06	-0.03	0.03	-0.07	-0.01	0.03	0.00	-0.14**	-0.15**	-0.11*	-0.13*	-005	-0.04	-	
20. Agriculture, forestry, mining, and hunting	0.003	0.05	0.04	-0.01	-0.04	-0.02	-0.01	-0.09	-0.02	-0.06	0.02	-0.01	0.03	-0.05	0.04	-0.04	-0.03	-0.03	-0.01	-0.01	-0.01	
21. Other services	0.03	0.16	-0.12	-0.04	-0.04	-0.07	-0.15**	-0.10	-0.00	-0.03	-0.06	0.02	0,00	-0.03	-0.09	-0.12*	-0.08	-0.1*	-0.04	-0.03	-0.03	-0.01

Table 3.2: Descriptive statistics and correlations

	Model 1 *Base model*			**Model 2** *Organizational ambidexterity*		
	B	SE	p	B	SE	p
Control variables						
Constant	6.21	2.17	0.00	6.38	2.16	0.00
TMT size	0.00	0.00	0.52	0.00	0.01	0.49
Organizational age	-0.76	0.49	0.12	-0.89	0.49	0.07
Organizational size (employees)	-0.00	0.00	0.28	-0.00	0.00	0.29
State-uncertainty	0.17	0.10	0.10	0.11	0.10	0.28
Structural differentiation	0.19	0.08	0.03	0.19	0.08	0.02
Shared leadership	0.20	0.10	0.06	0.12	0.11	0.28
Cross-functional interfaces	0.45	0.10	0.00	0.38	0.11	0.00
Intuition	0.33	0.11	0.00	0.31	0.11	0.01
Organizational slack	0.14	0.08	0.08	0.11	0.08	0.16
Country	0.47	0.24	0.05	0.55	0.24	0.02
Other services	-0.61	1.19	0.61	-0.48	1.18	0.69
Arts, entertainment, and food industries	-1.46	1.24	0.24	-1.54	1.23	0.21
Health care, social assistance and educational services	-0.73	1.18	0.54	-0.65	1.17	0.58
Administrative support, management of companies, professional, scientific and technical services	-0.77	1.04	0.46	-0.60	1.03	0.56
Retail and wholesale trade	-0.76	1.02	0.46	-0.65	1.02	0.52
Metal and wood manufacturing	-0.58	1.03	0.57	-0.48	1.02	0.47
Utilities and construction	-1.42	1.11	0.20	-1.20	1.11	0.28
Independent variables						
TMT Reflexivity				0.27	0.12	0.03
Mediator Variable						
Paradoxical cognition						
R^2	0.37			0.38		
F Δ	7.33			5.13		
p	0.00			0.05		

Table 3.3: Results of Hierarchical Regression Analyses

	Model 3 *Organizational ambidexterity*			**Model 4** *Paradoxical cognition*		
	B	SE	p	B	SE	p
Control variables						
Constant	5.73	2.01	0.01	1.40	1.26	0.27
TMT size	0.00	0.01	0.53	0.00	0.00	0.85
Organizational age	-0.80	0.48	0.10	-0.27	0.28	0.35
Organizational size (employees)	-0.00	0.00	0.37	0.00	0.00	0.71
State-uncertainty	0.06	0.10	0.54	0.11	0.06	0.09
Structural differentiation	0.15	0.08	0.07	0.12	0.05	0.02
Shared leadership	0.07	0.11	0.52	0.11	0.06	0.10
Cross-functional interfaces	0.33	0.10	0.00	0.11	0.06	0.07
Intuition	0.26	0.11	0.02	0.15	0.06	0.02
Organizational slack	0.14	0.08	0.08	-0.08	0.05	0.10
Country	0.61	0.23	0.01	-0.14	0.14	0.31
Other services	-0.68	1.15	0.55	0.47	0.71	0.51
Arts, entertainment, and food industries	-1.51	1.19	0.21	0.10	0.72	0.89
Health care, social assistance and educational services	-0.84	1.13	0.46	0.33	0.69	0.64
Administrative support, management of companies, professional, scientific and technical services	-0.78	1.00	0.44	0.40	0.62	0.52
Retail and wholesale trade	-0.84	0.98	0.39	0.40	0.61	0.51
Metal and wood manufacturing	-0.62	0.98	0.53	0.31	0.61	0.61
Utilities and construction	-1.32	1.07	0.22	0.18	0.65	0.79
Independent variables						
TMT Reflexivity	0.11	0.12	0.38	0.36	0.07	0.00
Mediator Variable						
Paradoxical cognition	0.46	0.11	0.00			
R^2	0.42			0.41		
F Δ	16.39			25.84		
p	0.00			0.00		

Table 3.3: Results of Hierarchical Regression Analyses

These findings provide support for hypothesis 1 and hypothesis 2. Clearly TMT reflexivity is a key antecedent for organizational ambidexterity (hypothesis 1). However, this effect is fully mediated by TMT paradoxical cognition. This indicates that TMT reflexivity does indeed increase the team's capacity to realize organizational ambidexterity

as it stimulates single and double-loop learning, but also that this capacity will only be translated into organizational ambidexterity if the TMT is able to differentiate cognitively between exploration and exploitation activities and to integrate those activities (i.e., using paradoxical cognition). I will explore the findings and their implications for theory and practice in the next section.

3.6 Discussion

Within the ambidexterity literature top management teams play a critical role: they are at the juncture of internal forces for stability and external forces for change (Smith & Tushman, 2005). In their role as the main governing entity within the firm, top management has considerable influence on organizational outcomes (Hambrick & Mason, 1984; Cho & Hambrick, 2006). Top managers influence the realization of organizational ambidexterity both directly and indirectly: directly as they make decisions regarding both the allocation and integration of resources (O'Reilly & Tushman, 2008; Teece, 2007), and indirectly as they devise specific organizational structures, systems, and processes (Teece, 2007). The common denominators in these decisions is the influence of the learning capacity as well as the cognitive structures of the TMT. In the end, what people see, do, predict, and understand depends on their cognitive structures and the capacity people have to change these cognitive structures (i.e. learn) (Argyris, 1993; Gavetti & Levinthal, 2000; Nystrom & Starbuck, 1984; Ocasio, 1997). The ambidexterity literature has focused predominantly on the outcomes of these decisions: the structures, systems, and routines by which the organization can deal with these challenges (O'Reilly & Tushman, 2008; Teece, 2007). However, how TMT members can deal effectively with their own biases and transcend the exploration–exploitation paradox has still not been adequately explored.

To shed more light on this matter I focused on the role of the TMT in realizing organizational ambidexterity. I extend the work of Smith and Tushman (2005) and Smith and Lewis (2011), and argue that top management's capacity to realize ambidexterity depends on TMT reflexivity as well as on TMT paradoxical cognition. I find confirmation that TMT reflexivity influences organizational ambidexterity. This study is first to argue for and demonstrate the important influence of TMT dialectics and learning behaviors associated with TMT reflexivity on organizational ambidexterity. Moreover, I show that

paradoxical cognition fully mediates the relationship between TMT reflexivity and organizational ambidexterity. This provides evidence to support my argument that, although learning behaviors are instrumental to overcome overcoming the paradox, actual transcendence of the paradox depends on the way that TMT shared mental models are organized. In the following section I will discuss the main theoretical implications of my study.

3.6.1 The importance of TMT reflexivity in relation to transcending the exploration–exploitation paradox

Literature on ambidexterity and organizational paradoxes has highlighted the role reflective behaviors can play in reframing mental models (Lewis, 2000; Lewis & Dehler, 2000; Lüscher & Lewis, 2008). These behaviors trigger double-loop learning processes (Lüscher & Lewis, 2008) that aid managers to transcend the exploration–exploitation paradox (Lewis, 2000). They therefore form an important antecedent to top management's ability to benefit from both exploration and exploitation, despite their clear differences (Smith & Lewis, 2011). I contribute to the ambidexterity literature in particular, and to the paradox literature more generally, by refining and extending the conceptualization of the nature of reflective behaviors, and showing how that then affects our understanding of how such behaviors influence organizational ambidexterity.

Regarding the nature of reflexive behaviors, the study by Lüscher and Lewis (2008) has shown how reflective questions from an independent third party can trigger individuals to carefully examine the assumptions that underlie their understanding of the world. I, however, adopt the definition of Schippers et al. and regard TMT reflexivity as "a discussion-based process in which teams assess current information and past or planned actions, decisions or conclusions, with respect to goals, processes or outcomes" (Schippers et al., 2015: 735). Because such reflexive behaviors need not depend on the involvement of an objective third party as suggested in previous work (Lüscher & Lewis, 2008), but can in fact be conceived as a stable TMT trait with a strong relational dimension (Schippers et al., 2008), this means that reflexive behaviors can be set in motion by the TMT itself, and the support of an outsider is not necessary to trigger reflection. Moreover, this definition emphasizes the intrinsically relational character of TMT reflexivity (Schippers et al.,

2008). As TMT members engage in dialectical discussions, they unearth false pretences and create new understandings of their work domain (Lewis, 2000). In other words, through reflexive practice TMT members as a team make sense of how the organization should divide its resources between exploration and exploitation, how they can protect both types of activity, and of course, how the two activities can potentially be combined. They do so by communicating ideas with each other, sharing concerns, or raising doubts and questions (Schippers et al., 2008). In this paper I emphasize this ongoing dialogue between TMT members, because it stimulates them to conceptually expand, combine, and reframe their existing mental models and through that process to discover new linkages across the paradoxical divide between exploration and exploitation on a continuous basis (Smith & Tushman, 2005; Tsoukas, 2009). This paper therefore contributes to the ambidexterity literature and paradox literature by conceptually extending and refining the nature of reflective behaviors.

This paper also elaborates on how TMT reflexivity affects organizational ambidexterity. Previous work has argued that self- and social reflection play an important role in revealing "the seemingly absurd and irrational coexistence of opposites" (Lewis, 2000: 761), as do double-loop learning behaviors (Lüscher & Lewis, 2008). Clearly, double-loop learning helps managers to reframe their existing mental models and is instrumental in recognizing new linkages between explorative and exploitation resources (Lewis, 2000; Lüscher & Lewis, 2008; Smith & Tushman, 2005). I argue that in addition to double-loop learning behaviors, single-loop learning behaviors are important, too, and even form the foundation for successful double-loop learning behaviors. The role of single-loop learning is more subtle, but nevertheless very important for enhancing top management's ability to realize organizational ambidexterity, yet it has gone unnoticed within the literature. When managers have a greater capacity for single-loop learning, they develop more refined and elaborate knowledge structures (Katila & Ahuja, 2002). In addition, given their greater sensitivity to potential deviations from the norm, reflexive top managers refine their knowledge structures more swiftly. Because of their greater reflexive capacity, reflexive TMTs thus have more accurate and sophisticated knowledge structures. These outcomes of single-loop learning are important as they provide fertile ground for double-loop learning. The more accurate and elaborate the knowledge structures of top

management are, the greater the chances that those top managers will discover novel linkages between different knowledge domains.

3.6.2 The critical link: paradoxical cognition

This study confirms the vital mediating role played by paradoxical cognition in the relationship between TMT reflexivity and organizational ambidexterity. As suggested by Smith and Tushman (2005), paradoxical cognition enables top managers to deal effectively with the cognitive strain involved in the exploration–exploitation paradox. I respond to Smith and Tushman's explicit request for large-sample analysis (2005: 533), and have developed a model that verified the mediating role played by the TMT's capacity for cognitive differentiation and integration (i.e. paradoxical cognition). This paper contributes to the ambidexterity and paradox literature in several ways.

First, this paper extends our understanding of the antecedents of paradoxical cognition by focusing on TMT reflexivity and the associated learning behaviors. As suggested in other literatures, learning behaviors can play a vital role in dealing with these tensions (e.g., Rothenberg, 1979; Lüscher & Lewis, 2008; Poole & Van de Ven, 1989; Barrett, 1998; Bledow et al., 2009; Hirst et al., 2009). I argue that the single and double-loop learning behaviors associated with TMT reflexivity have a direct impact on top management's capacity for cognitive differentiation and integration. Previous literature has emphasized more 'contextual' factors of the top management team as possible antecedents to ambidexterity, such as team design, leadership style, and task interdependence (Smith & Tushman, 2005). While I controlled for such factors, the effect of TMT reflexivity on paradoxical cognition was highly significant (β=0.36, p<0.00), showing that its influence is strong. The value of paradoxical cognition can be expected to be the greatest when the management team is able to process a lot of information from the environment. Here single-loop learning helps top managers to separate out explorative and exploitative activities and to develop a more coherent understanding of each of these activities. Double-loop learning, on the other hand, stimulates them to look beyond and actively question the tried and true, and discover new linkages between these exploration and exploitation activities. While the value of cognitive differentiation and integration has been eloquently explained by Smith and Tushman (2005), this paper argues for and

demonstrates the crucial role that TMT reflexivity and the associated single- and double-loop learning processes play in enabling these cognitive processes.

Second, although this paper stresses the importance of TMT reflexivity in relation to organizational ambidexterity, I also note that these learning behaviors do not on their own lead to ambidexterity. That depends on the shared mental model of the TMT. If this mental model is not geared to differentiation and integration of activities, any attempts to realize organizational ambidexterity will be severely hampered. Management needs to believe in the value of exploration and exploitation, and must be able to draw distinctions between these activities and to 'think' in terms of both types of activity. Failure to do so will inevitably lead to a reduction in either exploration or exploitation, or both. Similarly, if top managers are not able to reframe their own understanding of the exploration–exploitation paradox – i.e., if they cannot draw new categorizations, enact new relationships, and develop new meanings regarding the elements of a specific working model – they will not be able to combine exploration and exploitation activities in new ways. As such, this paper contributes to the literature by arguing that paradoxical cognition directs the learning activities associated with TMT reflexivity towards a transcendence of the exploration–exploitation paradox, and through this transcendence influences organizational ambidexterity.

Thirdly, my results also seem to provide new insights into the role which paradoxical cognition plays vis-à-vis structural differentiation (organizational differentiation) and cross-functional interfaces (organizational integration mechanisms). The regression analyses in Table 3.3 reveal that the effect size and significance level of structural differentiation drop and become insignificant once paradoxical cognition is introduced into the model. Moreover, the relationship between structural differentiation and paradoxical cognition is significant as well. This suggests that paradoxical cognition has a mediating role on the relationship between structural differentiation and organizational ambidexterity. These findings provide further evidence of the importance of paradoxical cognition in regard to the ability of top management to recognize new combinations of exploration and exploitation activities, but in particular also what role paradoxical cognition may play in regard to the differentiation and integration challenge. One could argue that cognitive differentiation is more straightforward than cognitive

differentiation. The biggest challenge top managers face here is that they need to believe in the value of exploration and exploitation, draw distinctions between these activities, and be capable of 'thinking' in terms of both these activities. Without dismissing the difficulties managers face in doing so, the challenges they are confronted with when they seek to integrate these seemingly incommensurable exploration and exploitation activities are of a different order. This requires them to fundamentally rethink and let go of their assumptions regarding certain exploration and exploitation activities and how they relate to one another (Lewis, 2000; Smith &Tushman, 2005; Smith & Lewis, 2011). The mediating effect of paradoxical cognition on the relationship between structural differentiation and ambidexterity is indicative of the important role paradoxical cognition plays in realizing integrations.

Interestingly though, cross-functional interfaces are only weakly related to paradoxical cognition (β= 0.11, p<0.10). Moreover, the introduction of paradoxical cognition into the model does not greatly affect the coefficient or significance level of cross-functional interfaces on organizational ambidexterity. These findings seem to suggest that paradoxical cognition is indeed of particular value for *solving* the differentiation and integration challenge, but may play a more limited role in the *functioning* of specific integration mechanisms. Although these findings are only indicative, they do provide some insight into the theoretical boundaries of paradoxical cognition.

3.6.3 Implications for SMEs

Overall this study shows the critical importance of TMT reflexivity and paradoxical cognition for top managers in SMEs. This study shows that TMT reflexivity and paradoxical cognition have a very significant impact on the ability of the TMT to realize ambidexterity. SMEs often lack the resources to create and support sophisticated organizational structures in which exploration and exploitation are structurally divided. They do not have the same capacity to develop integration mechanisms as larger organizations do. As such, investing in reflexivity and paradoxical cognition can be an alternative means by which TMTs in SMEs can achieve organizational ambidexterity. Compared to other more traditional methods of achieving ambidexterity, TMT reflexivity

and paradoxical cognition are relatively cheap to develop and maintain. As such, given the involvement of top managers in the daily operations of the firm, TMT reflexivity and paradoxical cognition might be particularly well suited to realizing ambidexterity in the typical organizational configuration of an SME (Mintzberg, 1980).

3.6.4 Limitations and suggestions for future research

Like any study, this study has some limitations. The first and perhaps main limitation has to do with the cross-sectional nature of the analysis. Although the findings in this study have a firm theoretical grounding, they should nevertheless be interpreted with some caution as, given the cross-sectional nature of the research design, we cannot be certain about causality. To deal with this limitation, future research could use an experimental design, rather than a survey. As designs of this type are very difficult for pragmatic reasons, an alternative solution might be to collect longitudinal data. Although this type of approach does not lead to irrefutable claims regarding causality, it does provide evidence that there is a relationship over time between the constructs. Ideally, such a model would demonstrate that different growth trajectories amongst TMTs in terms of reflexivity influence the growth trajectories of organizational ambidexterity through the development of paradoxical cognition. This could perhaps be achieved by using a lagged mediational latent growth curve model (LGM). The incorporation of a time-lag of one between each of the three constructs would, however, require at least five different waves. Another way to test such a mediational LGM would be to set the intercepts of each of the growth models at specific time intervals (Van Neerijnen, Ben-Menahem, Schippers & Von Krogh, 2015). However, a full cross-lagged panel model (Preacher, 2015) are even a simpler design with time lags between the constructs in the model would also be an improvement on the methodological design of the current study. Extending the idea of a longitudinal design, it would be particularly interesting to explicitly model a potential feedback loop between TMT reflexivity and paradoxical cognition. Although I make the logical assumption that learning behaviors affect the cognitive processes required for differentiation and integration, the development of these processes could in turn also lead to a certain preference for single- or double-loop learning. Modeling the dynamics of

learning and cognition within top management teams might provide significant insights into how these processes are related.

Second, based on the organizational behavior literature I have assumed that TMT reflexivity is associated with more extensive single- and double-loop learning behaviors. It would be interesting for future studies to measure these learning behaviors.

Third, although measuring paradoxical cognition is an effective way to establish the extent to which the top management team cognitively differentiates between and integrates exploration and exploitation activities, making it highly suitable for a large-scale variance study like this one, more qualitative research is also needed to determine how managers actually differentiate and integrate these activities. Although some exceptional conceptual work has been done on this (Smith & Tushman, 2005), and some creative methodological approaches have been used to answer these questions (Lüscher & Lewis, 2008), much more remains to be understood. Here I see the merits of using a combination of case studies (Gilbert, 2006; Isabella, 1990; Tripsas & Gavetti, 2000), content analysis (e.g. Barr & Huff, 1997), and experiments (Kilduff et al., 2000; Melone, 1994; Mirron-Spektor & Argote, 2008) to study cognition. These techniques can also be used to gain a more fundamental understanding of paradoxical cognition.

A final limitation stems from the fact that I used the same rater for the dependent and independent variables. I sent out the survey to the CEOs of the companies as they are the most knowledgeable regarding the constructs of the research topic. Although analysis revealed there was no cause for concern regarding common method variance, future research could circumvent the issue altogether by surveying the top ten clients of each firm regarding their perceived level of ambidexterity of their suppliers.

APPENDIX: MEASURES AND ITEMS

Overall model fit: χ^2= 474.259, DF= 222, CFI= 0.94, RMSEA= 0.05.

Exploratory innovation (adapted from Jansen et al., 2006)
Our organization accepts demands that go beyond existing products and services.
We invent new products and services.
We regularly experiment with new products and services in the market.
We commercialize products and services that are completely new to our organization.
We frequently utilize new opportunities in new markets.
Our organization regularly uses new distribution channels.
We regularly search for and approach new clients in new markets.**

Exploitative innovation (adapted from Jansen et al., 2006)
We improve our existing sales channels.
Lowering costs of internal processes is an important objective.
We improve the efficiency of our production processes and services.
Our organization expands services for existing clients.
We regularly implement small adaptations to existing products and services.
We frequently refine the provision of existing products and services.
We increase economies of scales in existing markets.

TMT reflexivity (adapted from Schippers et al. 2008)
The management team of our organization….
…discusses different ways goals can be realized.
…works out what can be learned from past activities.
…assess whether the team is on the right track during task execution.
…checks whether our activities produced the expected results.
… evaluates the results of actions.
…considers alternative courses of action if things don't work out as planned.

TMT paradoxical cognitive processes
Within our management team…
… we regularly make distinctions between current products and new products.**
… we regularly devise different strategies for current and future products.
… we regularly make distinctions in the organization between current and new products.
… we regularly try to identify synergies among current and future products.
… we regularly devise solutions for current and future products.
… we regularly aim for synergies between different organizational units.

** Item deleted after exploratory factor analysis.

All items were measured on a seven-point scale, anchored by 1= strongly disagree and 7= strongly agree, unless otherwise noted.

Chapter 4. Relational Capital and Individual Exploration: Unravelling the Influence of Goal Alignment and Knowledge Acquisition

4.1 Abstract

We investigate how the relational capital of a person within an organization affects the extent to which she or he conducts exploration activities. Our theory separates out a negative effect that comes from aligning goals with other organizational members from a positive effect that stems from acquiring knowledge from them. Our data from 150 members of the R&D teams of three leading R&D-intensive firms support the theoretical model. By developing and testing this theory, we contribute to the literature on exploration, which lacks understanding of the antecedents of individual exploration in organizations. We also contribute to relational capital literature, which has focused on organizational and group level exploration, but which has shown inconsistent findings regarding the relationship between relational capital and exploration. A reason for this may be that this body of research has emphasized positive effects of relational capital for exploration only, and has not accounted for the different mechanisms that mediate the effects of relational capital on individual exploration activities. Our theory offers a more comprehensive view by explaining how relational capital may provide both benefits and liabilities to individual exploration activities.

Keywords

Individual exploration, relational capital, knowledge acquisition, goal alignment, R&D teams

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4.2 Introduction

Organizations need to explore in order to adapt and survive in changing environments (McGrath, 2001; Nerkar, 2003). Existing studies on management and organization have focused on exploration as an organizational-level phenomenon (Alexiev, Jansen, Van Den Bosch, & Volberda, 2010; Nerkar, 2003; Phelps, 2010), and have investigated how aspects such as an organization's culture (Catino & Patriotta, 2013; McLean, 2005), structure (DeCanio, Dibble, & Amir-Atefi, 2000), and systems (Beugelsdijk, 2008; Kang, Snell, & Swart, 2012) may foster exploration. However, these studies can provide only limited understanding of why some people explore more than others in the same organization (Gupta, Smith, & Shalley, 2006), or why a particular individual may explore more in one organization than in another, even if those organizations operate in similar environments and have comparable cultures, structures and systems (Groysberg & Lee, 2009).

To better understand such important issues, we need to investigate the antecedents of individual-level exploration in organizations. This is vital, since an organization's capacity to explore is to a large extent rooted in the exploratory behaviour of its individual organizational members (Brady & Davies, 2004; March 1991; Nonaka, Von Krogh, & Voelpel, 2006). Individual exploration activities are associated with searching for, evaluating, and experimenting with new opportunities, and with developing new knowledge and skills (March, 1991; Mom, Van Den Bosch, & Volberda, 2007). Studies on learning have conceptualized such activities in terms of variety increasing learning processes by which a person renews and broadens his or her existing knowledge base (Holmqvist, 2003; McGrath, 2001). Surprisingly, there is a lack of understanding of what enables and motivates individuals in organizations to explore (Crossan & Apaydin, 2010; Li, Vanhaverbeke, & Schoenmakers, 2008).

Recent research on learning in organizations has been informed by relational capital theory (Berends & Lammers, 2010). Relational capital refers to the quality of a person's relationships with other organizational members in terms of the degree to which she perceives those relationships to be close and trustful (Moran, 2005). As such, relational capital theory would suggest that the exploratory behaviour of individuals in organizations may be shaped by the quality of social processes and interactions with colleagues. Together with the structural dimension, i.e. the configuration of a person's network, the

relational dimension constitutes an important aspect of a person's social capital (Adler & Kwon, 2002; Granovetter, 1992; Moran, 2005). While traditionally most attention has been devoted to structural aspects in studies on social capital, recent research indicates that it is particularly the relational dimension which may play an important role in explaining new, innovation-oriented activities and learning in organizations (Kijkuit & Van den Ende, 2010; Moran, 2005).

A couple of studies have investigated how relational capital relates to exploration, not at the individual level, but at the firm level (Land, Engelen & Brettel, 2012; Uzzi & Lancaster, 2003) or group level (Atuahene-Gima & Murray, 2007; Bogenrieder & Nooteboom, 2004). They argue that relational capital presents a valuable learning resource by enabling the acquisition of knowledge and information from other actors (Maurer, Bartsch, & Ebers, 2011). But strikingly, these studies have shown different findings including positive (Uzzi & Lancaster, 2003), negative (Bogenrieder & Nooteboom, 2004), and non-significant relationships between relational capital and exploration (Land et al., 2012; Atuahene-Gima & Murray, 2007). Scholars such as Brehm and Rahn (1997) and Lin (1999) have pointed out that the effects of relational capital on firm- or group level outcomes are to an important extent a demonstration of the effects of the relational capital of individual organizational members on their behaviour. Therefore, these scholars suggest, investigating relational capital and its effects at the individual level of analysis may be a helpful start in developing new insights and more comprehensive theory about the various ways in which it affects the behaviour of individuals and their organizations.

While the existing studies on relational capital and exploration have emphasized the ability enhancing effects of relational capital –through knowledge acquisition, recent research in the field of human resource management has highlighted that to understand exploration at the individual level, one needs to consider not only the ability of people to explore, but also their willingness to do so (Kang et al., 2012). Studies such as those of Coleman (1990), Granovetter (1992), and Lanzara & Patriotta (2007) have stressed that relational capital may shape people's willingness to engage in particular behaviours, especially by influencing the degree to which they align one another's needs and goals. Interestingly, while the acquisition of knowledge is often seen as a facilitator of individual exploration (Mom et al., 2007; Nonaka et al., 2006), the alignment of goals may possibly

constrain the exploratory efforts of an individual within the organization (Fleming, 2001; McGrath, 2001).

Drawing on these insights, we develop and test theory about how the relational capital of an individual within an organization affects the extent to which he or she conducts exploration activities. We do so by developing a theoretical model which separates out a negative effect that comes from aligning goals with other organizational members from a positive effect that stems from acquiring knowledge from them. As such, we contribute to the literature on exploration (e.g. Alexiev et al., 2010; Beugelsdijk, 2008; Brady & Davies, 2004; Holmqvist, 2003) by creating a better understanding of the drivers of individual exploration in organizations. We also contribute to relational capital literature (Maurer et al. 2011; Moran, 2005; Phelps, Heidl, & Wadhwa, 2012) by developing new and more comprehensive theory regarding the relationship between relational capital and exploration: it provides both benefits and liabilities to individual exploration activities. Identifying benefits and liabilities of relational capital, and explaining how they influence individual exploration may be an important step in helping us to better understand why, in some instances, relational capital may foster individual exploration in organizations whereas it may hinder it in other (Adler & Kwon, 2002; Edelman, Bresnen, Newell, Scarbrough, & Swan, 2004).

In the next section, we elaborate on the theoretical background of this paper and develop the model and hypotheses. Then, we discuss the methods and report compelling evidence of a negative effect of relational capital on individual exploration through goal alignment and a positive effect through knowledge acquisition. We discuss the findings in relation to previous research on relational capital and exploration, and conclude by suggesting as avenues for future research how contextual factors could explain differences regarding the "cost-benefit balance" of relational capital for individual exploration.

4.3 Theory and hypotheses

4.3.1 Exploration activities of organizational members and relational capital

The importance of individuals' exploration efforts in organizations confronting change is acknowledged in various related literatures. For example, studies on innovation indicate that organizations need to facilitate the creation of new knowledge by organizational members in order to develop the innovations needed to deal with market and technological change (Alexiev et al., 2010; Beugelsdijk, 2008; Slappendel, 1996). Studies on organizational learning emphasize the importance of organizational members' variety increasing learning activities for creating the requisite variety to adapt and explore (Holmqvist, 2003; McGrath, 2001). Similarly, studies on strategic management stress that to facilitate a successful change in the organization's strategy, organizational members in different positions need to search for new product and market opportunities and experiment with new business models and organizational forms (Augier & Teece, 2008; Floyd & Lane, 2000).

Relational capital is typically seen as a valuable resource for organizations. A focus on its benefits is common not only in studies on exploration, but also in those on other performance-related outcomes (Van Wijk et al., 2008). A few authors such as Adler and Kwon (2002) and Edelman et al. (2004) have offered a more balanced perspective, indicating that social relationships may have negative implications as well. Such a perspective is currently lacking for relational capital and its implications for exploration. Brehm and Rahn (1997) as well as Lin (1999) have argued that a reason for inconsistent findings regarding the implications of relational capital may be that at lower levels, such as that of the individual, it provides both benefits and liabilities, which may manifest themselves differently across different contexts. To shed more light on this, they suggest as a first step to develop theory on relational capital and its effects at the individual level of analysis, because by treating relational capital as an aggregate concept we may run the risk of obscuring the different mechanisms by which it may affect the behaviour of individuals in organizations (Brehm & Rahn, 1997).

The individual-level theoretical framework we develop takes into consideration that a person's relational capital affects not only that person's ability to explore, but also

his or her willingness to do so. Most scholars note that relational capital may shape the acquisition of knowledge (Maurer et al., 2011; Uzzi 1996), which at the individual level is considered to be an important enabler of new knowledge creation (Nonaka et al., 2006) and variety increasing learning processes (Mom et al., 2007). Others have indicated that relational capital shapes the extent to which people synthesize or align their points of views, aspirations, and goals with others (Granovetter, 1992; Lanzara & Patriotta, 2007), which may affect their willingness or attitude to explore (Fleming, 2001; McGrath, 2001).

A person's relational capital is based on two defining characteristics: the level of closeness and the level of trust in other organizational members (Kale, Singh, & Perlmutter, 2000; Moran, 2005). Taken together, these two facets represent deeper degrees of relational quality (Moran, 2005). Closeness refers to the personal familiarity in a relationship (Hansen, 1999; Uzzi, 1996). Close relationships are characterized by emotional attachment and commitment to the relationship (Hansen, 1999; Moran, 2005). Trust refers to the extent to which people are confident in the reliability, dependability, and favourable future actions of their peers, and is based on prior experiences (Maurer, 2010; McAllister, 1995).

4.3.2 Relational capital and individual exploration: Mediation effect of goal alignment

We first theorize how relational capital relates to goal alignment among organizational members. The goal alignment of an organizational member refers to the degree to which that person's goals are aligned to those of others within the organization (Locke & Latham, 1990; Vancouver, Millsap, & Peters, 1994). As people within an organization perceive their relationships with other organizational members to be closer and more trustful, the levels of mutual adjustment (Gittell, 2002) and cohesiveness between them increase (Granovetter, 1992; Moran, 2005). This stimulates their tendency to develop agreement about the goals they wish to achieve (Gittell, 2002; Vancouver et al., 1994). The close and trustful interactions associated with relational capital serve as social glue that binds actors together, causing them to identify with each other's goals (Adler & Kwon, 2002; Moran, 2005). Hence, the closer and more trustful the relationships between organizational members become, the more their goals become aligned, due to increasing levels of agreement and identification with each other.

Furthermore, norms start to form among organizational members who have developed a close relationship (Moran, 2005; Portes, 1998). This emergence of norms can be regarded as a reflection of consensus and idiosyncratic understanding (Lanzara & Patriotta, 2001; Tsoukas & Vladimirou, 2001), fostering social commitment between members to help each other and to guide each other's efforts towards achieving commonly identified goals (Coleman, 1990; Nahapiet & Ghoshal, 1998). The creation of shared norms and shared commitment creates social pressures to coordinate and align individual goals with those of others within the organization (Gittell, 2002; Locke & Latham, 1990). Thus, while agreement and identification with other organizational members results in an alignment of the goals that organizational members are striving for, the simultaneous creation of norms among actors rich in relational capital fosters compliance towards those goals.

Subsequently, we explain how goal alignment relates to individual exploration. Studies on goal-setting indicate that goal alignment among individuals may stimulate learning behaviours needed to achieve the common goal (Locke & Latham, 1990; Mathieu, Maynard, Rapp & Gilson, 2008). However, their shared commitment and agreement comes at a price as it lowers their willingness to invest time and energy in searching for opportunities and developing new knowledge that lie outside the scope of the common goal (Kiesler & Sproull, 1992), i.e. to invest in learning which is more exploratory in nature (McGrath, 2001). Furthermore, shared goals and strong bonds between individuals can give rise to behavioural conformity because not adhering to the common goals might be viewed as an undesirable or even wasteful allocation of resources (Edelman et al., 2004). This conformity may act as a centripetal force refraining people to engage in exploratory activities (Sheremata, 2000). In addition, when the goals of individuals are closely aligned, it becomes difficult for them to make independent personal assessments as they feel often strongly attached, cognitively and emotionally, to these goals (e.g., Collins, 1996). Several studies on learning and innovation have argued that autonomous judgement and personal reflection are critically associated with organizational members' willingness to engage in exploratory activities like creating new competences (Floyd & Lane, 2000), creatively developing radical innovations (Beugelsdijk, 2008), and engaging in variety increasing learning (McGrath, 2001) .

Goal alignment may also limit individuals' explorative behaviour because it directs their learning processes towards deepening their existing knowledge (Katila & Ahuja, 2002; Levinthal & March, 1993). While this may stimulate people to delve into a specific knowledge domain and develop new insights, studies on learning like those of Holmqvist (2004) and Levinthal and March (1993) argue that the aim of such learning processes is geared towards enhancing reliability in experience which is typically associated with exploitation rather than towards increasing variety in experience which is associated with exploration. Furthermore, strong goal alignment among organizational members is likely to induce an inward-focused attitude among them (Gavetti & Levinthal, 2000) which is likely to increase their drive for learning processes aimed at refinement and improvement, but at the same time to also reduce their openness for more exploratory learning processes directed at renewal, change, and experimentation (Gavetti & Levinthal, 2000; Levinthal & March, 1993). Finally, as individuals deepen their knowledge and enhance reliability in experience triggered by goal alignment, their perceptions and beliefs become more ingrained (Fleming, 2001). This increases cognitive inertia, restricting the breadth of individuals' learning processes, and making them less inclined to develop new or unexpected ideas or insights (Fleming & Sorenson, 2004; Katila & Ahuja, 2002). This leads us to argue that:

Hypothesis 1: The relational capital of an organizational member is negatively related to that organizational member's exploration activities through increasing goal alignment with other organizational members.

4.3.3 Relational capital and individual exploration: Mediation effect of knowledge acquisition

The second variable we investigate as a mediator is knowledge acquisition. We first explain how relational capital relates to knowledge acquisition. The closer the relationships between organizational members and the greater their mutual trust, the more they are committed, open, and responsive to each other (Hansen, 1999; McEvily, Perrone, & Zaheer, 2003). Therefore, they not only share more information and knowledge, but they also tend to provide more detailed feedback, listen more to each other's ideas even if these

are complex or unproven (Hansen, 1999; Moran, 2005; Uzzi, 1996), and are more inclined to clarify how different knowledge components may relate to each other (McFadyen & Canella, 2004; Phelps et al., 2012). Such clarification is valuable for tacit and explicit knowledge alike, as even explicit knowledge requires some degree of personal interpretation (Brown and Duguid, 2005). These qualities of relational capital are especially valuable when it concerns the acquisition of complex, new or unproven knowledge which may be tacit or explicit in form (Van Wijk et al., 2008).

While the arguments above indicate that relational capital can facilitate the acquisition of a wide and diverse knowledge spectrum, others have proposed that the reciprocity and commitment norms associated with close relationships can – if abused (cf. Edelman, 1994, p. 66) – actually provide a disincentive to knowledge sharing. For instance, individuals may guard their knowledge closely if they do not receive credit for their involvement in the creation or identification of the knowledge (Edelman, 2004). While we recognize such potential pitfalls of close relationships for knowledge acquisition, the trust aspect of relational capital may – at least to some extent – reduce abuse or the expectation of abuse. For instance, organizational members who have a high level of benevolence based trust tend to share more knowledge with each other as they believe that this will be reciprocated and mutually beneficial in the long term (McAllister, 1995; Uzzi & Lancaster, 2003). Others have argued that the more trusting the relationships are among exchange partners, the less they feel the need to protect themselves from knowledge misuse or unwanted appropriation (Inkpen & Tsang, 2005; McEvily et al., 2003). Consequently, they will be more receptive to acquiring personal and unique knowledge from each other and will have greater faith in factual information received (Maurer et al., 2010). Trust may also help them to deal with conflict more effectively (Olsen, Parayitam, & Bao, 2007) and reduce the need for bargaining and monitoring, enabling them to focus on the actual knowledge exchange (Maurer et al., 2010).

The acquisition of knowledge emanating from a person's relational capital may increase that person's ability to explore for several reasons. The unique and new knowledge and expert insights acquired from others enable people to broaden their own knowledge, enrich it with new insights (Mom et al., 2007), discover new opportunities (Moran, 2005), and learn to solve problems in new ways (Sheremata, 2000). In other

words, acquiring knowledge from others, both in tacit and explicit form, enables the acquirer to create new knowledge and to increase the variety of his or her experience (Holmqvist, 2004). Knowledge acquisition also helps to renew a person's conceptual models by providing knowledge that broadens his or her current understanding. It offers opportunities to discover novel combinations among knowledge elements and new ways of thinking by bringing different concepts together and reshuffling the interrelationships between the elements of specific knowledge domains (Katila & Ahuja, 2002; Tsoukas, 2009).

While the arguments above indicate that, at the individual level, relational capital through knowledge acquisition may be conducive to exploration, others such as Edelman (2004) proposed that, at the organizational level, strong relational capital may hinder exploration. For instance, strong relational capital in groups which are not interconnected may increase the barriers to knowledge sharing between the groups and obstruct efforts to engage in creative company-wide problem-solving and innovation. However, also in such a case, within the group, relational capital may actually facilitate mutual knowledge sharing between individuals and as such foster individual problem solving and creativity (see Edelman, 2004, p. 65-66). Hence, at the individual level, based on our arguments we hypothesise:

Hypothesis 2: The relational capital of an organizational member is positively related to that organizational member's exploration activities through more knowledge acquisition from other organizational members.

4.4 Method

4.4.1 Research context

The data were collected from 150 organizational members within the large R&D departments of three R&D intensive firms in the Netherlands. The firms operate within the electronics (Firm A), information and communication (Firm B) and telecommunication industry (Firm C). Each firm is active worldwide and listed on the Fortune Global 500 (2012). Their industries are characterised by shortening product development cycles, technological fusion, and increasing levels of competition (Galan & Sanchez, 2006).

Because of this, and rapid and uncertain technological developments, the R&D departments are involved in knowledge intensive dynamic processes and there is pressure on R&D members to conduct exploration activities (Engwall & Westling, 2004). The multidisciplinary approach of the teams creates a social context constituted by multiple interdependent experts and expert communities and the effectiveness of individual R&D employees notably depends on the quality of their relationships with other R&D colleagues (Bouty, 2000). For these reasons, the R&D departments of these firms provide an interesting context to investigate organizational members' exploration activities and their relational capital.

In consultation with senior management, we invited a selected number of R&D staff from each of these departments to fill out the online survey. These employees received the invitation to fill in the survey from the supervisors that supported the research. It was clarified to the employees that –in order to ensure confidentiality– their supervisor would not be informed about the employee's responses to the survey questions. The employees typically work in several cross-functional teams simultaneously and have a background in various functional areas such as R&D, marketing, sales, or operations. In each firm, we consulted HR management in order to select the potential respondents in such a way that their distribution over the functional backgrounds does not significantly differ from the distribution of all members of the R&D department (chi-square test: $p<0.05$; $\alpha=0.05$). In total, 458 people were invited to fill out the survey (Firm A: 75; B: 250; and C: 133). We received 152 completed surveys, corresponding to a response rate of 33%. Due to missing values, the final sample size was reduced to 150 (Firm A: 18; B: 101; C: 31). Of the respondents, 58% have a functional R&D background, 87% are male, 62% have a tenure contract, and all of them have a higher education background. We performed t-tests to compare the respondents with the overall sample in terms of gender, tenure, and functional background, and found no significant differences at a 5% significance level. After receiving the completed surveys, we consulted HR management to identify each respondent's direct supervisor and to invite that supervisor to fill out a part of the online survey as well, i.e. the part pertaining to the independent variable.

4.4.2 Measurement

We used existing scales for all variables to construct the first version of the questionnaire. Subsequently, we held four in-depth interviews with R&D-staff to further increase content validity and to enhance the wording of the items.

Table 4.1. Items[a] used in the questionnaire.

Overall model fit: $\chi^2_{19} = 28.13$, $p < 0.08$; CFI = 0.98; RMSEA = 0.05; 90% confidence interval of RMSEA: 0.01–0.08

Exploration activities (adapted from Mom, 2007), Cronbach's alpha = 0.84
The employee's direct supervisor was asked: During the previous year, to what extent did the employee conduct work related activities that can be characterised as[b]:

- Searching for new possibilities with respect to products/services, processes or markets
- Evaluating diverse options with respect to products/services, processes or markets
- Activities requiring him or her to learn new skills or knowledge
- Activities that are not (yet) clearly existing company policies

Relational Capital (formative-reflective scale of closeness and trust) (adapted from Moran, 2005)
Closeness: Respondent was asked: During the previous year, how close was your working relationship with colleagues from your teams?

- Distant/arm's length (1)----------(7) Very close

Trust: Respondent was asked: Please agree or disagree with the following items[c].

- Colleagues of my teams are generally honest and truthful in the information provided to me
- Colleagues of my teams are very competent in the areas in which we interact

Goal alignment: (adapted from Tjosvold et al, 2004), Cronbach's alpha = 0.69
Respondent was asked to agree or disagree with the following items[c].

- I do "my own thing" in our teams (reversed)
- In my teams, I work for my own individual goals (reversed)
- I like to get my rewards through my contribution to the work of the teams as a whole
- I am most concerned about what our teams accomplish as a group

Knowledge acquisition (Formative-reflective scale of tacit and explicit knowledge acquisition)
Tacit knowledge acquisition (adapted from Dhanaraj et al., 2004), Cronbach's alpha = 0.86
Respondent was asked: Please indicate to what extent you acquired the following from your colleagues in your teams during the previous year[b]:

- Personal expertise and experience
- Vision on new market developments and technology trends
- Personal experience on managerial techniques

Explicit knowledge acquisition (adapted from Dhanaraj et al., 2004), Cronbach's alpha = 0.80
Respondent was asked: Please indicate to what extent you acquired the following from your colleagues in your teams during the previous year[b]:

- Factual knowledge about technology
- Procedural manuals or technical manuals
- Written knowledge about management techniques

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[a] The respondents typically work in several cross-functional teams simultaneously. Correspondingly, the relational capital scale refers to the quality of the respondent's relationships with colleagues in his or her teams, the goal alignment scale refers to the alignment of goals with those of colleagues in his or her teams, and the knowledge acquisition scale refers to the acquisition of knowledge from colleagues in his or her teams. Hence, all these scales refer to the same level and unit of analysis.
[b] 'To a very small extent' (1) - (7) 'To a very large extent';
[c] 'Strongly disagree' (1) - (7) 'Strongly agree'

Dependent variable: An organizational member's exploration activities.

Exploration activities at the individual level were measured with the validated scale of Mom, Van Den Bosch and Volberda (2007, 2009), who used the scale to measure the exploration activities of organizational members of various functional backgrounds working in an R&D driven manufacturing company. The scale measures the extent to which an organizational member conducts exploration activities according to his or her direct supervisor. As not all activities of an R&D department employee are exploratory, this scale explicitly probes into exploratory activities by asking about activities which require the person to learn skills and knowledge new to the person, variety-increasing activities which do not clearly fall within company policy, and activities associated with discovering and evaluating new opportunities. All items were measured on a seven-point Likert scale. The scale was found to be reliable and valid (Cronbach α= 0.84). The assessment of the direct supervisor was significantly correlated with the assessment of the respondent (r = .62; p<.001). In the analysis, we use the assessment of explorative activities by the supervisor of each employee to reduce potential problems associated with common source data collection.

Independent and mediator variables.

The relational capital of an organizational member with other organizational members was measured based on the scale of Moran (2005). Corresponding to the conceptualisation of relational capital and the empirical setting of the respondents, this scale assesses the extent to which the respondent perceives his relationships with colleagues in his R&D teams to be close and trustful. As closeness and trust do not necessarily need to be totally aligned, these dimensions are treated as formative dimensions of relational capital. Using principal component procedures, we calculated the weights of closeness and trust and found that they were both substantial and significant. We adapted the scale developed by Tjosvold, Yu and Hui (2004) to measure *goal alignment of an organizational member with other organizational members*. The items measure the extent to which the respondent's goals are aligned with those of other colleagues in her R&D teams. The scale demonstrates acceptable reliability (α= 0.69). To measure *knowledge acquisition by an organizational member from other organizational members*, we used the tacit and explicit knowledge acquisition scales developed by

Dhanaraj, Lyles, Steensma, & Tihanyi (2004). The scales take into consideration, in line with the theoretical arguments developed in this paper, that the knowledge acquired can be tacit and/ or explicit (Nonaka et al., 2006). The two scales show high reliability (explicit knowledge α= 0.86, tacit knowledge α= 0.80) and are positively and significantly correlated to each other (r = .67, p < .001). Using principal component procedures, we determined the weights of the two components and found that both were substantial and significant. The resulting formative scale measures the acquisition of a broad spectrum of tacit and explicit knowledge by the respondent from colleagues in his or her R&D teams.

Control variables.

We included variables to control for firm (we included one dummy for Firm A and one for B, making Firm C the reference group), gender (1 = male), tenure (1 = tenured), and R&D background (1 = R&D background, 0 = for the other backgrounds such as marketing, sales, or operations).

Measurement model.

We measured all items on seven-point Likert scales and factor analysed the scales, using principal component analysis and varimax rotation to assess the unidimensionality and factor structure. We applied the following criteria to each item: (1) communality higher than 0.3; (2) dominant loading greater than 0.5; (3) cross-loading lower than 0.3; and (4) satisfactory scree plot criterion (DeVellis, 1991). All items correlate significantly with their respective constructs, suggesting satisfactory item reliability. We used structural equation modelling (SEM) with EQS version 6.1 to further explore the validity of the scales by adding constraints to the measurement model. The model obtained a satisfactory fit for models of this complexity and sample size. The CFI is 0.98 while a CFI value above 0.90 indicates a good fit, and the RMSEA of 0.05 indicates good model fit as it does not exceed the critical value of 0.08 (Bentler & Bonett, 1980). Average variance extracted is well above the commonly accepted threshold of 0.50 which suggests satisfactory divergent validity, and composite reliabilities are all well above the 0.70 (Nunnally, 1967). Based on these indices, we conclude that the measurement model suggests satisfactory measurement validity.

4.5 Results

	Means	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Exploration activities (1)	4.29	1.63	-							
Company A (2)	.12	.32	-.284	-						
Company B (3)	.67	.47	.167	-.523	-					
Gender (4)	.87	.34	.045	.266	-.098	-				
Tenure (5)	.62	.49	..074	.036	-.179	.141	-			
R&D functional background (6)	.58	.50	.-.181	.093	-.418	.052	.089	-		
Goal alignment (7)	4.34	1.08	-.146	.133	-.077	.145	.138	-.062	-	
Relational capital (8)	5.34	.66	.136	.116	-.127	.029	-.043	.059	.271	-
Knowledge acquisition (9)	4.02	.95	.241	.129	-.184	.004	.056	-.075	.608	.226

Table 4.2. Descriptive Statistics.

N = 150; Correlations > |.15| are significant at a 5% level.

In Table 4.2, we report the means, standard deviations and pair-wise correlations.

We applied a three-step approach to test the hypothesised relationships. First, we estimated the effects of the theorized structural paths including the control variables. Second, because the correlation table shows a significant positive relationship between goal alignment and knowledge acquisition, we added to our theorized model a path between goal alignment and knowledge acquisition. We assessed the change of model fit and we explored how sensitive the model estimates are to adding this alternative path and how it affects the predictive quality of the model. Third, we applied the Langrange Multiplier test as suggested by Anderson and Gerbing (1988) to verify the data fit of potential other model specifications and effect paths. This test systematically compares the fit of all alternative specifications.

Because it is recommended that centred variables are used in SEM analysis we rescaled the variables into standardized z-scores. Although our sample is relatively small (n=150), it is sufficiently large to estimate a structural equation model with eight predictor variables (Byrne, 2008). Model I of Table 4.3 includes all theorised and control effects. Model II estimates the competing model that includes the path between goal alignment and knowledge acquisition. Model I has a better fit with the data, and the path between goal alignment and knowledge acquisition of Model II is not significant. These results suggest that the correlation between goal alignment and knowledge acquisition (see Table 4.2) reflects a spurious relationship rather than a real effect, which provides further support for our theory specified model. We will therefore use the estimates of Model I to test our hypotheses.

Model I demonstrates a satisfactory fit for the theory specified model ($\chi 2/(df)$= 1.156; NNFI = 0.975; CFI = 0.989; RMSEA = 0.033). The ratio of chi-square to degrees of freedom in the model is far less than the 3.0 which indicates a good fit (Carmines and McIver, 1981). A CFI and NNFI value above 0.95 also indicate a close fit, and RMSEA of 0.03 indicates a close model fit (Browne & Cudek, 1993), and is below the critical value of 0.08. In Model I, the path between relational capital and goal alignment is positive and highly significant (β = 0.291, p< 0.001), while the path between goal alignment and exploration activities is negative and significant (β = -0.160, p< 0.05). Furthermore, Model

I shows that relational capital has a positive and significant effect on knowledge acquisition (β = 0.608, $p < 0.001$), and knowledge acquisition has a positive and significant effect on exploration activities (β = 0.230, $p < 0.01$).

Table 4.3. Structural Equation Modelling Estimates of the Structural Paths (N=150)

Model fit/structural paths	Model I	Model II
	Theory Specified Model	Competing Model
χ2 (df)	18.492 (16)	17.889 (15)
Bentler-Bonett NNFI	.975	.969
CFI (comparative fit index)	.989	.987
RMSEA (absolute fit index)	.033	.036
90% confidence interval RMSEA	.000 .086	.000 .090
Company A→ Exploration activities	.047	.049
Company B→ Exploration activities	-.244 ***	-.224 ***
Gender → Exploration activities	.339 ***	.339 ***
Tenure → Exploration activities	.029	.029
R&D functional background → Exploration	-.111 *	-.109 *
Relational capital → Goal alignment	.291 ***	.280 ***
Relational capital → Knowledge acquisition	.608 ***	.593 ***
Goal alignment → Knowledge acquisition		.053
Goal alignment → Exploration activities	-.160 **	-.161 **
Knowledge acquisition → Exploration activities	.230 ***	.231 ***
R-Square path Exploration activities	.294***	.291***
R-Square path Knowledge acquisition	.370***	.373***
R-Square path Goal alignment	.085***	.085***

Note: ***p<.001; **p<.01; *p<.05.

The SEM model presented in Table 4.3 tests the individual effects of the theoretical model. However, the path model estimates do not explicitly test the mediation effect of goal alignment and knowledge acquisition as formulated in Hypotheses 1 and 2. The Sobel test (Sobel, 1982) is often used by researchers to test mediation paths. However, this test does not consider the effects of multiple mediation paths and is therefore not appropriate to test the multiple mediation paths as specified in our theoretical model. We performed the multiple mediation analysis as suggested by Preacher and Hayes (2008) to account for the effect of multiple mediation paths in the estimates of indirect effects. This test allows the assessment of specific mediating effects at the same time (as well as the total indirect effect), by providing insight into the effect sizes and significance of the different paths in the model as well as a bootstrapped Sobel test for the specific indirect effects. The results show that the specific indirect effect of relational capital on exploration activities through goal alignment is negative and significant (ab path= -0.148, $p< 0.05$). The specific indirect effect through knowledge acquisition is positive and significant (ab path= 0.118, $p< 0.05$). In addition, we performed a bootstrapping procedure using 5000 samples to perform a Sobel test for the specified mediating effects. The 95% confidence interval included only positive numbers for knowledge acquisition and negative numbers for goal alignment. These results confirm the pattern suggested by the structural equation modelling. Thus, based on the evidence presented in Table 4.3, combined with the results of the multiple mediation tests and the bootstrapping procedure, we conclude that *Hypotheses 1 and 2 are supported* by the evidence presented in this study.

Finally, in line with the Lagrange multiplier test (Anderson and Gerbing, 1988), we compared the different alternative specifications with this procedure including a reverse effect but we found no better fit with the data of these alternative specifications.

The R-square estimates in Table 4.3 are the squared multiple correlation coefficients of the standardised solution (Byrne, 2008). The measures of our model are used as input to estimate the structural paths. A multiple correlation coefficient shows the explained variance in a particular path. In the standardised solution, all variables have been transformed to unit variance. The R^2 values given for the standardised equations represent

the proportion of variance in each variable that is explained by the factor it loads on, and for those measured variables that are conceptualised as its predictors.

Post Hoc Analysis.

The respondents work in three different firms. To examine whether our results are driven by firm related differences, we estimated if significant interaction effects exist between the main effects and the firm dummy variables (Aiken & West, 1991). The main effects that were found to be significant remain so after including the interactions. Moreover, the fit of the model did not improve after adding the interaction terms. This suggests that the results are not driven by firm related differences. Furthermore, to assess if nonlinear specifications would contribute to the fit of the model we explored the impact of functional form by adding second order terms (quadratic effects) to the model. These terms proved insignificant suggesting that the results are not driven by the functional form.

4.6 Discussion and conclusion

While individual exploration activities are crucial for organizational exploration (Brady & Davies, 2004; Holmqvist, 2003; March, 1991), there is little understanding of what drives individuals in organizations to explore (Crossan & Apaydin, 2010; Li, Vanhaverbeke, & Schoenmakers, 2008). To address this gap, we introduced a theoretical model outlining how the relational capital of a person in an organization affects his or her exploration activities. The findings support our theory in which we separate out a negative effect that comes from aligning goals with other organizational members from a positive effect derived from acquiring knowledge from them. By developing and testing this theory, we also contribute to relational capital literature (Maurer et al., 2011; Moran, 2005; Uzzi & Lancaster, 2003) which has focused on organizational- and group level exploration and emphasized positive effects but has shown inconsistent findings regarding the relationship between relational capital and exploration. Below, we outline the main implications of our study for theory and practice.

4.6.1 Individual exploration activities in organizations

In order to understand exploration in organizations, existing organization studies have focused on various formal and structural factors as antecedents designed by senior management (Beugelsdijk, 2008; DeCanio et al., 2000). By adopting a firm level of analysis, these studies implicitly assumed homogeneity at the individual level and have found it difficult to explain why some people in the same organization explore more or less than others (Gupta et al., 2006). Our study shows the importance of more personal, informal and voluntary antecedents in understanding individual-level exploration in organizations and differences across individuals, i.e., the person's relational capital and the associated social processes that result in knowledge acquisition and goal alignment. Additionally, notwithstanding the importance of measures taken by senior management, this implies that future studies should not ignore that by building relational capital individuals might, at least to some extent, influence their own ability to explore.

Related to this is another important phenomenon which is poorly understood in current exploration research; i.e., why a particular individual will explore more in one firm than in another, even if those firms operate in similar environments and have comparable cultures, structures and systems (Groysberg & Lee, 2009; Groysberg, Lee, & Nanda, 2008). While human capital theory traditionally assumes that workers' human capital is portable and that its applicability may depend on firm level factors (Crook, Todd, Combs, Woehr, & Ketchen, 2011), Groysberg and Lee (2009) show that stars who have been hired away from a competitor to explore experience a dip in their level of exploration and effectiveness during the first two years, and that this temporary dip is not related to firm factors or individual attributes. Our study may provide important additional insights into this phenomenon. Notwithstanding the importance of a person's individual attributes and prior experience, our study indicates that studies on human capital and the transfer of people across organizations for exploration should take into consideration the importance of building personal relationships within the new organization. In particular, they should recognise that developing the two defining characteristics of relational capital, i.e., closeness and trust towards other organizational members, takes time and effort.

4.6.2 Individual exploration activities and relational capital: a more comprehensive perspective

By explaining both benefits and liabilities of relational capital for individual exploration, our study offers the possibility to formulate some suggestions which may help to explain why existing firm- and group level studies have reported different findings on the relationship between relational capital and exploration in organizations (Atuahene-Gima & Murray, 2007; Bogenrieder & Nooteboom, 2004; Land et al., 2012; Uzzi & Lancaster, 2003). The existing body of literature has stressed the positive effects of relational capital, arguing that it enables exploration activities of firms and groups through processes of knowledge acquisition. The theoretical model we introduced indicates that the effect of relational capital on individual level exploration activities is not only positive. Besides a positive effect through knowledge acquisition, our model outlines another effect: a negative one through a person's goal alignment with other organizational members. Our study sheds new light on the existing literature by providing a more nuanced and comprehensive model that recognizes the simultaneous enabling and constraining dynamics for individual exploration activities that emanate from an individual's relational capital.

This matters as some have argued that organizational level relational capital and its effects on organizational exploration can be seen, at least to some extent, as a manifestation of the effects of the relational capital of individuals on their exploration activities (Brehm & Rahn, 1997; March, 1991). Furthermore, based on this argument, and when considering the effects of context at the individual level, our study may provide some suggestions that may explain higher-level differences across contexts as well. Our findings suggest that the effect path of relational capital on individual exploration through goal alignment is negative (ab path= -0.148, p <0.05) and is positive through knowledge acquisition (ab path= 0.118, p<0.05). However, the size of these effects may be driven to some extent by the context of our study and could therefore be different across different contexts (Adler & Kwon, 2002).

In our discussion of how context might impact the relationship between individuals' relational capital and their exploration activities, we will focus on three

characteristics of our study's empirical context which may have influenced the size of the individual level effect paths. We will do so following Adler and Kwon's (2002) contingency model which proposes three types of contextual factors likely to impact the "cost-benefit balance" (Adler & Kwon, 2002, p. 32) of social relationships: norms and beliefs in the surrounding environment, task characteristics, and complementary capabilities.

Adler and Kwon's (2002) first type of contextual factor may point to the importance of the organizational context of the research setting (Lehrer & Asakawa, 2003), in our case large multinational, multi-unit, high-tech organizations. Institutional conditions in organizations can constrain the behaviour of individuals to what is considered legitimate (Tripas & Gavetti, 2000). Individuals may overcome such constraints by using micro-institutional affordances such as competing logics (Marquis & Lounsbury, 2007) and heterogeneity (Battilana, Leca, & Boxembaum, 2009). The companies in our sample are established firms but they operate with different business units applying various technologies across different countries, constituting a heterogeneous institutional context with multiple institutional constituents that maintain differentiated sets of interests, norms and beliefs (Van Dijk, Berends, Jelinek, Romme & Weggeman, 2011). Such institutional heterogeneity may have mitigated the positive effect of relational capital on goal alignment by offering individuals through their social relationships access to a variety of interests groups that may support, promote or facilitate their exploration activities (Battilana et al., 2009). This would suggest that the employees in the organizations of our study may feel less constrained to engage in exploration activities through their relational capital compared to those in a more homogeneous institutional context.

For their second type of contextual factor, Adler and Kwon (2002) point to contingencies relating to a person's tasks. Here, one aspect common to all our respondents was that they worked in several teams at the same time. Moreover, each team is composed of people with different disciplinary backgrounds. Compared to a person who works only in one monodisciplinary team rather than in several multidisciplinary teams at the same time, our respondents are likely to be acquiring, through their relational capital, knowledge that is more diverse, unrelated, and new to them (Taylor & Greve, 2006). Consequently, the

positive effect on exploration of their relational capital through knowledge acquisition may be stronger. In contrast, the goal alignment with colleagues may take place more easily and quickly when a person is working solely in one monodisciplinary team (Pelled, Eisenhardt & Xin, 1999), suggesting that the strength of the goal alignment path in this kind of work context would be greater than in our respondents' work context.

Finally, the third type of contextual factor proposed by Adler and Kwon (2002) are complementary capabilities. According to them, these may include people's individual characteristics that influence how their relational capital affects their behaviour. Knowledge workers in R&D units like our respondents tend to share several characteristics, including a greater need for cognition (Park, Baker, & Lee, 2008), i.e. an inclination to engage in and enjoy effortful cognitive endeavours (Cacioppo & Petty, 1982), and a greater openness (Lounsbury et al., 2012) which includes intellectual curiosity and an interest in new experience for its own sake (McCrae, 1987). These two characteristics are associated not only with a greater search for new knowledge from relational contacts (Cabrera, Collins, & Salgado, 2006; Ringberg & Reihlen, 2008), but also with an increased use of such knowledge for creatively developing new ideas and knowledge and innovating (McCrae, 1987; Schweizer, 2006). This would suggest that the positive effects of relational capital on individual exploration activities in our setting would be stronger compared to a setting in which organizational members have lower levels of need for cognition or openness.

In sum, when seeking to understand how relational capital affects exploration in organizations, we need to comprehend its positive effects on individual exploration activities through knowledge acquisition and its negative effects through goal alignment. In order to better understand differences of its effects across diverse settings, we suggest that we also need to understand how individual exploration activities in different contexts are influenced by relational capital. The suggestions offered above may provide some insights into this issue offering important starting points for future research. The findings of our paper answer calls for a more fine-grained explanation of the complex influence of social relationships on individual and organizational behaviour (Edelman et al., 2004; Grugulis & Stoyanova, 2012; Maurer & Ebers, 2006), and may be helpful in further

developing a contextual perspective on the relationship between relational capital and individual and organizational exploration.

4.6.3 Managerial implications

Our research suggests that organizations which intend to increase exploration need to do more than merely encourage the formation of relational capital among employees. They need to be aware of both the positive and negative consequences that relational capital can have for exploration, and work to create conditions in which the positive effects that come through knowledge acquisition outweigh the negative effects arising from goal alignment. In situations where organizations are unable to ensure the sharing of knowledge among employees and to mitigate against the relational liabilities through goal alignment, there may actually be a reduction in the employees' levels of exploration. These insights may be particularly valuable for organizations in dynamic and uncertain environments in which the exploration of new opportunities and different knowledge domains is necessary for survival (McGrath, 2001). These include innovation-oriented organizations with R&D departments – like those in our study – as well as other organizations such as professional service firms (Robertson, Scarbrough, & Swan, 2003), design consultancies (Michlewski, 2008), and organizations in the creative industries (Daskalaki, 2010).

4.6.4 Limitations and future research

There are limitations to this study that might indicate fruitful opportunities for future research. First, as discussed above, the extent of the effects through knowledge acquisition and goal alignment may to some degree be context-specific. While this indicates that we must take care when seeking to generalize our findings, it also opens up an important avenue for future research investigating how the positive and negative effects of relational capital on exploration are contingent upon contextual factors. Such research might also investigate multilevel effects (Hecker, 2012) to give us a better understanding of how individual level relational capital and exploration result in group- or organization level outcomes.

Second, due to the cross-sectional nature of our study no empirical claims can be made regarding the causal direction of the relationships between the variables in our model. The direction of causality between knowledge acquisition and exploration may be subject to some discussion. To reduce confusion, we deliberately focused on the concept of knowledge acquisition which implies a flow of knowledge from a donor to a recipient, rather than on concepts such as knowledge transfer or exchange which may imply a more reciprocal relationship. This matters: while the intention to explore may trigger a person to acquire the knowledge needed to do so, it is the acquisition of that knowledge which enables that person to actually conduct the intended exploration activity (Mom et al., 2007). To gain better insights into the directions of causality, future research could adopt a longitudinal approach which incorporates time-lags between the independent, mediating, and dependent factors.

Third, we limited this paper to exploration. While there is a substantial body of literature which focuses on exploration as it is crucial for organizational adaptation and survival in times of change (e.g., Alexiev et al., 2010; Beugelsdijk, 2008; McGrath, 2001), there is also a body of research which combines the study of exploration with that of exploitation (Gupta et al., 2006; March, 1991). The focussed commitment and specialization associated with goal alignment could be conducive to exploitation (Levinthal & March, 1993). Hence, it might be an interesting option for future research to investigate how relational capital influences exploitation and the dynamics between exploration and exploitation.

Finally, some have argued that goal alignment could be positively related to the exchange of knowledge (Nahapiet & Ghoshal, 1998). Interestingly, this relationship appears not to be significant in the competing model (see Table 4.3). There are several possible arguments for this. First, goal alignment and knowledge exchange may act as different coordination mechanisms, which may, at least in part, substitute for each other's effects (Martinez & Jarillo, 1989). Therefore, more goal alignment may be associated with a reduced need for exchanging knowledge and information. Second, goal alignment tends to be associated with a lower level of cognitive conflicts among organizational members, which reduces their need to debate different views, exchange ideas and assumptions, and

synthesize different perspectives (Jehn, 1995). Third, studies on the attention-based view suggest that persons who are very closely aligned tend to focus their development of knowledge on a specific focal domain or problem (Ocasio, 2011). As a result, their knowledge becomes less differentiated, which may make it less interesting for them to acquire knowledge from each other. All in all, the relationship between goal alignment and knowledge acquisition and how it may evolve over time offers interesting avenues for future research.

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Samenvatting

Om te overleven moeten bedrijven in staat zijn om te reageren op veranderingen in hun omgeving. Hoe meer het gedrag van de organisatie is afgestemd op de externe omgeving, des te groter zullen de prestaties van de organisatie zijn. Omdat omgevingen constant aan verandering onderhevig zijn, is dit adaptatie proces zeer dynamisch van aard. Het vereist dat bedrijven trachten hun gedrag af te stemmen op de behoeften van vandaag, maar dwingt hen tegelijkertijd na te denken over hoe zij hun gedrag gaan aanpassen aan de wensen van morgen. Een organisatie moet derhalve gelijktijdig inspelen op de behoeften van het heden en de toekomst door bestaande middelen te exploiteren en nieuwe middelen te exploreren. Met andere woorden: de organisatie moet ambidexter worden. Gegeven het sterke contrast dat bestaat tussen de aard van exploratieve en exploitatieve activiteiten, dienen deze activiteiten van elkaar gescheiden te worden. Echter, een centraal idee in relatie tot ambidextere organisatievormen is dat deze activiteiten ook voeding geven aan elkaar. Dit komt omdat exploratieve activiteiten gebaseerd zijn op bestaande middelen, en op hun beurt exploratieve middelen gecombineerd dienen te worden met huidige activiteiten binnen de organisatie om uiteindelijk van waarde te kunnen zijn. Dit creëert echter significante spanningen op verschillende niveaus binnen de organisatie. Het combineren van exploratieve en exploitatieve activiteiten is derhalve moeilijk. Pogingen of ideeën aangaande hun combinatie worden vaak beschouwd als onlogisch of soms zelfs absurd. Dit kan resulteren in onwil of weerstand bij medewerkers om pogingen te ondernemen om beide activiteiten met elkaar te integreren. Binnen de literatuur wordt de noodzaak om exploratieve en exploitatieve activiteiten met elkaar te combineren terwijl zij ogenschijnlijk zo diametraal ten opzichte van elkaar staan de ambidexteriteitsparadox genoemd.

Binnen de literatuur over ambidexteriteit hebben velen geschreven over de aard van de spanningen tussen exploratie en exploitatie binnen organisaties, alsmede hoe binnen organisaties dergelijke spanningen gemanaged kunnen worden. Echter, en verassend genoeg, is er veel minder aandacht uit gegaan naar de individuele, team, en organisationele factoren welke medewerkers wellicht stimuleren om combinaties tussen

exploratieve en exploitatieve activiteiten te maken en het hoofd te bieden aan de emotionele, sociaal-culturele, en cognitieve aspecten welke samenhangen met de spanningen tussen exploratie en exploitatie. Werk dat zich heeft gericht op factoren welke mogelijk van invloed zijn op de acceptatie en omhelzing van de spanningen tussen exploratie en exploitatie hebben getheoretiseerd over de rol van, en eerste bewijs geleverd voor, het belang van zogenaamde positief stimulerende cycli (virtuous cycles). Om deze cycli in gang te zetten, moet de organisatie haar werknemers van de benodigde emotionele en cognitieve vaardigheden voorzien die nodig zijn om met dergelijke veeleisende situaties om te gaan. Dit belicht het belang van sociaal-cognitieve factoren als beïnvloedende factoren van ambidexteriteit. Hoewel sociaal-cognitieve factoren ten grondslag liggen aan deugdzame cycli is er binnen de literatuur relatief weinig aandacht aan besteed, dit ondanks hun belang. In dit proefschrift heb ik daarom verschillende belangrijke sociaal-cognitieve beïnvloedende factoren, welke de wijze waarop de spanning tussen exploratie en exploitatie wordt gemanaged, conceptueel verder uitgewerkt en empirisch getoetst. Omdat deze factoren direct invloed uitoefenen op het informatieverwerkings- en leergedrag van medewerkers, beïnvloeden deze factoren direct de motivatie en vaardigheid van medewerkers om met de risico's, onzekerheden, complexiteit, en angsten om te gaan welke gepaard gaan met de ambidexteriteitsparadox en exploratie activiteiten. Dit heeft in de volgende formele onderzoeksvraag geresulteerd:

Dit proefschrift beoogt het wetenschappelijk en praktisch inzicht te vergroten aangaande de invloed van informatieverwerking en leergedrag van medewerkers op hun motivatie en vaardigheid om zich bezig te houden met, en het managen van, de ambidexteriteitsparadox en exploratieactiviteiten.

Contributies

Dit proefschrift bestaat uit drie verschillende studies die elk op een unieke wijze bijdragen aan de hierboven gespecificeerde algemene onderzoeksvraag. Elke studie richt zich op verschillende vraagstukken welke relevant zijn voor de theorie, gebruikt hierbij verschillende theoretische constructen, en is gesitueerd op verschillende analyseniveaus.

Studie 1: Organisationele sociaal-cognitieve verklarende factoren van ambidexteriteit

In deze eerste studie richten wij ons op twee kwesties met betrekking tot ambidexteriteit die relatief weinig aandacht hebben gekregen. De eerste kwestie betreft de gedistribueerde aard van de middelen van organisaties welke een ambidexter organisatieontwerp hebben aangenomen. In een dergelijk gedifferentieerde organisatie, zijn middelen te verspreid om nog een overzicht te kunnen houden. Dit limiteert het potentieel om mogelijkheden voor reconfiguraties te herkennen en dus beperkt het de mogelijkheden voor de organisatie om ambidexter te worden. De tweede kwestie heeft te maken met de noodzaak om diegene die met de spanningen die inherent zijn aan pogingen om exploratieve en exploitatieve middelen te integreren in staat te stellen met deze uitdagingen om te kunnen gaan en het integratieproces door te zetten. Het succes van integratiepogingen zal waarschijnlijk sterk ondermijnt worden bij het uitblijven van dergelijke ondersteuning.

Wij beargumenteren het belang van organisatieleren in relatie tot organisatie ambidexteriteit en tonen deze ook aan. Wij introduceren een reflexief klimaat en transactive memory system als verklarende factoren van ambidexteriteit en tonen aan dat zij beide medewerkers stimuleren en in staat stellen om de spanningen gerelateerd aan de ambidexteriteitsparadox aan te gaan en te overwinnen. Omdat beide factoren leeractiviteiten faciliteren, helpen ze ook om medewerkers om te kunnen laten gaan met de gedistribueerde aard van de ambidextere organisatie. Door te focussen op organisatiesystemen die medewerkers in staat stellen en motiveren om de uitdagingen omtrent de ambidexteriteitsparadox aan te gaan, vergroten we ons inzicht in hoe organisaties zowel de materiele alswel de perceptuele aspecten van de

ambidexteriteitsparadox kunnen managen. Ten slotte toont onze studie aan dat de de grootte van de organisatie een significant interactie-effect heeft met reflexief klimaat maar niet met organisatie TMS.

Studie 2: De cognitieve verklarende factoren van het top-management team van ambidexteriteit

De huidige literatuur over ambidexteriteit toont aan dat top-managers een vitale rol pelen in het managen van de exploratie-exploitatie paradox omdat zij verantwoordelijk zijn voor het herkennen, benutten, en reconfigureren van deze gedifferentieerde middelen. De literatuur geeft aan dat, om dit te kunnen, managers in staat moeten zijn de ambidexteriteitsparadox te managen. Dit vereist van hen een zekere emotionele en cognitieve vooringenomenheid met betrekking tot de integratie van exploratieve en exploitatieve middelen die mogelijk bij henzelf aanwezig is, te adresseren. Hoewel de huidige literatuur deze problematiek erkent, biedt het weinig inzicht in de factoren die topmanagers motiveren en in staat stellen om de ambidexteriteitsparadox aan te gaan en te managen. Deze studie verfijnt en verbreed de literatuur over ambidexteriteit op verschillende wijzen.

Ten eerste belicht het de rol van single en double-loop TMT-leergedrag welke geassocieerd worden met TMT-reflexiviteit en de gezamenlijke rol zij spelen in de totstandkoming van ambidexteriteit. TMT-reflexiviteit kan een eigenschap zijn van TMT's, in plaats van een ad-hoc gebeurtenis welke in gang moet worden gezet door een externe partij zoals gesuggereerd door ander werk over deze relatie. Daarnaast benadruk ik het belang van zowel single als double-loop leergedrag in contrast met eerder werk dat enkel heeft gefocust op de rol van double-loop leergedrag voor het bewerkstelligen van ambidexteriteit.

Ten tweede draagt deze studie bij aan de literatuur over ambidexteriteit door te stellen dat paradoxical cognition bepaald hoe managers ideeën, welke gegeneerd worden door TMT-reflexiviteit, zullen interpreteren en uiteindelijk op basis van deze interpretatie een keuze zullen maken.

In het algemeen draagt deze studie derhalve bij aan de literatuur over ambidexteriteit door een meer gedetailleerd beeld te geven van hoe TMT-reflexiviteit, en het daarmee geassocieerd leergedrag, samenhangt met paradoxical cognition en organisatie ambidexteriteit.

Studie 3: De invloed van relationeel kapitaal op individuele exploratie

Hoewel de huidige literatuur over organisatie adaptatie erkent dat de capaciteit van een bedrijf om te exploreren grotendeels gestoeld is op het exploratieve gedrag van haar medewerkers, is er een beperkt begrip van wat individuen in organisaties in staat stelt en motiveert om te exploreren, en waarom zij een verschillende mate van exploratief gedrag laten zien ondanks dat zij in vergelijkbare omgevingen opereren. Recent onderzoek heeft aangetoond dat relationeel kapitaal mogelijk een waardevolle rol speelt in het verklaren van nieuwe en innovatie georiënteerde activiteiten alsmede leren binnen organisaties. Echter, onderzoek aangaande de relatie tussen relationeel kapitaal en exploratie heeft verschillende uitkomsten gegenereerd. Dit komt mogelijk doordat op lagere niveaus (individuele niveau) relationeel kapitaal zowel voor- als nadelen heeft welke zich verschillend manifesteren in verschillende contexten.

Wij dragen bij aan de literatuur door een multi-mediatie model te ontwikkelen en te testen waarin wordt gehypothetiseerd dat relationeel kapitaal individuele exploratie beïnvloed via een positief effect van kennis acquisitie en een negatief effect middels een overeenstemming van doelen met andere leden binnen de organisatie. Hierdoor adresseren wij het gebrek aan helderheid binnen de literatuur aangaande de invloed van relationeel kapitaal op exploratieactiviteiten. Wij tonen aan dat relationeel kapitaal zowel voor- als nadelen heeft, en dragen zodoende bij aan wetenschappelijk en praktisch begrip over de drijvende factoren achter individuele exploratie binnen organisaties.

Conclusie

Gezamenlijk tonen de studies in dit proefschrift het belang aan van de sociaal-cognitieve antecedenten van ambidexteriteit, en meer in het algemeen, dat het managen van de ambidexteriteitsparadox in de kern een sociaal-constructief proces is. Er is reeds

veel inzicht verkregen door factoren te bestuderen die gerelateerd zijn aan organisatie design of topmanagement team karakteristieken. Meer aandacht voor de sociaal-constructieve aard van het managen van de ambidexteriteitsparadox kan onze kennis over dit belangrijke onderwerp nog verder uitbreiden. Dit proefschrift is een eerste stap in deze richting.

Summary

Firms must be able to generate the appropriate organizational responses to environmental changes in order to survive. The closer the behavior of the firm is aligned with the needs of the environment, the greater the organizational performance will be. As environments are ever changing, this adaptation process is highly dynamic in nature. It requires firms to maximize the level of fitness with their environment in the present, yet simultaneously forces them also to consider how they will adapt to the environment of tomorrow. An organization therefore needs to simultaneously address the needs of the present and the future by exploiting its current resources and exploring new ones. In other words: it needs to become ambidextrous. Given the strong contrast between the nature of these activities, within ambidextrous firms explorative and exploitative activities have to be separated from each other. However, a central idea concerning ambidextrous designs is that at the same time these activities also feed into each other as exploration activities are based on the current resources of the organization, while in turn exploration activities need to be combined with the ongoing activities of the firm. This however creates significant pressures at various levels within the organization. Combing exploration and exploitation is difficult as given their radical different nature, attempts or ideas concerning their combination are often thought of as illogical or even absurd, resulting in unwillingness or even resistance of employees to engage in attempts to integrate the two. The necessity to combine exploration and exploitation activities while they are seemingly so at odds with each other is commonly referred to as the ambidexterity paradox.

Within the ambidexterity literature many scholars have commented on the nature of the tensions between explorative and exploitative activities within the firm, as well as how the firm can seek to manage these tensions. However, surprisingly, far less attention has been granted to individual, team, and organizational factors that might stimulate people to try to combine explorative and exploitative activities and face up to the emotional, social-cultural, and cognitive aspects associated with the tension between explorative and exploitative activities. Work that has been written on the factors that might lead employees to accept and embrace the tensions between exploration and exploitation

has theorized and shown preliminary proof of the importance of so called virtuous cycles. For the organization to set these virtuous cycles in motion, it must equip its employees with the emotional and cognitive skills to cope with these demanding situations. This highlights the importance of socio-cognitive antecedents of ambidexterity. Socio-cognitive factors lie at the heart of virtuous cycles yet have been granted very limited attention within the literature, despite their importance. In this PhD dissertation I therefore conceptually extend and empirically validate several key socio-cognitive antecedents that influence the management of the tensions between exploration and exploitation. As these factors shape the information processing and learning behaviors of employees, they directly influence those individuals' motivation and ability to deal with the risks, uncertainties, complexities, and anxieties attached to both the ambidexterity paradox and exploration activities. This has resulted in the following formal research question:

This PhD dissertation aims to advance scholarly and practical understanding regarding information processing and learning behaviors of organizational participants that influence their motivation to engage with, as well as their ability to manage, the ambidexterity paradox and individual exploration activities.

Contributions

This dissertation consists of three different studies which each in their own unique way contributes to answering the general research question specified above. Each study focuses on different gaps, uses different theoretical constructs, and is situated at different units and levels of analysis.

Study 1: Organizational socio-cognitive antecedents of ambidexterity

In the first study we draw attention to two issues in regard to ambidexterity that have received relatively little attention. The first issue is the distributed nature of the

resources of organizations adopting an ambidextrous design. Within such a differentiated organization, resources become too scattered to be overseen as whole, limiting the potential to recognize reconfiguration opportunities, and thus the organization's capacity to become ambidextrous. The second issue revolves around the need to persuade those who have to deal with the tensions inherent in integrating explorative and exploitative resources to face up to the challenges involved and to see the integration process through. The success of targeted integration efforts is likely to be hampered without such support.

We elaborate on and demonstrate the important role of organizational learning in relation to organizational ambidexterity. We introduce a reflexive climate and a transactive memory system as antecedents to ambidexterity, and show that they are instrumental in stimulating and enabling organizational participants to engage with and overcome the tensions inherent in the ambidexterity paradox. They also help participants to deal with the distributed nature of the ambidextrous firm as both facilitate learning activities. By focusing on the organizational systems that enable and motivate organizational participants to engage with the ambidexterity paradox, we enlarge our understanding of how organizations can manage both the material and perceptual aspects of the ambidexterity paradox. Finally, our study shows that organizational size has a significant interacting effect with reflexive climate but not with organizational TMS.

Study two: TMT cognitive antecedents to ambidexterity

The current ambidexterity literature shows that top managers play a vital role in managing the exploration–exploitation paradox as they are responsible for sensing, seizing, and reconfiguring these differentiated resources. The literature indicates that, in order to do this, top managers must manage the ambidexterity paradox. This requires them to overcome possible emotions and cognitive biases they might have in respect to the integration of explorative and exploitative resources. Although the current literature does recognize these difficulties, it offers few insights regarding the factors that enable and motivate top managers to engage with – and ultimately – deal with the ambidexterity paradox. This study extends and refines the ambidexterity literature in several ways.

First of all, it draws attention to single and double-loop TMT learning behaviors associated with TMT reflexivity and the interrelated role they play in enabling ambidexterity. TMT reflexivity can be an enduring quality of TMT's, instead of an ad-hoc event triggered by a third party as suggested by other work on this relationship. Moreover, I argue for the importance of both single and double-loop learning behaviors in contrast to earlier work that has solely focused on double-loop learning behaviors.

Second, this study extends the ambidexterity literature by arguing that paradoxical cognition determines how managers will make sense of, and select among, ideas generated through TMT reflexivity.

Overall, this study contributes to the ambidexterity literature by providing more detail on how TMT reflexivity and its associated learning behaviors relate to TMT paradoxical cognition and organizational ambidexterity.

Study three: The influence of relational capital on individual exploration

Although the current literature on organizational adaptation recognizes that a firm's capacity to explore is to a large extent rooted in the exploratory behavior of its members, there is a limited understanding of what enables and motivates individuals in organizations to explore or why they show differing degrees of explorative behavior despite similar surroundings. Recent research has indicated that relational capital may play a particularly valuable role in explaining new, innovation-orientated activities as well as facilitates learning in organizations. However, research on the relationship between relational capital and exploration has generated mixed findings, possibly because at lower levels (individual) relational capital has both benefits and drawbacks which may surface differently in different contexts.

We advance the literature by developing and testing a comprehensive multi-mediational model in which relational capital is hypothesized to influence individual exploration through a positive effect which stems from knowledge acquisition and a negative effect emanating from goal alignment from other members in the organization. We thereby address the current lack of clarity within the literature regarding the influence of relational capital on exploration activities. We demonstrate that relational capital has

both benefits and drawbacks, and by so doing, we increase both scholarly and managerial understanding regarding the drivers of individual exploration in organizations.

Conclusion

Jointly the studies in this dissertation underscore the importance of the socio-cognitive antecedents of ambidexterity, and more broadly, that the management of the ambidexterity paradox is at its core a socio-constructionist process. Much insight has already been gained by studying factors related to organizational design or top management team characteristics. Greater attention to the socio-constructionist underpinnings of the management of the ambidexterity paradox can further extend our knowledge on this important area. This dissertation represents one of the first steps in this direction.

About the author

Pepijn van Neerijnen (Naarden, April 23, 1980) obtained his MSc. in Business Administration from the Rotterdam School of Management at the Erasmus University with a specialization in Strategic Management. After completing his bachelor in Communication Management at the Hogeschool van Utrecht, Pepijn decided to enroll at RSM. After his graduation Pepijn stayed in touch with his thesis supervisor Shahzad Ansari as they had written an article together which was based on his master thesis and which was to be presented at the Strategic Management Conference in Copenhagen (2006). It was at one of these meetings that he learned there was a job opening at the Strategic Management Department at RSM as a full-time lecturer. Pepijn immediately jumped at the opportunity and started as a full-time lecturer in January 2007. As he became increasingly interested in research, Pepijn started a PhD project in parallel to his position as full-time lecturer in 2008. In this dual role Pepijn has been given the opportunity to teach a large variety of different courses at the bachelor and master level. Moreover, he had the pleasure of supervising many bachelor and master thesis students. Also, he successfully initiated and coordinated several qualitative and quantitative research projects during this period.

From the studies in his dissertation, study 3 has already been published in Organization Studies, study 1 has been nominated for the best paper proceedings of the Business Policy and Strategy track of the Academy of Management Conference in Boston (2012), and study 2 will be presented at the Academy of Management Conference in Anaheim (2016). Besides these papers, that will be submitted to international journals in 2016, Pepijn has presented numerous other papers at international conferences such as the Strategic Management Society Conference, the Organization Science Winter Conference, and EURAM.

Currently Pepijn is employed as an Assistant Professor at the Amsterdam Business School at the University of Amsterdam. Here he focusses predominantly on research and management responsibilities. Amongst other things he is coordinator of the

internship program, manager corporate relationships of the business administration program, and a member of the workers council of the Faculty of Economics and Business. In his current research Pepijn is particularly interested in how organizations adapt to change over time and how factors situated at different levels within the organization affect these –dynamic- adaptive outcomes. A common denominator in his work is the focus on information processing within social systems.

Author Portfolio

Work experience

2013-present: *Amsterdam Business School, Universiteit van Amsterdam*

- Assistant Professor in Strategic Management.
- Member worker's council
- Internship coordinator
- Manager corporate relationships

2007-2013: *Rotterdam School of Management, Erasmus University*

- Assistant Professor in Strategic Management (Wetenschappelijk docent).
- PhD student in strategic management.

Education

2008-2016: *Rotterdam School of Management, Erasmus University*

- PhD in Strategic Management.
- Dissertation tile: "The Adaptive Organization: The Socio-Cognitive Antecedents of Ambidexterity and Individual Exploration".

2002-2006: *Rotterdam School of Management, Erasmus University*

- MSc. in Business Administration
  Dissertation tile: "Capability generation in hypercompetitive environments: The reconfigurational abilities of strong and weak ties and the recursive cycle of routine development".

1998-2002: *Communication Management, Hogeschool van Utrecht*

- Bachelor in Communication Management.
  Dissertation title: "*Kroymans en communiceren: een corporate communicatiemodel*"

Publications in refereed journals

- Mom, T. J., van Neerijnen, P., Reinmoeller, P., & Verwaal, E. 2015. Relational Capital and Individual Exploration: Unravelling the influence of goal alignment and knowledge acquisition. *Organization Studies*, *36*(6), 809-829.

Honors and recognitions

Best paper proceedings Academy of Management Conference 2012, Business Policy & Strategy, Boston, United States.

- Van Neerijnen, P., Schippers, M., Tempelaar, M. & Figge, P. 2012. 'Creating performance through ambidexterity: The role of an organizational transactive memory system and organizational reflexive climate'.

Conference presentations

- Van Neerijnen, P. Tempelaar, M. & Van de Vrande. 2016. Embracing Paradox: The Mediating Role of TMT Paradoxical Cognition on the Relationship between TMT Reflexivity and Ambidexterity. Paper send in for review for the *Academy of Management Conference, Anaheim*, United States.
- Mom, T., Van Neerijnen, P., Reinmoeller, P., & Verwaal, E. (2015, January). Relational Capital and Individual Exploration. In *Academy of Management Proceedings* (Vol. 2015, No. 1, p. 16513). *Academy of Management Conference*, Vancouver, Canada.
- Van Neerijnen, P., Ben-Menahem, S. & Schippers, M. 2015. Team Tie Strength and Performance Development: The Mediating Role of Team Reflexivity Over Time. Symposium on "Teams Research - The Need to Consider Time in Order to: "Keep on Slippin' into the Future"". *Academy of Management Conference*, Vancouver, Canada.
- Rosenkranz, N. Tempelaar, M. & Van Neerijnen. 2014. The company you keep – Influences of identity at the individual and team level on creative problem solving. *Academy of Management Editor Retreat EPFL*.
- Ben-Menham, S. & Van Neerijnen, P. 2013. The Impact of Task-, Social-, and Environmental Context Characteristics on Firm Proactiveness. *Academy of Management Proceedings* (Vol. 2013, No. 1, p. 12157). *Academy of Management Conference*, Orlando, United-States.
- Ben-Menahem, S. & van Neerijnen, P. 2012. 'Antecedents of Firm Proactive Behavior: Understanding the Impact of Autonomy, Cooperation, and Environmental Dynamism'. *Israël Strategy Conference*, Tel Aviv, Israël.
- Van Neerijnen, P., Schippers, M., Tempelaar, M. & Figge, P. 2012. 'Creating performance through ambidexterity: The role of an organizational transactive memory system and organizational reflexive climate'. Best paper proceedings *Academy of Management Conference*, Boston, United States.
- Van Neerijnen, P., Mom, T. & Reinmoeller, P. Verwaal, E. 2012. 'Embedded and Exploring? Unraveling the relationship between relational embeddedness and individual exploration' *Academy of Management Conference*, Boston, United States.
- Van Neerijnen, P., Schippers, M., Tempelaar, M. & Figge, P. 2012. 'Creating performance through ambidexterity: The role of an organizational transactive memory system and organizational reflexive climate'. *EURAM*, Rotterdam, The Netherlands.
- Van Neerijnen, P., Mom, T. & Reinmoeller, P. Verwaal, E. 2012. 'Embedded and Exploring? Unraveling the relationship between relational embeddedness and individual exploration'. *EURAM*, Rotterdam, The Netherlands.
- Ben-Menahem, S.B., Dolgova, E. & van Neerijnen, P. 2012. The Role of Team Members' Proactive Personality and Advice-Seeking Behavior in the Emergence of Team Proactive Behavior. *Strategic Management Society Conference*, Prague, Czech Republic.

- Van Neerijnen, P., Schippers, M. & Figge, P. 2011. 'Uncovering the Micro-Foundations of Dynamic Capabilities: The Impact of the Organization's Transactive Memory System on Knowledge (Re-)Activation and its Contribution to Reconfigurative Performance'. *Organization Science Winter Conference XVII*, Steamboat, United States).
- Van Neerijnen, P. & Verwaal, E. 2008. 'Relational embeddedness, Explorative and Exploitative Innovation: How to Create Strategic Advantage from Knowledge transfer.' *Strategic Management Society Conference*, Cologne, Germany.
- Van Neerijnen, P. & Verwaal, E. 2008. 'The Influence of Relational Embeddedness on Explorative and Exploitative Innovations'. *Academy of Management Conference*, Anaheim, United-States.
- Ansari, S. & Van Neerijnen, P. 2007. 'Capability generation in hyper-competitive environments: Leveraging strong and weak social ties to integrate organizational knowledge'. *Academy of Management Conference*, Philadelphia, United-States.
- Ansari, S., Van Neerijnen, P. 2006. 'Capability generation in hyper-competitive environments: Leveraging strong and weak social ties to integrate organizational knowledge'. *Strategic Management Conference of the Copenhagen Business School*, Copenhagen, Denmark.

Managerial responsibilities

2015-2016

Internship coordinator Faculty of Economics and Business
Manager corporate relationships
Member worker's council Faculty of Economics and Business

Teaching

Courses developed

2015 Master Internship in Business Administration

- Developed this course in close collaboration with program management and the ESC.

2014 The Adaptive Organization

- Co-developed this master core course together with Bernardo Lima.

2010 Strategic Management

- Co-developed a new second year bachelor core-course together with Prof. dr. ir. Vareska van de Vrande. First to introduce a large scale simulation game into the bachelor program (Business Strategy Game with +/-700 students participating).

2008 Strategy and Corporate Entrepreneurship

- Co-developed this third year bachelor elective with Prof. dr. ir. Vareska van de Vrande.

Courses taught

2015-2016 Strategic Management coordinator.
Internship MSc.BA
Thesis supervision

2014-2015 The Adaptive organization, coordinator EPMS and full-time program.
Strategic Management coordinator.
Thesis supervision

2013-2014 Strategic Organization
Strategic Management
Thesis Proposal, EPMS coordinator
Thesis supervision

2012-2013 Minor Strategy Consulting
Strategic Management
Strategic Business Plan
Internship supervision
Research clinic (master thesis theme)

- Examining the frontiers of innovation (9 master students)
- Investigating Top Management Team Decision Making Performance (6 students)

2012-2011 Minor Strategy Consulting
Strategic Management
Strategic Business Plan
Internship supervision
Research clinic (master thesis theme)

- Examining the frontiers of innovation (9 master students)
- Investigating Top Management Team Decision Making Performance (6 students)

2011-2010 Minor Strategy Consulting
Strategic Management
Business Project
Internship supervision
Research clinic (master thesis theme)

- Uncovering the microfoundations of dynamic capabilities (10 students)

2010-2009 Business Project,
Bachelor thesis

- Surviving hypercompetitive environments?! Getting to grips with the drivers of knowledge reconfiguration.

International Business Study

- Contract research on investment opportunities in Chile conducted together with 35 students.

Internships
Research clinic (master thesis theme)
- Drivers of Knowledge-Resource Reconfiguration (8 students)

2008-2009 Bachelor elective Strategy and Corporate Entrepreneurship
Minor Strategic Renewal & Corporate Entrepreneurship
Minor Strategy as Practice
Strategic Businessplan
Research clinic (master thesis theme)
- Organizational knowledge and firm strategy

2007-2008 Bachelor elective strategy and corporate entrepreneurship
Strategic business plan, supervision of 48 teams which write a business plan
Bachelor thesis Social Capital: know-how vs. know-who?
Research clinic

Research projects

2015-2016 Incubator survey
- Survey amongst start-ups situated in incubator
- Multi-level and longitudinal
- Co-initiator and co-coordinator (together with Dr. Joris Ebbers)

Impact Hub survey
- Survey amongst start-ups situated in an 'entrepreneurial ecosystem'
- Multi-level and longitudinal
- Co-initiator and co-coordinator (together with Dr. Nathan Betancourt and Dr. Flore Bridoux)

2012-2013 Business Strategy Game
- 10 week simulation game with 650 students divided in 120 teams combined with survey at five moments in time. Survey focusses on dynamics within work teams regarding decision making.
- Multi-level and longitudinal
- Initiator and coordinator (amongst others together with Prof. dr. Michaela Schippers and Dr. Michiel Tempelaar)

2011-2012 Innovation Excellence
- Survey amongst new product development teams within 3 knowledge intensive organizations
- Cross-sectional and multi-level (goal is to expand number of organizations in 2016-2017 and develop a longitudinal database).
- Initiator and coordinator (together with Dr. Michiel Tempelaar)

Business Strategy Game

- 10 week simulation game with 650 students divided in 120 teams combined with survey at three moments in time. Survey focusses on dynamics within work teams regarding decision making.
- Multi-level and longitudinal
- Initiator and coordinator (amongst others together with Prof. dr. Michaela Schippers and Dr. Michiel Tempelaar)

Innovation Benchmark

- Large scale survey (+/- 10.000 organizations) among Dutch and German firms focusing on drivers of superior firm performance.
- Cross-sectional
- Co-initiator and co-coordinator (together with Prof. dr. Justin Jansen, Dr. Michiel Tempelaar, Prof. dr. ir. Vareska van de Vrande, and Patrick Figge).

2010-2011 Innovation Excellence

- Comparative case study within 3 knowledge intensive organizations. Focus lies on new product development trajectories and main success drivers.
- Initiator and coordinator (together with Dr. Michiel Tempelaar)

Business Strategy Game

- 10 week simulation game with 650 students divided in 120 teams combined with survey at three moments in time. Survey focusses on dynamics within work teams regarding decision making. Objective performance data is generated through the simulation game.
- Multi-level and longitudinal
- I Initiator and coordinator (amongst others together with Prof. dr. Michaela Schippers and Dr. Michiel Tempelaar)

2009-2010 Erasmus Competition and Innovation Monitor

- Large scale survey among Dutch firms focusing on drivers of superior firm performance.
- Cross-sectional
- Coordinator: Prof. dr. Henk Volberda
- Participants: Dr. Michiel Tempelaar, Prof. dr. Justin Jansen, Dr. Sebastiaan van Doorn, Pepijn van Neerijnen

Consultancy projects

- Coordinated and executed four advisory projects for business unit management of four high-tech organizations.
    - Focus area were on strategic renewal, corporate entrepreneurship, and innovation.

Research skills

- Coordinator of the Innovation Excellence program. Comparative case study as well as survey research among knowledge intensive and high-tech organizations in the Netherlands.
- Coordinator of Business Strategy Game, 10 week simulation game with +/- 650 students divided among 120 teams.
- Co-coordinator of Innovation Benchmark, survey amongst +/- 8000 organizations in the Netherlands and Germany.
- Familiar with NVIVO, SPSS, AMOS, and M-Plus (multi-level and longitudinal modelling).

Research interests

Organizational adaptation approached from an information processing perspective.

The ERIM PhD Series

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Dissertations in the last five years

Abbink, E.J., *Crew Management in Passenger Rail Transport*, Promotors: Prof. L.G. Kroon & Prof. A.P.M. Wagelmans, EPS-2014-325-LIS, http://repub.eur.nl/pub/76927

Acar, O.A., *Crowdsourcing for Innovation: Unpacking Motivational, Knowledge and Relational Mechanisms of Innovative Behavior in Crowdsourcing Platforms*, Promotor: Prof. J.C.M. van den Ende, EPS-2014-321-LIS, http://repub.eur.nl/pub/76076

Akin Ates, M., *Purchasing and Supply Management at the Purchase Category Level: strategy, structure and performance*, Promotors: Prof. J.Y.F. Wynstra & Dr E.M. van Raaij, EPS-2014-300-LIS, http://repub.eur.nl/pub/50283

Akpinar, E., *Consumer Information Sharing*, Promotor: Prof. A. Smidts, EPS-2013-297-MKT, http://repub.eur.nl/pub/50140

Alexander, L., *People, Politics, and Innovation: A Process Perspective*, Promotors: Prof. H.G. Barkema & Prof. D.L. van Knippenberg, EPS-2014-331-S&E, http://repub.eur.nl/pub/77209

Almeida e Santos Nogueira, R.J. de, *Conditional Density Models Integrating Fuzzy and Probabilistic Representations of Uncertainty*, Promotors: Prof. U. Kaymak & Prof. J.M.C. Sousa, EPS-2014-310-LIS, http://repub.eur.nl/pub/51560

Bannouh, K., *Measuring and Forecasting Financial Market Volatility using High-frequency Data*, Promotor: Prof. D.J.C. van Dijk, EPS-2013-273-F&A, http://repub.eur.nl/pub/38240

Ben-Menahem, S.M., *Strategic Timing and Proactiveness of Organizations*, Promotors: Prof. H.W. Volberda & Prof. F.A.J. van den Bosch, EPS-2013-278-S&E, http://repub.eur.nl/pub/39128

Benning, T.M., *A Consumer Perspective on Flexibility in Health Care: Priority Access Pricing and Customized Care*, Promotor: Prof. B.G.C. Dellaert, EPS-2011-241-MKT, http://repub.eur.nl/pub/23670

Benschop, N, *Biases in Project Escalation: Names, frames & construal levels*, Promotors: Prof. K.I.M. Rhode, Prof. H.R. Commandeur, Prof. M.Keil & Dr A.L.P. Nuijten, EPS-2015-375-S&E, hdl.handle.net/1765/79408

Berg, W.E. van den, *Understanding Salesforce Behavior using Genetic Association Studies*, Promotor: Prof. W.J.M.I. Verbeke, EPS-2014-311-MKT, http://repub.eur.nl/pub/51440

Betancourt, N.E., *Typical Atypicality: Formal and Informal Institutional Conformity, Deviance, and Dynamics*, Promotor: Prof. B. Krug, EPS-2012-262-ORG, http://repub.eur.nl/pub/32345

Bliek, R. de, *Empirical Studies on the Economic Impact of Trust*, Promotor: Prof. J. Veenman & Prof. Ph.H.B.F. Franses, EPS-2015-324-ORG, http://repub.eur.nl/pub/78159

Blitz, D.C., *Benchmarking Benchmarks*, Promotors: Prof. A.G.Z. Kemna & Prof. W.F.C. Verschoor, EPS-2011-225-F&A, http://repub.eur.nl/pub/22624

Boons, M., *Working Together Alone in the Online Crowd: The Effects of Social Motivationsand Individual Knowledge Backgrounds on the Participation and Performance of Members of Online Crowdsourcing Platforms*, Promotors: Prof. H.G. Barkema & Dr D.A. Stam, EPS-2014-306-S&E, http://repub.eur.nl/pub/50711

Brazys, J., *Aggregated Marcoeconomic News and Price Discovery*, Promotor: Prof. W.F.C. Verschoor, EPS-2015-351-F&A, http://repub.eur.nl/pub/78243

Burger, M.J., *Structure and Cooptition in Urban Networks*, Promotors: Prof. G.A. van der Knaap & Prof. H.R. Commandeur, EPS-2011-243-ORG, http://repub.eur.nl/pub/26178

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